

September 2023

Adapting to climate change

Progress in Wales

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Climate Change Committee
September 2023

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Executive summary

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| <u>1. Adaptation progress in Wales</u> | 12 |
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There is a clear need for a more effective response to climate change in Wales. February 2020 brought devastating flooding to Wales with record rainfall levels and successive storms, and in 2022, Wales recorded its highest temperature of 37.1°C at Harwarden Airport, Flintshire. Continued climate changes will bring hotter and drier summers and warmer and wetter winters alongside rising sea levels. These changes will bring risks across Wales's ecosystems, infrastructure, communities and economy. The most recent Climate Change Risk Assessment identified 61 risks and opportunities from climate change to Wales, with around half requiring urgent action by the next adaptation plan to reduce future risks.

This report sets out the Climate Change Committee's independent assessment of progress in adapting to climate change in Wales. We provide this assessment as requested under the current national adaptation plan, [Prosperity for All: A Climate Conscious Wales \(PfACCW\)](#), and ahead of the next national adaptation plan, which is expected in 2024. The key messages in our assessment are:

- **PfACCW provides a good coverage of required research and potential actions across priority climate risk areas.** The current national adaptation plan focuses on building a knowledge base and increasing understanding of climate risks in central government. It is accompanied by a monitoring and evaluation framework which aims to set out indicators relevant to the action areas.
- **There is insufficient progress in delivery and implementation of adaptation and monitoring is limited.** We were unable to evaluate progress on delivery for more than half the adaptation outcomes. Across almost all areas, even where there is some good planning in place, monitoring and evaluation are limited or showing insufficient progress towards desired outcomes.
- **There are some positive examples of good plans in place, although this is not consistent across sectors.** There is credible or partial planning for about a third of climate resilience outcomes. However, the variable score reflects a lack of clarity in responsibilities for responding to climate risks across the public sector.
- **The next national adaptation plan for Wales must go further to drive delivery across the public sector and more widely.** Policies should aim to enable action within Government, across the public sector and elsewhere, taking a 'Team Wales' approach. To support clear decision making and urgent action, there is a need for greater clarity on risk owners and where responsibility for delivering adaptation action sits. The plan should also be accompanied by a strengthened monitoring and evaluation framework to enable assessment of progress against managing climate risks and delivering adaptation outcomes.
- **Welsh Government should embed adaptation into its plans for Net Zero, future well-being and increasing biodiversity.** Without consideration of climate risks, these other societal goals will not be achieved. The next adaptation plan, as well as plans for other government objectives should recognise the overlaps, maximising co-benefits and minimising negative impacts where possible.

The rest of this executive summary is laid out in two sections:

1. Adaptation progress in Wales
2. Priorities for the next national adaptation plan

1. Adaptation progress in Wales

This report is the Committee's first assessment of progress in delivering the current adaptation plan. We assess all relevant policy development from across the period of Prosperity for All: A Climate Conscious Wales (PfACCW), whether or not it is formally included within the programme document. This allows our assessment to provide more comprehensive coverage of all relevant aspects of adaptation policy and planning, beyond the PfACCW plan. We also consider adaptation planning and delivery beyond central government alone, reviewing progress across key public sector bodies in Wales.

(a) Prosperity for All: A Climate Conscious Wales

Prosperity for All: A Climate Conscious Wales (PfACCW) was published in 2019 and sets out the range of policy measures the Welsh Government is taking to address the most urgent areas of climate risk.

The plan has a strong ambition to increase the capacity to adapt to impacts of climate change. It has good coverage of the identified climate risks and includes associated actions against each (Figure 1). It was supported by a positive monitoring and evaluation framework with clear links to the actions in the plan, to help assess progress.

Figure 1 Key action areas of PfACCW

| Adaptation plan action area | Areas covered | Adaptation plan action area | Areas covered |
|---|--|---|---|
| Adaptive nature and the rural economy  | <ul style="list-style-type: none">Water resourcesAgricultureTerrestrial ecosystemsPests, Diseases, Invasive non-native speciesPeatland and soilsWoodland and forestry | Caring for the historic environment  | <ul style="list-style-type: none">Historic features, archaeological sites, historic buildings, parks, gardens, townscapes and landscapes. |
| Protecting our coasts and seas  | <ul style="list-style-type: none">Coastal erosion and floodingMarine ecosystems and fisheries | Successful business  | <ul style="list-style-type: none">Risks to productivity and business sites |
| Staying healthy  | <ul style="list-style-type: none">Heat and weather impactsVector-borne pathogensAir qualityFood safety and securityFuel poverty | Resilient infrastructure and transport  | <ul style="list-style-type: none">TransportEnergyDigitalMaterial collection, recycling and disposal |
| Safe homes and places  | <ul style="list-style-type: none">Wastewater and drainageBuildingsPlanning | Strategic actions  | <ul style="list-style-type: none">CommunicationInternational engagementIntegration into planning across Government |

Source: Welsh Government (2019) *Prosperity for All: Climate Conscious Wales Technical Annex*.
Notes: CCC graphic creation.

(b) Assessment findings

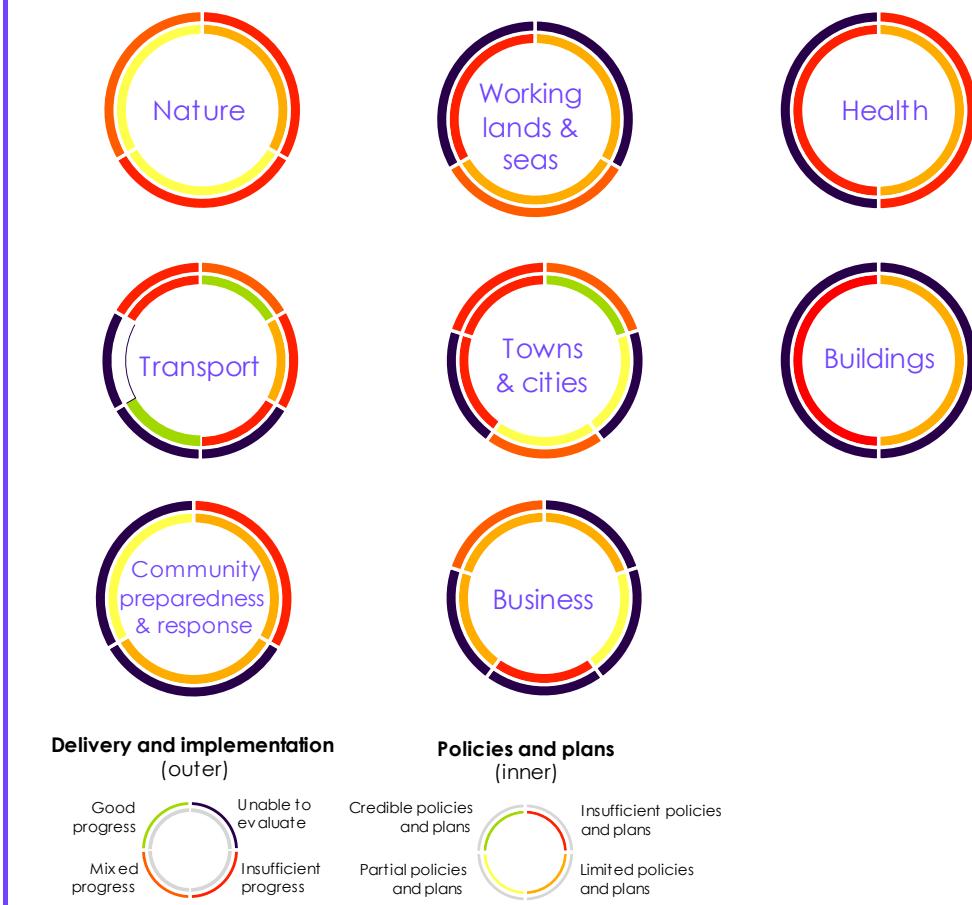
We find there are some positive examples of plans in place, although this is not consistent across sectors. Delivery and implementation are more limited and assessing progress is hampered by significant data gaps.

- **Where policy levers are devolved, there is some good planning but limited implementation progress across adaptation outcomes with high climate risk.** There is credible or partial planning for adaptation for about a third of climate resilience outcomes where there is high climate risk and policy levers are largely devolved. This reflects a lack of clarity in responsibilities for responding to climate risks across the public sector. Across almost all areas, even where there is some good planning in place, monitoring and evaluation are limited or showing insufficient progress towards desired outcomes.
- **Data to assess progress in Wales across areas which are mostly reserved are extremely limited, despite the impacts of climate risks in these areas being felt across the nations.** Understanding and monitoring the impacts even for reserved policy areas in Wales is key to understanding the adaptation gap overall. There is a lower climate risk to water supply in Wales than in other parts of the UK, but delivery and implementation scores still show mostly insufficient progress.

For more than 50% of adaptation outcomes, the lack of indicator data prevents a full assessment of progress. Datasets to evaluate adaptation delivery either do not exist, or where they do exist, are not publicly available, are not sufficiently comprehensive in scope or only provide a point-in-time snapshot, preventing trends being identified in aspects of climate vulnerability and exposure. Initiatives such as DataMapWales (a shared data platform for members of the public and public authorities) are positive steps towards making adaptation information more accessible, but rapid progress in this area must be a priority.

Our assessment is split into adaptation areas structured around assets or systems impacted by climate risks. Often key assets and systems are impacted by multiple risks and require joined up policy responses to manage them adequately.

Figure 2 Overview of adaptation areas with devolved policy levers and higher climate risk



Source: CCC analysis.

Notes: Each segment of the charts corresponds to an identified climate resilience outcome within our framework. The outer ring assesses delivery and implementation, while the inner ring assesses policies and plans. 'Unable to evaluate' for the delivery and implementation score is used when sufficient relevant indicator datasets are not available, up to date, or do not allow a trend to be robustly estimated. Segments are left white where policy is largely reserved.

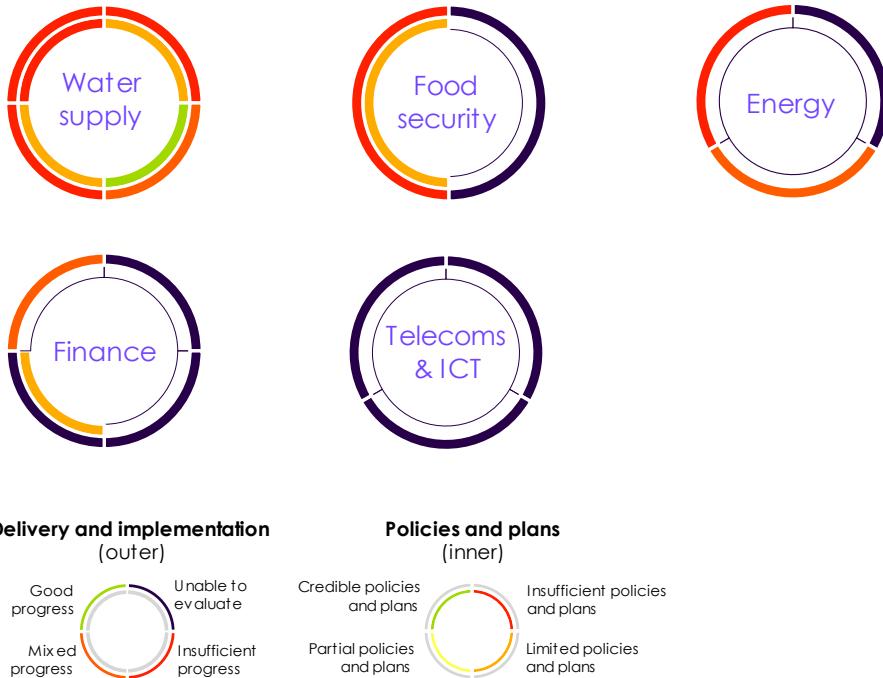
For each adaptation area with devolved policy levers and higher climate risk the main conclusions from our assessment are:

- **Nature.** Most terrestrial, freshwater and marine habitats are in unfavourable condition, with significant data gaps limiting an assessment of current and past trends. There are plans in place or in development for terrestrial, freshwater and marine habitats, which, if managed and implemented well could improve the climate resilience of these habitats. However, the scale and rate of deployment of actions to support the plans is not clear.
- **Working land and seas.** There is an insufficient level of data available to conduct a robust assessment of the resilience of Welsh agricultural production and the commercial fisheries and aquaculture sector to climate change. Policies and plans for fisheries and aquaculture are currently insufficient to ensure the sector remains resilient to climate change, although the new Sustainable Farming Scheme could form a comprehensive plan to improve agricultural resilience. While limited data are available for commercial forests in Wales, indicators for woodland show increasing forest management under the UK Forestry Standard. The Woodland for Wales strategy lacks a clear set of actions to deliver its targets.

- **Health.** Heat-related mortality has increased in recent years and the numbers of mosquitos and ticks (vectors), which can carry disease, are increasing. There are limited actions on health and well-being in the current adaptation plan. Data on disruption to health and social care services are not available. Adaptation planning is at an early stage of development and funding for adapting healthcare settings is not available. There are building standards for health buildings and a health impact assessment which considers climate resilience.
- **Transport.** The rail network and Cardiff Airport both have credible planning for adaptation. Gaps remain in adaptation planning for local road networks, with a lack of data to assess progress. A low proportion of critical road structures, such as bridges, are in good or very good condition, but there are promising early-stage plans to address climate resilience. There is limited evidence that interdependencies across infrastructure and transport sectors are being managed. There is limited information to assess asset and system level reliability of port operations.
- **Towns and cities.** Current flood risk management policy and funding show significant progress in adaptation planning. Some gaps remain, with complicated roles and responsibilities and a lack of data to assess implementation. Coastal change is being managed through actions in long-term plans and increased investment, but delivery is variable and there are monitoring data gaps. Policies to manage urban drainage are partially in place but there are limited data to assess the scale and success of delivery of sustainable drainage systems. Climate resilience is not embedded nor sufficiently enforceable within existing planning policy in Wales. Policies for new development in areas of flood risk are outdated and there are no recent data to evaluate trends. Urban tree monitoring over time is a promising initiative, but beyond this there is limited to no monitoring of cooling interventions in towns and cities and no plans for managing urban heat risk in national policy.
- **Buildings.** There are insufficient data on residential and non-residential overheating. Updated building regulations address overheating in some new buildings, but there are no regulations for existing buildings and there are no policies or financial instruments to support adaptation of the building stock. There are insufficient data to evaluate property-level adaptation to flood risk. Homeowners at flood risk in Wales can access insurance through Flood Re and, through its Build Back Better scheme, funds to install property-level protection measures as part of damage repairs. Beyond this, there are no clear policy mechanisms designed to accelerate the uptake of property flood resilience measures in Wales or regulate building design.
- **Business.** There are limited data to assess business sites at risk from climate change over time or business access to insurance and capital for adaptation. UK-wide climate risk reporting schemes are helping to drive some progress on risk assessment and disclosure, but there is limited data on adaptation actions taken in response. There has been progress to establish some grants and loans targeted to business adaptation but they are not currently at the scale needed. There has been progress to place resilience to climate change within public procurement duties.
- **Community preparedness and response.** Communities are prepared for some climate shocks, particularly flooding, and there are extensive emergency response structures in place. However, data are limited on impacts and recovery from extreme weather events, and local adaptation

roles and responsibilities are complex and overlapping, hindering coordination. Climate risk to cultural heritage is increasingly well mapped through sectoral planning, although there are limited data available to assess progress on delivery to date.

Figure 3 Overview of adaptation areas with reserved policy levers and/or low current climate risk



Source: CCC analysis.

Notes: Each segment of the charts corresponds to an identified climate resilience outcome within our framework. The outer ring assesses delivery and implementation, while the inner ring assesses policies and plans. 'Unable to evaluate' for the delivery and implementation score is used when sufficient relevant indicator datasets are not available, up to date, or do not allow a trend to be robustly estimated. Segments are left white where policy is largely reserved.

We also assessed areas where policy is largely reserved or where current climate risk is low.

- **Water supply.** Whilst current climate risk to public water supplies in Wales is low, there is still a need to plan actively for future climate conditions. There are good policies and plans in place for improving system performance. However, per capita consumption levels remain high and there is no national-level per capita consumption target. Water company management plans are in draft stages but provide statements of supply-side and demand-side interventions to deliver system resilience.
- **Food security.** Household food insecurity (not due to climate change) has increased in recent years, leaving households more vulnerable to food price spikes from climate shocks. The Government's vision for the food and drink industry in Wales does not consider adapting to climate change but there is ongoing consultation on a community food strategy.

- **Energy.** The majority of policies for energy are reserved to UK Government. Available information from energy generators and network operators in Wales suggests good assessment of climate risks but limited actions in place to manage the risks.
- **Telecommunications and ICT.** Regulation of telecommunications and ICT is reserved to UK Government, but the impacts from climate risks are being felt by people and businesses in Wales. There is a lack of available data to evaluate progress in reducing exposure and vulnerability to climate change in this sector. There remains no visible plan or process, by the industry or UK Government, to manage climate risks.
- **Finance.** Financial services regulation is reserved, but the role of both private and public financial institutions is key in supporting adaptation action in Wales. The establishment of the Development Bank of Wales is helping to improve access to finance for some SMEs in Wales, but it is currently focused more on decarbonisation activities than adaptation.

2. Priorities for the next national adaptation plan

The next climate change adaptation plan for Wales is expected in 2024. It is essential that the next plan goes further than its predecessor, moving rapidly beyond research and capacity building, to deliver stronger action across sectors. The key requirements for the next adaptation programme are:

- **Increased ambition and extending action beyond central government.** The next adaptation plan must move from building a knowledge base and increasing understanding to delivering action on adaptation across all of the above areas. The plan should define a vision for adaptation in Wales that goes beyond central government, taking a 'Team Wales' approach, supporting and requiring action across the public sector, private sector and individuals.
- **Wider scope.** Prosperity for All: A Climate Conscious Wales provided good coverage of identified climate risks from the previous CCRA. The next plan should build on this, as well as driving action across telecommunications and ICT networks; finance for adaptation for households and businesses; and interdependencies between sectors. Climate risks to these areas are missing from the current programme.
- **Clarified responsibility.** Greater clarity is needed on risk owners and where responsibility for delivering adaptation action sits, to support clear decision making and urgent action. A range of public bodies have a role in realising adaptation outcomes, including Natural Resources Wales, the 22 local authorities, four local resilience forums, 28 risk management authorities, and 13 public service boards. The development of the next adaptation plan should engage with these organisations to define their roles and responsibilities.
- **Integration with other societal goals.** Welsh Government should seek to align adaptation action with its other commitments on well-being, increasing biodiversity and reaching Net Zero, all of which will be at risk without appropriate consideration of the future climate. Our additional briefings on [Adaptation and social justice](#); [Adaptation and the nature emergency](#); and [Adaptation and decarbonisation](#) provide more advice on key principles for achieving this.
- **Strengthened monitoring and evaluation.** The next monitoring and evaluation framework, and the data collected against it, will be essential to assess how climate risks are being managed. Indicators for the framework should be developed in collaboration with policy and delivery teams to ensure they are relevant, useful and feasible to collect. The Welsh Government should review how the reporting power could be used to collect information on climate risks and adaptation actions across organisations such as local authorities, water companies, transport providers and other infrastructure owners and operators in Wales.



Chapter 1

Context and next national adaptation plan

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Introduction

This report assesses preparation for the effects of climate change in Wales, under the current national plan to adapt to the impacts Wales may face from climate change, “Prosperity for All: A Climate Conscious Wales” (PfACCW). This chapter summarises the evidence of past and expected future climate change and the relevant policy frameworks for adaptation in Wales. The assessment framework used across this report is also summarised. The chapter concludes with recommendations for the next national adaptation plan expected in 2024.

The key messages of this chapter are:

- **There are increasing observations of changes in the climate in Wales.**
Recent temperature records are consistent with long-term warming trends driven by human emissions of greenhouse gases, with a new maximum temperature record set in Wales in 2022. Winters will continue to become, on average, warmer and wetter. Summers will become hotter and drier at least until mid-century. Sea levels will continue to rise until the end of the century.
- **We use an assessment framework focused on tracking both policy and planning, and progress on delivery and implementation.** In this report, we consider what is needed to be well adapted to climate change across thirteen different areas, which together address the range of risks identified in the latest Climate Change Risk Assessment.
- **The current national adaptation plan for Wales has a strong ambition to increase the capacity to adapt to impacts of climate change** and good coverage of identified climate risks and associated actions against each. It was supported by a good monitoring and evaluation framework with clear links to the actions in the plan, to help monitor progress.
- **The next national adaptation plan needs to go further in driving delivery.**
The next plan should increase ambition on delivering adaptation action across the public sector and to encourage further action in the private sector. The plan should build on the previous scope to include interdependencies, finance and telecommunications and ICT networks. Monitoring and evaluation should be extended to collect more data on adaptation progress, including reporting from public bodies and other reporting authorities to provide an overview of how climate risks are being assessed and managed across sectors.

This chapter is set out in five sections:

1. Observed and projected climate change in Wales
2. Adaptation policy in Wales
3. Assessment approach
4. Integration with Net Zero and other policy goals
5. The next national adaptation plan

1. Observed and projected climate change in Wales

This section covers the latest evidence regarding observed and projected changes in Wales's weather and climate.

(a) Observed climate change

The latest observations of weather and climate in Wales demonstrate several clear trends:¹

A new record for the daily maximum temperature in Wales was set in 2022.

- **Warmer average temperature.** Across Wales, average land temperature in the decade 2010-2019 was 0.9°C warmer than in the period of mid 1970s to mid-2010s. 2022 was the hottest year on record for the UK and in July 2022, a new maximum daily temperature was recorded in Wales of 37.1°C in Harwarden Airport, Flintshire.^{2,3}
- **Increased annual rainfall.** There has been a small observed increase in annual mean rainfall in recent decades. Between the period of mid 1970s to mid-2010s and 2010-2019 there was an increase of 2%.
 - February 2020 brought devastating flooding to Wales with record rainfall levels and successive storms. Most of Wales was affected, with significant damage to properties in communities including Llanrwst, Llanfair Talhaiarn, Tylorstown, Nantgarw, Pontypridd, Pentre, Llanhilleth, Crickhowell and Mountain Ash.⁴ These storms also caused landslides across North and South Wales, such as in Tylorstown, Rhondda Cynon Taf. River levels in many places hit record or near-record heights. Along the Taff, levels were 80cm higher in places than those for the 1979 floods.⁵
- **Higher average sea levels.** A UK-wide sea level index suggests that sea level has risen by between 1.2 and 1.6 mm per year since 1901.

(b) Projected climate changes

The UK's Third Climate Change Risk Assessment (CCRA3) was published in 2021. CCRA3 provided a detailed assessment of the changes in the UK and Wales's weather and climate that might be expected in the future.⁶

Under future climate conditions, rainfall will be higher in Wales in the winter and lower in the summer.

- **Continued increased temperature.** Annual temperatures in Wales are expected to rise between approximately 1.2°C by the 2050s, and between 1.3 and 2.3°C by the 2080s from a 1981-2000 baseline.
- **Wetter winters and drier summers.** In winter, rainfall is expected to increase by approximately 6% by the 2050s from a 1981-2000 baseline. Conversely, summer rainfall is expected to decrease by approximately 15% by the 2050s and by between 18% to 26% by the 2080s.
- **Continued sea-level rise.** Using scenarios for Cardiff, sea level is expected to rise by between approximately 22 and 28 cm by the 2050s and by approximately 43 to 76 cm by the 2080s.

2. Adaptation policy in Wales

This section summarises governance structures related to the delivery of adaptation to climate change in Wales.

(a) Prosperity for All: A Climate Conscious Wales

Prosperity for All: A Climate Conscious Wales (PfACCW) was published in 2019, based on the evidence from the second UK Climate Change Risk Assessment, published in 2017. The Plan sets out a range of policy measures the Welsh Government is taking to address the most urgent areas of climate risk. The delivery of PfACCW is coordinated by an adaptation team with the Climate Change Division but delivery is distributed across Welsh Ministerial portfolios and divisions.

The current national adaptation plan for Wales outlines key research priorities to respond to urgent climate risks.

PfACCW sets out identified research priorities for climate change adaptation in Wales, along with short- and medium-term actions to drive progress across four categories of urgent risks for Wales.

- Risks to people, communities, buildings and infrastructure from flooding.
- Risks to public water supplies from drought and low flows.
- Some land management practices exacerbating flood risk.
- Risks to ecosystems and agriculture businesses from changes in climatic conditions.

It is supported by a technical annex, and a monitoring and evaluation framework that provides further detail on actions, sub-actions, outputs, outcomes, timelines and indicators. Further detail on specific objectives and indicators is provided within each relevant chapter of this report. The Welsh Government also produced an interim progress report in December 2022.⁷

(b) Major legislation in place for adaptation

- **Climate Change Act (2008).** The Act places requirements on Welsh Ministers to produce a report from time to time on the Welsh Government's objectives, actions and future priorities regarding the impacts of climate change.
- **Environment Act (Wales) 2016.** The objective of Part 1 of the Environment (Wales) Act 2016 is to maintain and enhance the resilience of ecosystems so they support the benefits to well-being, including the ability to adapt to climate change. In addition, Part 7 establishes the Flood & Coastal Erosion Committee and clarifies the law for other environmental regulatory regimes including flood risk management and land drainage.
- **Well-being of Future Generations (Wales) Act 2015** aims to improve the social, economic, environmental and cultural well-being of Wales, and sets out seven well-being goals. The Act also details five ways of working (long-term, integration, involvement, collaboration, prevention) which public bodies must follow in developing policy and delivery of services.

The Well-being of Future Generations Act sets out seven well-being goals.

3. Assessment approach

The CCC was commissioned by the Welsh Government to conduct an independent assessment of the status and effectiveness of climate adaptation planning and action in Wales. The Committee has welcomed this request as an opportunity to provide its advice ahead of the development of the next national adaptation plan. It is the Committee's first assessment of progress in delivering Prosperity for All: A Climate Conscious Wales (PfACCW). The sub-sections below document aspects of our assessment framework for this report.

(a) Assessment areas and methodology

Full details of our assessment methodology are provided in a supporting publication.

A separate publication, [CCC Adaptation Monitoring Framework](#) explains in detail the approach of the updated assessment framework applied within each chapter of this report.⁸ An overview is provided below.

(i) Assessment areas

We assess progress in preparing for climate change across thirteen chapters and integrate consideration of the PfACCW actions within these (Box 1.1). These chapters are structured around assets or systems impacted by climate risks. Often key assets and systems are impacted by multiple risks and require joined up policy responses to manage them adequately.

Box 1.1

Areas of adaptation covered within each chapter of this report

The areas of adaptation covered within each chapter of this report are:

- **Nature** (Chapter 2): This chapter covers protecting terrestrial (including on farmland), freshwater, and marine and coastal habitats and biodiversity from climate change.
- **Working lands and seas** (Chapter 3): This chapter covers the necessary adaptation needed to ensure that agriculture, forestry and fisheries and aquaculture sectors remain economically productive under changing climate conditions.
- **Food security** (Chapter 4): This chapter covers domestic and imported food supply chains and their climate resilience, as well as the vulnerability of society to climate-related food disruption.
- **Water supply** (Chapter 5): The chapter covers the public water system which supplies households and businesses.
- **Energy** (Chapter 6): This chapter covers adaptation within the key energy systems – the electricity system (transmission, distribution, and generation), gas networks and novel sources of energy supply (such as hydrogen), as they develop.
- **Telecoms & ICT** (Chapter 7): This chapter covers the communications and ICT infrastructure (data centres, networks and other critical national infrastructure) that needs to be climate resilient.
- **Transport** (Chapter 8): This chapter covers the road networks (both the national strategic road network and local roads), railways, ports and airports.
- **Towns and cities** (Chapter 9): This chapter covers adaptation needed within, or for, the built environment. Only settlement scale adaptation is covered in this chapter. This includes flood defences to protect people and property, urban design to limit urban heat islands and surface water flooding, coastal protection for settlements on the coast and the planning system.

- **Buildings** (Chapter 10): This chapter covers building-level interventions to ensure that they are protected from overheating and flooding.
- **Health** (Chapter 11): This chapter covers actions needed to ensure public health is maintained and improved despite climate change. This includes mortality and morbidity risks from overheating as well as climate-sensitive vector-borne diseases and the delivery of health care during periods of extreme weather.
- **Community preparedness and response** (Chapter 12): This chapter covers the preparedness of communities for climate impacts, including the ability to protect cultural heritage, and their ability to effectively respond when climate and weather-related disruptions occur.
- **Business** (Chapter 13): This chapter covers the adaptation that is required of business, specific to their function as a commercial entity. This includes adapting their supply chains (both domestic and international), their business sites and assets, access to capital and productivity impacts.
- **Finance** (Chapter 14): This chapter covers adapting the UK's financial system so that systemic risks from climate change are minimised and it can effectively support the economy in investing in necessary adaptation actions.

(ii) Assessment methodology

Within each chapter our updated assessment framework has the following components:

- **A monitoring map**, which lays out an indicative high-level goal or vision for what being resilient to climate change in this area might mean, and identifies tangible key outcomes, enablers and policies that the Committee believes will need to be in place to help deliver this.
- **Evaluation of relevant delivery and implementation indicators** to track progress towards the delivery of the identified outcomes and the extent to which key enabling factors are in place.
- **An assessment of progress against policy and planning requirements** described in the monitoring map. We document recent developments in relevant policies and plans and assess: to what extent the relevant policy milestones identified on the monitoring maps are in place; to what extent they are appropriately ambitious; and whether there is appropriate monitoring and evaluation to allow them to function effectively.

We assess all relevant policy development from 2019 to May 2023, whether it is formally included within the PfACCW document or not.

(iii) Scoring

We score progress on adaptation across 'delivery and implementation' and 'policies and plans'.

Within this report, we score progress in preparing for climate change at the level of the identified key outcomes within each chapter. For each outcome we identify two summary scores, one for 'delivery and implementation' (Table 1.1) and one for 'policies and plans' (Table 1.2). While the criteria below are followed to determine scores, inevitably some judgement is required to synthesise all the available evidence into one score.

Table 1.1

Scoring criteria for delivery and implementation

| Score | Criteria |
|-----------------------|--|
| Good progress | Indicators are moving in the right direction or being maintained at a high level |
| Mixed progress | Some indicators are moving in the right direction, others are stagnant at a low level or moving in the wrong direction |
| Insufficient progress | Indicators are stagnant at a low level or are moving in the wrong direction |
| Unable to evaluate | Limited or no available data |

Table 1.2

Scoring criteria for policies and plans

| Score | Criteria |
|---------------------------------|---|
| Credible policies and plans | Policy milestones: <ul style="list-style-type: none"> almost entirely achieved or in place comprehensive and appropriately ambitious include monitoring and evaluation |
| Partial policies and plans | Policy milestones: <ul style="list-style-type: none"> achieved or in place for key milestones but some gaps remain cover most important elements, could be more ambitious include some monitoring and evaluation |
| Limited policies and plans | Policy milestones: <ul style="list-style-type: none"> achieved to some extent or in place with some key milestones missing cover some important elements, could be more ambitious include some monitoring and evaluation |
| Insufficient policies and plans | Policy milestones: <ul style="list-style-type: none"> mostly not achieved, only minor policies in place lack important elements, do not cover key areas or lack ambition have minimal monitoring and evaluation |
| Reserved | Whilst most policy areas that are relevant to climate change adaptation are devolved, some areas are reserved to the UK Government and are not scored.* |

* The CCC separately undertakes an assessment of the UK National Adaptation Programme every two years which covers reserved matters in more detail.

4. Integration with Net Zero and other policy goals

Action to reduce emissions in Wales must be integrated with adaptation.

Delivery of other policy goals are at risk if the effects of a changing climate are not integrated into planning.

(a) Net Zero and adaptation

While the First Carbon Budget (2016-2020) has been achieved, the CCC's latest progress report on reducing emissions found that Wales is not yet on track to meet its targets for the second half of this decade.⁹ Action on decarbonisation in Wales must now accelerate, and as this happens it must be integrated with adaptation. A few key examples are given here, and further advice is provided in our separate briefing [Adaptation and decarbonisation](#).¹⁰

- **Increasing long-term carbon storage.** Restoration of peatlands can improve their ability to store carbon and make them more resilient to climate change. Tree and hedgerow planting and catchment-sensitive farming can have benefits for increasing climate resilience as well as carbon sequestration.
- **Decarbonisation of the building stock.** Without consideration of future climate when undertaking retrofit programmes, emissions reduction measures, such as increasing the energy efficiency of homes, may inadvertently increase the risk of overheating in buildings and worsen indoor air quality.
- **Maintaining a resilient power system.** The growing dependence of other systems on electricity in the transition to Net Zero highlights the importance of considering changing climate hazards as part of diligent planning. While energy policy is largely reserved, the impacts of failures and emergency response will happen at the local level.

(b) Well-being and adaptation

The well-being goals for Wales will not be achieved without action to adapt to climate change.

Effective adaptation can help deliver against the seven well-being goals for Wales. Conversely, failure to address climate risks or poorly designed interventions can have negative impacts on well-being in Wales. See also our separate briefing [Adaptation and social justice](#).¹¹

- **Nature.** Changing rainfall, water scarcity, flooding, extreme heat and wildfire could affect habitat and species loss across Wales. A greater number of pests, pathogens and invasive non-native species could increase. These climate changes threaten the goal for a resilient Wales. See also our separate briefing [Adaptation and the nature emergency](#).¹²
- **Health.** Health and social care systems are exposed to flooding, overheating and water scarcity. Health inequalities mean that health risks from climate change are not evenly distributed, threatening the goals for a healthier and more equal Wales.
- **Cultural heritage.** Risks to cultural heritage from climate change are increasing due to extreme weather, precipitation and flooding, and coastal change. These risks threaten goals for a Wales of vibrant culture.

5. The next national adaptation plan

The next national adaptation plan for Wales is expected in 2024. It is an opportunity to close gaps from the PfACCW and build on progress made in other areas. This report includes recommendations relevant for specific areas of adaptation within each respective chapter. Here we present cross-cutting recommendations or recommendations related to the design of the next adaptation programme.

(a) Design

(i) Ambition

In the current adaptation plan, the vision is stated as ‘Wales is a country which has the resources and is prepared, has the knowledge to understand the risk and challenges ahead, and has the capacity to adapt to the impact of climate change’. The ambition for the next national adaptation plan needs to move from building a knowledge base and increasing understanding, to action and delivery.

Action on adaptation is urgently needed to reduce the impacts of climate change. The Net Zero agenda is gaining increasing momentum across Welsh Government with a focus from ministers on skills, jobs and public engagement.¹³ There is a risk that this comes at the expense of focus on adaptation, leading to missed opportunities for both policy goals. See our briefing on Adaptation and decarbonisation for further detail on how to tackle these challenges together.

Adaptation actions can support the seven well-being goals if fairness is embedded in their design and implementation. Conversely, adaptation actions which don’t appropriately consider fairness can impede the success of the well-being goals. Embedding fairness in the design of the next adaptation plan should be a key ambition. See our briefing on Adaptation and social justice for further detail.

The next national adaptation plan should go beyond central government actions, taking a ‘Team Wales’ approach.

The next national adaptation plan should define a vision for adaptation in Wales that goes beyond central government, taking a ‘Team Wales’ approach. Policies included in the plan should aim to enable action outside Government, across the public sector and elsewhere, including supporting and requiring action through public service boards, corporate joint committees and local authorities.

(ii) Scope

The PfACCW provided good coverage of identified climate risks. The next national adaptation plan should build on this and aim to cover additional areas to reach a well-adapted Wales.

Areas to further consider include:

Interdependencies across sectors should be included in the next adaptation plan.

- **Interdependencies.** Interdependencies from infrastructure linkages, dependencies on the natural environment and socioeconomic connections all increase exposure to cascading and interacting climate change risks. Whilst challenging, the next national adaptation plan should provide a more systematic assessment of interdependency risks. It should set out clear responsibilities across Welsh Government and effective mechanisms for the necessary cross-Government collaboration to identify and manage these risks.

- **Finance.** Access to finance to implement adaptation for both households and businesses needs to be further integrated into the next plan. Further assessment is also needed on Wales's financial exposure to climate risks such as flooding, which impacts on insurance, mortgages, and investment.
- **Telecommunications and ICT.** PfACCW includes consideration of resilient infrastructure but lacks specific actions for telecommunications and ICT networks. Whilst regulation of these networks is reserved, the growing reliance on these types of infrastructure and the interconnection with other types of infrastructure requires further consideration within the next plan to identify and manage risks.

(iii) Adaptation programming cycle

The current plan was published in 2019 and is based on the evidence from the second Climate Risk Independent Assessment published in 2017. The third Climate Risk Assessment was published in 2021 and presented an updated evidence base of the risks to Wales and the UK. Amending the cycle of future adaptation plans to align with the climate change risk assessment would enable Welsh Government to design policy based on the latest evidence and better inform wider action across public sector.

(b) Delivery

(i) A Team Wales approach

Greater clarity is needed on risk owners and where responsibility for adaptation action sits.

The next national adaptation plan should provide greater clarity on risk owners and where responsibility for delivering adaptation action sits, to support clear decision making and urgent action. A range of public bodies alongside Welsh Government have a role in delivering adaptation actions including Natural Resources Wales, the 22 local authorities, four local resilience forums, 28 risk management authorities, and 13 public service boards, amongst others. As a result, in some cases, the roles and responsibility for preparing and responding to extreme weather and climate change remains unclear (see Chapter 12 for further details). The development of the next adaptation plan should include engagement with these organisations and aim to enable a 'Team Wales' approach to drive action beyond central government.

(ii) Monitoring and evaluation

High-quality data to measure progress against the delivery and implementation of adaptation outcomes is an important part of any adaptation programme. The technical annex and monitoring and evaluation framework made a positive step forward in linking actions to adaptation outcomes across the key areas. This should be replicated for the next plan with an accompanying monitoring and evaluation plan to collect the information.

Further steps could be taken in the next plan to improve monitoring and evaluation:

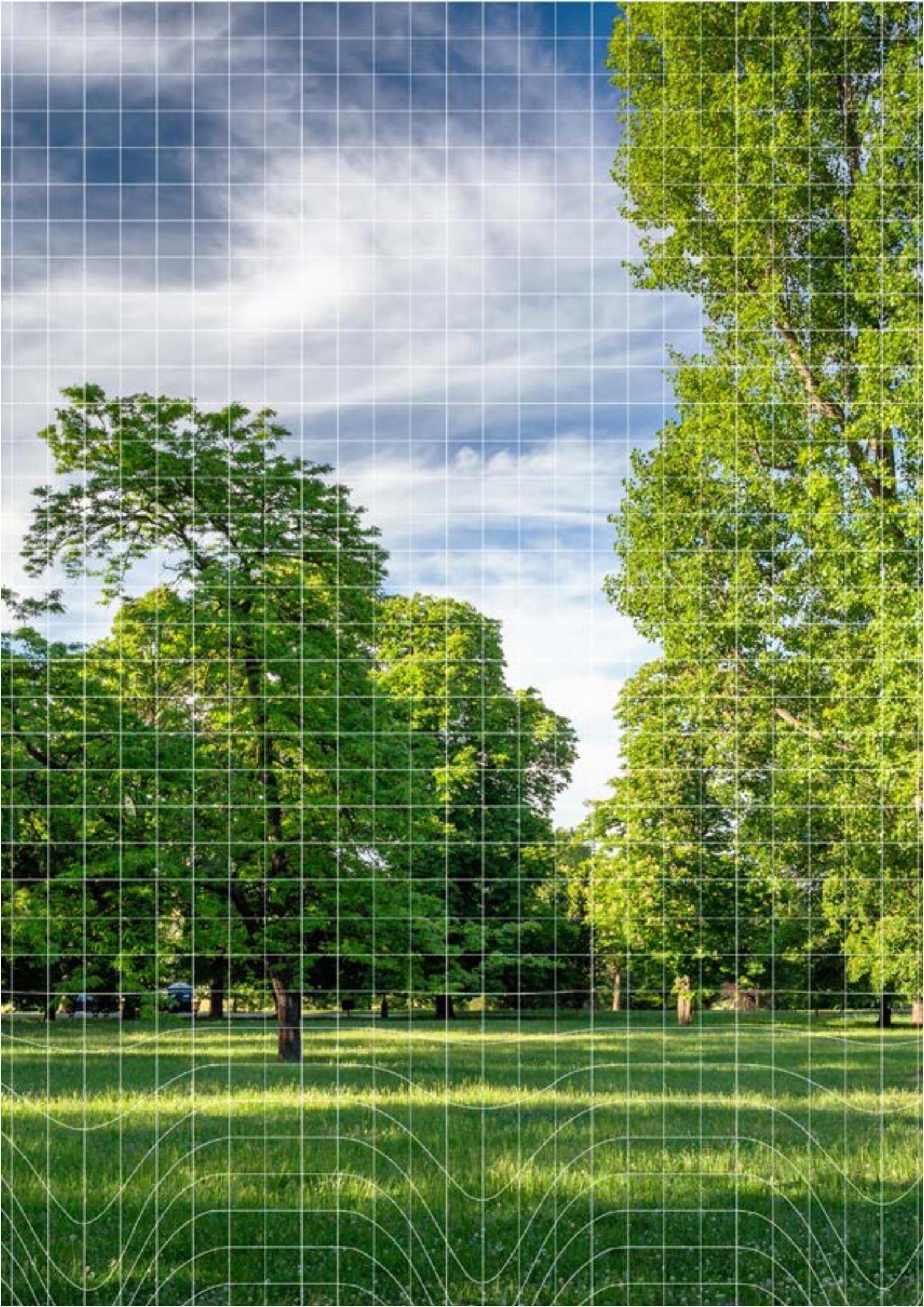
- **Reporting powers.** The Climate Change Act (2008) includes a provision that Welsh Ministers may require public bodies and other statutory undertakers (also called reporting authorities) to assess the current and predicted impact of climate change in relation to their functions and report on appropriate action being taken.¹⁴ To date, this power has not been used in Wales, but it could provide an important source of information across a

range of sectors on adaptation planning and delivery. As part of the of next plan, the Welsh Government should review how this reporting power (or other reporting mechanisms) could be used effectively to collect information on progress in responding to climate risks across organisations such as local authorities, water companies, transport providers and other infrastructure owners and operators in Wales.

- **Collecting adaptation indicator data.** There were some notable key gaps in available data. In some cases, data collection has been discontinued, for example, the proportion of planning permissions granted for new developments in flood risk zones is not available after 2019. In other cases, data has likely not been collected at the required scale, such as pesticide use on farms in Wales, or data is held across different teams or not being regularly collected and reviewed to inform action. Initiatives such as DataMapWales are positive steps towards making adaptation information more accessible. This should be accompanied by a programme to maintain and update adaptation progress indicators regularly and adjust actions as needed. The adaptation indicators identified in the monitoring and evaluation (M&E) framework should be co-developed with the relevant policy teams in Welsh Government to ensure they are relevant, useful and feasible to collect.
- **Understanding vulnerability.** Welsh Government should develop and publish an assessment of the characteristics of vulnerability and adaptive capacity to different climate risks in Wales. This work would support central government, government agencies and local government to consider fairness and social justice in the design of adaptation policies.
- **Progress reports.** The Welsh Government published an interim progress report on PfACCW in 2022. This was positive and contained useful updates on the programmes. Future progress reports should be aligned to the M&E framework to provide an update on indicators and also serve as an interim review of the direction of trends in adaptation.

Endnotes

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- ² Met Office (2023) Climate change drives UK's first year over 10°C, <https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2023/climate-change-drives-uks-first-year-over-10c>.
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- ⁴ Welsh Government (2021) National Strategy for Flood and Coastal Erosion Risk Management in Wales, <https://www.gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales>.
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- ⁷ Welsh Government (2022) Prosperity for all: A Climate conscious Wales: progress report, <https://www.gov.wales/prosperity-all-climate-conscious-wales-progress-report>.
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- ⁹ CCC (2023) Progress report: Reducing emissions in Wales, <https://www.theccc.org.uk/publication/2023-progress-report-reducing-emissions-in-wales/>.
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Chapter 2

Nature

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Introduction

Table 2.1

Progress summary - Nature

| | Delivery and implementation | Policies and plans | Summary |
|---|-----------------------------|----------------------------|--|
| Outcome 1: Terrestrial habitats are in good ecological health | Insufficient progress | Limited policies and plans | <ul style="list-style-type: none"> Most terrestrial sites of special scientific interest (SSSIs) and special area of conservation (SACs) are not in favourable condition. The Sustainable Farming Scheme currently in development will take a public money for public goods approach. Climate adaptation is a core objective under the scheme, but it is unclear which actions will be eligible for payments. |
| Outcome 2: Freshwater habitats are in good ecological health | Insufficient progress | Partial policies and plans | <ul style="list-style-type: none"> Most freshwater habitats are in unfavourable condition and remain under pressure. There are a range of policies and plans in place, which, if delivered, should effectively support climate resilience in freshwater habitats. However, the scale and rate of deployment of actions to support the plans is not clear. |
| Outcome 3: Marine and Coastal habitats are in good ecological health | Mixed progress | Partial policies and plans | <ul style="list-style-type: none"> Despite a large proportion of Welsh seas having statutory protection, data indicates actions taken have had limited effect. Only 45% of Marine Protected Areas are in good condition. Coastal habitats are deteriorating meaning they are not well adapted for future climate change pressures. Some progress has been made in the development and delivery of adaptation plans for marine and coastal habitats, although it remains to be seen how effective these will be. While a lack of evidence on climate risks and associated impacts persists, the plans do include provisions to help fill the information gap. |

Relevant risks from CCRA3:
Risks to terrestrial habitats and species (N1, N2, N3); Risks to soils (N4); Risks and opportunities for natural carbon stores, carbon sequestration and GHG emissions (N5); Risks to freshwater habitats & species (N11, N12); Opportunities to freshwater habitats and species (N13); Risks to marine habitats and species, and fisheries (N14, N16); Opportunities to marine habitats and species, and fisheries (N15); Risks and opportunities to coastal habitats and species (N17); Risks and opportunities to landscape character (N18).

This chapter covers adaptation to climate change for habitats and species native to terrestrial, freshwater, and marine and coastal environments in Wales.

Thriving ecosystems are essential both for the intrinsic value of nature, but also for the ecosystem services they provide.

Thriving natural ecosystems are important both for the intrinsic value of nature, but also for the range of benefits that nature provides (often implicitly) to people and the UK economy (e.g. pollination and improved flood mitigation). If natural ecosystems are damaged by climate change, other societal goals (including climate adaptation, nature recovery and Net Zero) will be increasingly jeopardised.

The changing climate directly impacts the condition of nature in Wales (Box 2.1). The 2021 Independent Assessment of UK Climate Risk by the Climate Change Committee identified three risks directly pertaining to nature that require urgent immediate action from Government:¹

- Risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards.
- Risks to soil health from increased flooding and drought.
- Risks to natural carbon stores and sequestration from multiple hazards leading to increased emissions.

Box 2.1

Climate impacts on nature in Wales

The third UK Climate Change Risk Assessment (CCRA3) found that:

- There is strong evidence that climate risk factors will increase, with more prevalent heavier rainfall events and increased soil moisture deficits in summer. This will exacerbate soil degradation through erosion and compaction, and have important environmental, economic and social consequences. The magnitude of this risk will increase from medium to high in Wales later this century.
- New and emerging pests, diseases, and invasive non-native species (INNS) were identified as important risks due to their negative effect on biodiversity. The current magnitude of this risk in Wales is considered to be medium - increasing to high by the 2080s +4°C at 2100 scenario.
- The magnitude of current and future risks from climate change to terrestrial species and habitats, both now and in the future, is considered to be high due to the number of species adversely affected and likely to be affected. Lowland landscapes (woodland and wetland) are likely to be affected by hotter, drier summers and upland woodland by drought. Studies on changing bioclimatic suitability for different species groups show impacts from mean or extreme changes in climate, combined with other drivers acting separately or in combination with climate such as land use and habitat loss.
- Risks from reduced water availability and higher water temperatures will increase the degradation of freshwater habitats and compromise the viability of some freshwater species. The magnitude of current and future risks is judged to be medium by the 2050s, under a +2°C at 2100 scenario. This increases to high magnitude for the 2080s +4°C at 2100 scenario.
- Marine ecosystems are impacted by climate change through effects on the distribution and abundance of species groups including plankton, fish, seabirds, and marine mammals. There is good evidence to suggest major changes will occur to the marine environment under both +2°C and +4°C at 2100 warming scenarios but it is difficult to be precise on specific details due to multiple risk factors and the interconnectivity of marine ecosystems. Risk magnitude for this topic is projected to increase from medium at present to high in the future. There is also high potential for significant thresholds to be crossed causing irreversible changes.

Source: Climate Change Committee (2021) *Evidence Report for the Third Climate Change Risk Assessment Summary on Wales*.

Nature underpins society and the economy, so its health is fundamental to their ability to function effectively.

The fundamental underpinning that nature has on many parts of society and the economy means there are key links between climate adaptation covered in this chapter and elsewhere in the report (Box 2.2). This is particularly the case for climate risks to farming, forestry and fishing, as economic activities dependent on

large-scale rural land, water and sea use require healthy and functioning ecosystems (see Chapter 3).*

Box 2.2

Inter-relationships of nature with other parts of this assessment

The systems within this report where links to nature are most pronounced include:

- **Working Land and Seas.** Around 90% of land in Wales is used for agriculture. Land-use change and pollution associated with agriculture, forestry and fisheries are drivers of biodiversity loss, while water abstraction by agriculture can also undermine the health of ecosystems and their ability to function.
- **Food.** The food system depends on a healthy, functioning natural environment. This includes diverse and abundant assemblages of biodiversity, which can pollinate crops and control pests. For example, diverse and abundant soil microbiota can enhance soil fertility, which supports crop yields and healthy grasslands.
- **Water.** Measures to improve the condition of nature support its capacity to supply clean water for consumption and use by the public and industry (e.g. improved water supply and filtration benefits through peatland restoration). However, overuse and pollution of water by society can harm nature.
- **Health and Community.** Nature helps to keep us healthy in many ways. Trees and hedgerows can improve air quality; access to nature can support mental health; certain plant species can absorb harmful minerals such as lead; and biodiversity has a crucial role to play in mitigating the threat of pests and diseases.
- **Flooding, Towns and Cities, and Infrastructure.** Ensuring adequate adaptation plans are in place using nature-based solutions (NbS) (such as riverine tree planting, re-meandering rivers, and green/blue infrastructure such as urban ponds) can increase infiltration of water, reducing run-off and downstream flooding that can impact infrastructure and urban areas.

Building the resilience of nature to climate change is one of the central themes of Wales's climate adaptation strategy.

There was comprehensive coverage of adaptation for nature within 'Prosperity for All: A Climate Conscious Wales' (PfACCW) (Box 2.3).

Box 2.3

Nature in 'Prosperity for All: A Climate Conscious Wales'

Objectives for Nature:

- Restoration of uplands and managing them for biodiversity, carbon, water, flood risk, energy and recreational benefits.
- Increased canopy cover and well-located woodland for greatest ecosystem service value.
- Develop resilient ecological networks.
- Protect our natural habitats from the increasing risks associated with invasive non-native species.
- Maintain, enhance and restore floodplains and hydrogeological systems to reduce flood risk and improve water quality and quantity.
- Improve the resilience of habitats and heritage in Wales's coastal zones from the impacts of climate change.
- Improve the condition of the wider marine ecosystem to enable resilience to the impacts of climate change.

* In a change from previous progress reports, farmland habitats are now assessed within the outcome 'Terrestrial habitats are in good ecological condition'.

- Carry out research to better understand the impact of climate change on marine ecosystems, ecosystem services and marine heritage.

Indicators:

- These objectives are supported by a range of indicators for each to track progress across a range of quantitative and qualitative measures.

Source: Welsh Government (2020) *Prosperity for All: A Climate Conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress towards well-adapted nature

Protecting, connecting and restoring habitats, while supporting genetic and species diversity, can help build the resilience of nature to the impacts of climate change.

Climate resilience of nature includes having healthy and well-connected ecosystems, as species can withstand pressures and adapt in response to change. A healthy ecosystem means protecting, restoring, and connecting habitats, and reducing pressures on ecosystems from pollution, over-exploitation, and invasive species.

A UK-wide non-binding target from Westminster in the 2022 G7 Summit and at the Convention on Biological Diversity's 2022 Montreal Agreement has established a target to halt biodiversity loss by 2030. The '30x30' initiative to conserve and protect at least 30% of the land and sea by 2030 was also set in accordance with this target. To achieve this, nature recovery and conservation strategies must consider the impacts of changes in average climate conditions and climate extremes projected over the coming decades.

We focus our assessment on three biome-based outcomes needed to deliver this goal (Figure 2.1):

- **Terrestrial habitats are in good ecological health.** These include natural and semi-natural habitats (e.g. native woodland, peatland, scrub, grassland, heath); urban nature (blue and green space such as urban ponds, parks, gardens, allotments); farmland (arable, pasture, hedgerows, field margins); and the soils underpinning these habitats.
- **Freshwater habitats are in good ecological health.** These include rivers, streams, canals, ditches, lakes, and ponds.
- **Coastal and marine habitats are in good ecological health.** These include saltmarshes, sand dunes, maritime cliffs, vegetated shingle, beaches, lagoons, estuaries, mudflats, reefs, seagrass, kelp, and marine sediments in both shallow and deep waters.

We assess the climate resilience of nature using a headline outcome that looks at overall ecological health. Supporting the delivery of the assessment are various sub-outcomes, and enablers such as funding, skills, and monitoring.

These outcomes focus on overall habitat ecological health, as habitats that are in good ecological health are more resilient to climate change. To underpin these outcomes, we also consider progress towards certain sub-outcomes associated with reducing the vulnerability of nature to climate change. These sub-outcomes are primarily based on the principles set out in the 2010 Lawton Review.² The sub-outcomes are:

- **Larger and more connected habitats.** Larger areas of habitat supporting larger populations of species tend to be less vulnerable to climate stress. Greater connectivity of habitats enables species to track their preferred ecological niche as the climate changes.
- **Diverse habitats and species.** Diverse ecosystems with healthy populations of species that have high genetic diversity are better able to buffer and potentially adapt to changing pressures on their environments, including climatic impacts.
- **Protected and resilient habitats.** Protecting and restoring natural and seminatural habitats, including by ensuring effective and sustainable management and monitoring, is vital for supporting the biodiversity that underpins resilience to environmental pressures such as climate change.

- **Reduced pressure on nature.** External factors that reduce resilience to climate change include: pollution; habitat loss; degradation and fragmentation; spread of pests, disease and invasive species; overuse of natural resources; and coastal squeeze from sea-level rise.
- **Use of nature-based solutions (NbS) for adaptation.**^{*} NbS such as protecting, sustainably managing, and restoring riverine habitats, woodlands, or peatlands can help build nature's resilience to climate change impacts by protecting biodiversity and increasing connectivity, while storing carbon, protecting biodiversity and supporting livelihoods.[†]

Managing external pressures that compromise the ability of ecosystems to function efficiently will be key to building the resilience of nature.

To support the delivery of these outcomes, various enabling factors are needed across the private and public sectors. Key enablers we identified are:

- **Funding and investment.** Delivering the outcomes listed above will require funding, such as for nature recovery action and monitoring. The benefits of adaptation flow to many different beneficiaries and can be difficult to quantify, so sustained public funding is vital. However, as public funding is likely to fall short of needed levels, accessible private investment streams will also be needed.
- **Skills and workforce.** More training is needed to build a bigger and more skilled workforce to protect and restore nature. This includes help with learning new skills, training and information to implement sustainable land/sea management and ecosystem restoration approaches and to measure and monitor the health of the ecosystems and their biodiversity.
- **Engagement and education.** Public understanding of the value of nature and the innumerable benefits it provides is vital to secure the acceptance and adoption of measures to protect and restore it.
- **Data and monitoring.** Improved data for measuring and monitoring ecosystem health across land and seascapes are needed to track if outcomes are being achieved. In particular, more robust and frequently collected indicators across a wider range of species and ecosystems are needed to monitor progress in reducing climate change risk and the effectiveness of different interventions.
- **Regulation.** Effective and enforced planning regulation is important to protect against new developments resulting in habitat and biodiversity loss and to contribute to improved ecological condition.
- **Research.** More research is needed on the effectiveness of different interventions for restoring ecosystem health and improving climate resilience. Areas where this is particularly critical include: identification of climate-resilient native species; mapping of future UK wildfire risks; effectiveness of NbS for adaptation; impacts of changing ocean temperature and chemistry; and species dispersal projections.
- **Governance and policy co-ordination.** Achieving climate resilience for nature in Wales depends on the behaviour of natural resource managers such as landowners, farmers, foresters, fishermen and marine managers. These actors need to be listened to, supported and incentivised to adopt

^{*} Not included in the Lawton Principles.

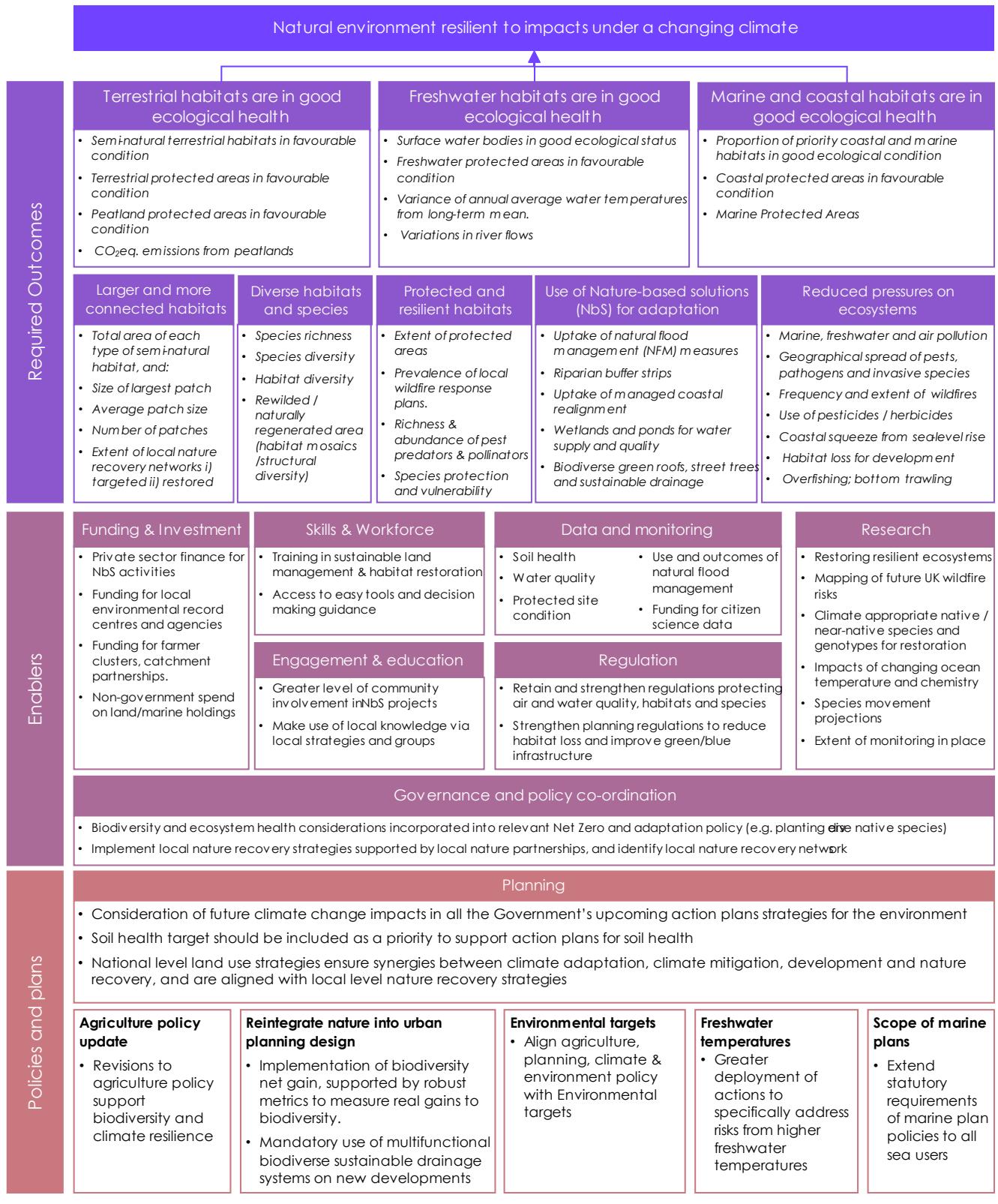
[†] Examples of nature-based solutions include the protection and restoration of natural and semi-natural ecosystems inland and along our coasts; sustainable management of working lands and seas; and the creation of new ecosystems in our urban area.

Policies covering the planning system, agricultural sector, marine habitats and wider environmental issues across land and sea must ensure the resilience of nature in Wales.

more sustainable practices, such as peatland restoration and the use of natural flood management techniques. Effective policy and governance through practical and financial support, coupled with consistent standards and regulations, can help influence shifts to more resilient practices.

- **Agriculture policy update.** Primary legislation on agriculture in Wales should be prioritised, and agricultural policy must consider and support biodiversity and climate resilience. Actions that reduce vulnerability and exposure to climate change across all environmental public good outcomes should be rewarded with more targeted agri-environment schemes.
- **Environment (Wales) Act targets.** The wide-ranging benefits delivered through meeting the proposed outcome-based targets must be clearly linked to the suite of climate, environmental and planning policies that support them.
- **Freshwater and sea temperatures.** There needs to be a clear mechanism to account for the consequences of higher water temperatures and low flows (including drying up) in water bodies for marine and freshwater habitats and species.
- **Scope of marine plans.** The statutory requirements of marine plan policies should be extended to the decisions of public and private organisations. At present, only public authorities are duty bound under law to apply the plan policies to their decisions. This leaves a significant gap in the protections they are designed to provide.

Figure 2.1 Monitoring map for nature



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

(a) Apex target: Natural environment resilient to impacts under a changing climate

Improved indicators for measuring biodiversity and ecosystem health are needed. The monitoring map for nature will be updated as more detailed indicators become available.

Quantitative measures of progress towards climate resilience outcomes for nature have several methodological challenges that need addressing. These include technological challenges of measuring biodiversity and other indicators of ecosystem health above and below ground; having to rely on proxy indicators for some adaptation outcomes; and the lack of long-term, consistent datasets. The below assessments of progress are therefore based on a limited set of fragmented datasets while we await more detailed indicator development and monitoring. We will continue to update the monitoring map and indicators as more data become available. The outcomes and indicators are therefore likely to change over time as data improve.

(b) Outcome 1: Terrestrial habitats are in good ecological health

Indicators for this outcome show **insufficient progress** in reducing vulnerability and exposure of terrestrial habitats to climate change. The majority of terrestrial habitats are in unfavourable condition, with a large data gap resulting in a significant number of features in unknown condition.

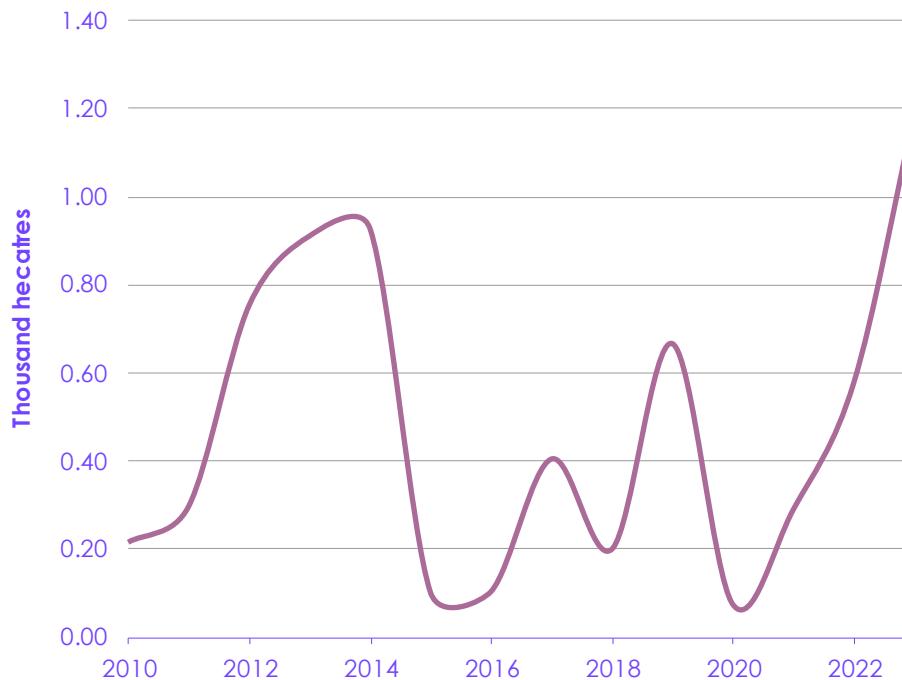
(i) Outcome 1a: Larger and more connected habitats

Insufficient progress has been made in ensuring terrestrial habitats are in good ecological health.

- **Semi-natural grassland extent has declined significantly.** These habitats have declined by 90% during the latter part of the 20th century, mainly driven by land-use policies focused on agricultural production. Connectivity varies across Wales, with poor connectivity in lowland habitats due to losses in extent, and good connectivity in upland habitats with little change in recent decades.³
- **Area of woodland habitat has remained stable.** Woodland extent has increased from 303,000 ha in 2010 to 309,000 ha in 2019, although it is reported that some of the increase is due to changes to National Forest Inventory (NFI) mapping.⁴ Since 1905, woodland cover has increased from 4.2% to 15% of total land cover in Wales.⁵ Only 14% of woodlands are classed as ancient and semi-natural, which are known to be most important for woodland biodiversity.⁶ Native woodlands have good connectivity to other habitats but, as a whole, they remain a fragmented resource, compared to non-native woodland that exists in large blocks across Wales.⁴ The Welsh Government had a 2010 target to create 100,000 ha of new, well-located* woodland by 2030, equating to 5,000 ha a year. However, only 6,790 ha of new planting occurred between the 2010/11 and 2022/23 planting seasons (Figure 2.2).⁷ Between 2016 and 2019, 1,300 ha of new woodland was created via Government grants.⁴ The Welsh Government has since updated its target for 2030 to plant 43,000 ha of woodland, and a total of 180,000 ha by 2050.⁸ This would require around 6,000 ha of new planting each year.

* Well-located is defined as areas where woodland will have the greatest recreational and ecosystem service value.

Figure 2.2 Area of new planting, 2010 to 2023



Source: Forestry Research (2023) Provisional Woodland Statistics – new planting and restocking statistics.

- **Connectivity of Mountains, Moorlands and Heath (MMH)* habitats vary across Wales.⁹** While upland MMH habitats form well-connected and unfragmented landscapes, lowland habitats are becoming increasingly fragmented and occur in smaller patches.¹⁰ However, there is a lack of timeseries data on changes in the connectivity of MMH.

(ii) Outcome 1b: Protected and resilient habitats

Over 90% of protected terrestrial habitats are not in favourable condition.

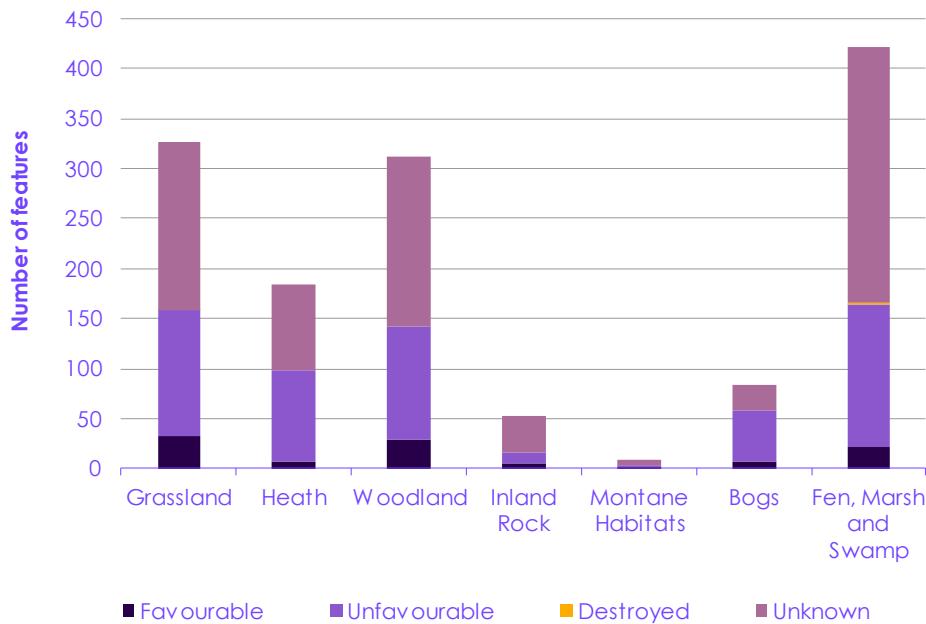
- **Over 90% of terrestrial areas under statutory protection are not classed as in favourable condition.** Terrestrial habitats and species that are within Sites of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC) are highly protected for their ecosystem services. There are 1,078 SSSIs in Wales, an addition of 12 since 2016, covering just over 12% of the nation's land area, and 95 SACs covering 8.5% of Welsh land area.⁶ In 2020, an estimated 8% of assessed terrestrial habitats were in favourable condition, 37% were in unfavourable condition and 54% were in unknown condition (Figure 2.3). This is the first time the condition of Wales protected site features has been assessed at a national scale since 2003.¹¹
- **Studies have found much of surveyed Mountain, Moorland[†] and Heath areas are in poor ecological health, although the condition is unknown for a high proportion of this habitat type.** In 2020, only 2% of the assessed features of these habitats were in good condition, with 30% in not good condition and the remaining 68% in unknown condition.¹⁰ A separate 2020 study produced broadly consistent results, finding that 50% of assessed features in heathland habitats are in unfavourable condition, 4% are in

* A UK National Ecosystem Assessment component habitat and includes Bracken, Dwarf Shrub Heath, Upland Fen, Marsh and Swamp, Bog, Montane (mountain heaths and willow scrub) and Inland Rock.

† A type of peat.

favourable condition and the remaining 46% of features are in unknown condition.¹¹

Figure 2.3 Condition of terrestrial habitats in sites under statutory protection, 2020



Source: Natural Resources Wales (2021) Protected sites baseline assessment 2020.

Only a small proportion of Welsh peatlands have been classified as being in good condition.

- **Only 10% of Welsh peatlands are in good condition.** Emissions from degraded peatlands areas have been estimated to equal 10% of Wales's transport emissions, the third largest emitting sector in Wales.^{12,13} The probability of peat degradation in 2019 in different land-use types (e.g. Urban,* Horticulture, Arable, Grassland and Wildscape) is high in most cases. A 2019 condition assessment found that 37% of the 532 km² of Welsh blanket bog are not in good condition, with the remaining 63% in an unknown condition. Within SACs, all assessed features were in unfavourable condition. It should be noted, however, that some of these features are extensive and cover vast areas of blanket bog.¹⁴
- **The National Peatland Action Programme (NPAP) has surpassed its peatland restoration target.** The aim is to deliver 600-800 ha of peatland restoration per year, and NRW restored 650 ha between 2020 and 2021 and 1000 ha between 2021 and 2022.^{8,15} Restoration is a key component in avoiding irreversible loss of peatlands under warmer and drier conditions. The risks of irreversible change are higher for those natural assets in less favourable condition.¹⁶
- **Wales is still below the UK Peatland strategy target.** The non-statutory target requires that 95% of peatlands are under statutory protection by 2040.¹⁷ Wales has a long way to go to meet this target. A total of 69% of upland and 43% of lowland peatland habitats are within statutory protection.¹⁰ In addition, 68% of deep peatlands are protected within SSSIs and only 45% within SACs.¹⁸ Applying statutory protections to peatlands helps facilitate

Some progress is being made in peatland restoration, but Wales is still below the UK Peatland strategy targets.

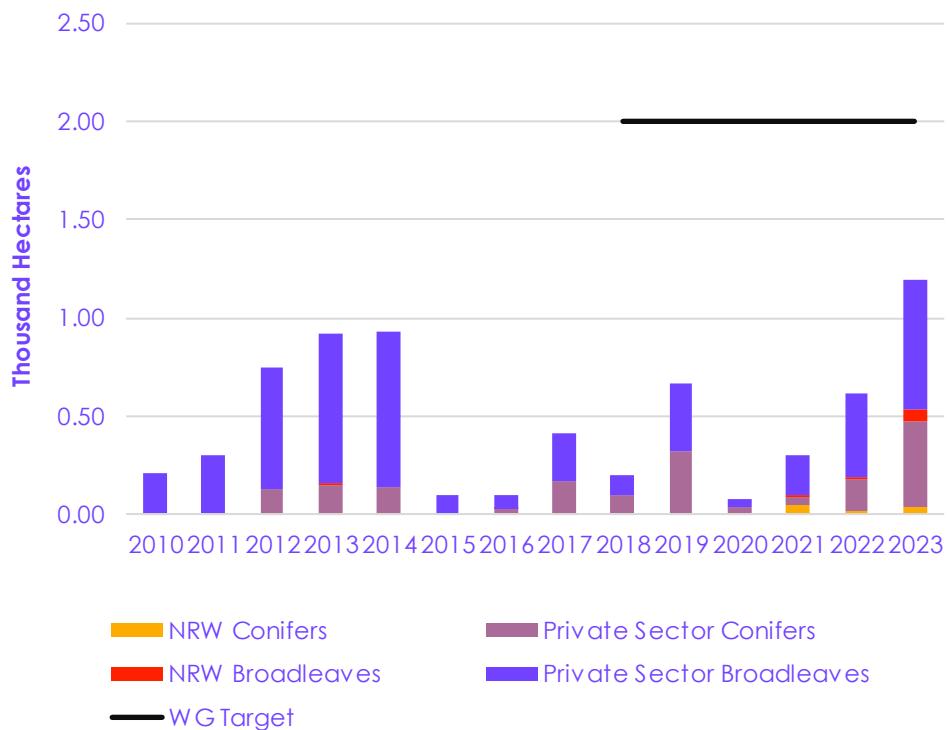
* Where urban areas are sited on peat soils.

better management practices that enhance peatlands' ability to cope under changing climate conditions.

- **Condition of most semi-natural grasslands is unknown.** Out of the 124 lowland semi-natural grassland SSSI features assessed over the period 2004 to 2017, 72% were in unfavourable condition, mainly driven by undermanagement / scrub and over-grazing by agriculture. Only 27% of semi-natural grassland is under statutory protection, while only 10% of Priority Habitat grassland being on protected sites. This is lower than the Convention on Biological Diversity (Aichi) target of 17%.¹⁹ Condition is essentially unknown for 60% of the habitat in Wales, mainly covering all non-statutory sites.²⁰ There is urgent need for structured monitoring on both statutory and non-statutory sites.
- **The condition of most woodland habitat features is unknown.** Data from 2020 show that 9.6% of assessed woodland features are in favourable condition, 36% are in unfavourable condition and 54.3% are in unknown condition.¹¹ A previous assessment of 47 SAC woodland features between 2012 and 2017 showed that 26% were in favourable condition and 74% were in unfavourable condition.²¹ The proportion of conifer and broadleaf woodlands are similar, both roughly 150,000 ha each. New planting rates show an increase in broadleaf species being planted compared to conifer species, 720 ha and 470 ha in the 2022/23 planting season respectively (Figure 2.4).²²

More broadleaf species were planted compared to conifer species in the 2022/23 planting season.

Figure 2.4 New planting by forest type, 2010 to 2023, by sector



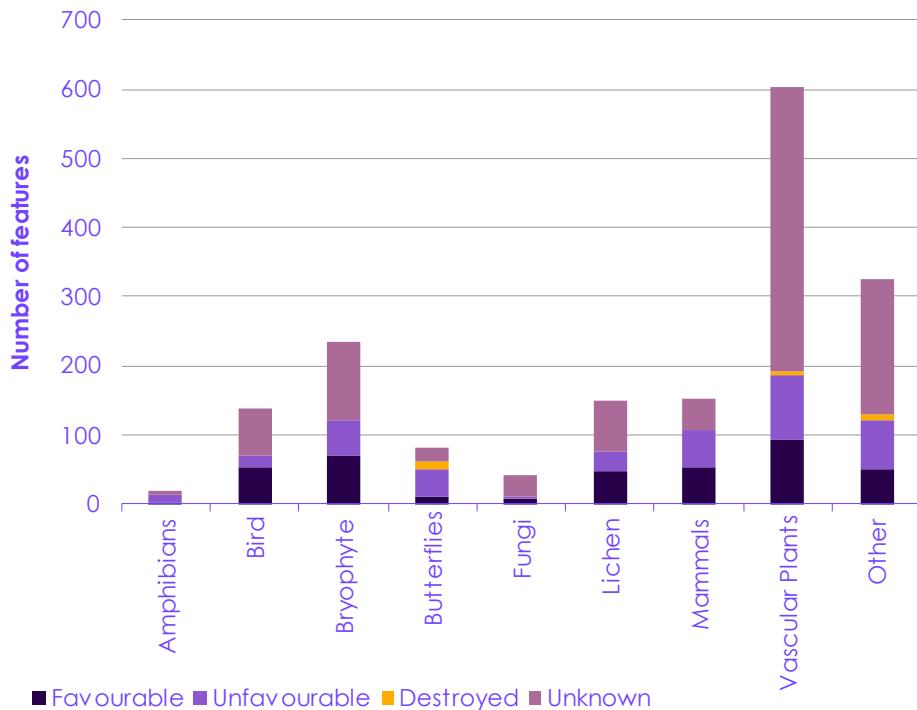
Source: Forest Research (2023) Provisional Woodland Statistics – new planting and restocking statistics.

The condition of over half of terrestrial species under statutory protection is unknown, with many terrestrial species under threat of extinction.

(iii) Outcome 1c: Diverse habitats and species

- **The condition of over half of terrestrial species under statutory protection is unknown.** Out of 1,742 species features analysed, 22% were in favourable condition, 22% were in unfavourable condition, 1% were destroyed and 55% were in unknown condition (Figure 2.5).¹¹

Figure 2.5 Condition of terrestrial species in sites under statutory protection, 2020



Source: Natural Resources Wales (2021) Protected sites baseline assessment 2020.

- **One in three mammal species are threatened with extinction in Wales.**²³ A 2020 review of 42 out of 49 monitored mammal species in Wales found that, since the last review in 1995, 26% of species had increasing populations, while 15% of species populations were found to be declining. Over half of the species had unknown population trends, largely due to data deficiencies in bat populations (15 species).
- **Grassland-specific biodiversity has been severely negatively impacted as a direct result of habitat loss.** Bumblebee species have declined, breeding bird corncrake populations have collapsed (down 98% since 1970), while 75% of the curlew bird species population has been lost in the last 25 years and is now the most pressing bird conservation priority in Wales.¹⁹
- **Many wild pollinator species are under threat.** Butterflies show a statistically significant decline of 52% across 33 species' types between 1976 and 2020. In the shorter term, the indicator was 14% lower in 2016 compared to 2006.²⁴ A combination of dramatic historical losses of grassland and heathland, changes to farmland management, and the fragmentation and isolation of surviving flower-rich habitats have all contributed towards the decline in pollinator abundance.

(iv) Outcome 1d: Reduced pressures on ecosystems

There is evidence to suggest climate change continues to affect biodiversity in Wales, with INNS continuing to spread.

- **Invasive non-native species (INNS) continue to spread across Wales.** Around 350 different INNS species have been recorded in Wales, with 10-12 new species becoming established every year.^{25,26} In terrestrial habitats, 197 species have been identified.
- **Welsh woodlands are under pressure from several diseases and pests.** The Welsh Plant Health Surveillance Network (WHSPN) has outlined six key insects, and six key pathogens that pose a threat to tree health in Wales.²⁷ Outbreaks from ash dieback (caused by fungus) had affected 26% of all broadleaves and larch disease had affected 20% of Wales's larch woodlands in 2019.²⁸ Oak trees are under increasing pressure from oak processionary moths (OPM) while spruce and pine trees are increasingly damaged by Green spruce bark beetles.^{4,29} The WPHSN programme deployed 35 insect and spore traps in 2022 at 10 sites that are of high relevance to conservation and are at high risk to invasion and colonisation. Nine out of ten sites had presence of larch bark beetles, but an absence of OPMs and emerald ash borers.³⁰
- **There is strong evidence that climate change is affecting biodiversity in Wales.** Many species are shifting their geographical ranges northwards. The greater horseshoe bat has spread to North Wales recently having previously been limited to the south and west of the country.³¹ Spring life-cycle events (such as leafing, flowering and egg laying) are occurring two weeks earlier in most species monitored. This has negative feedbacks on the species that rely on them for food, such as the pied flycatchers relying on caterpillars for food in Snowdonia. Pied flycatchers are migratory birds and do not overwinter in Wales so will be negatively impacted unless they migrate to breeding grounds earlier.³²
 - Some habitats are and will continue to be more sensitive to climate change; habitats at increased risk are montane habitats (due to projected higher temperatures) and wetlands (due to changes in water availability).³³

(c) Outcome 2: Freshwater habitats are in good ecological condition

Indicators for freshwater outcomes show insufficient progress in reducing their vulnerability and exposure to climate change.

Indicators for this outcome show **insufficient progress** in reducing vulnerability and exposure of freshwater habitats to climate change. Available data suggest the extent and condition of freshwater habitats, the decline of the species they support, and that pressures of pollution and INNS remain an issue.

(i) Outcome 2a: Larger and more connected habitats

- **The extent of freshwater habitats is decreasing across Wales.** There is no evidence of a change in extent of lakes across Wales. While the extent of rivers in Wales reduced significantly over the last 200 years, the rate of change has reduced with little to no change since 2016. Additionally, while the extent of ponds is declining, the current evidence is inadequate to base any analysis on. Up to 90% of the area of lowland ponds in the UK has been lost during the 20th century due to succession or direct infilling.²⁴
- **The number of water bodies within River Basin Districts (RBD) classed as 'in good overall status' have increased** since 2015.

- The Western Wales RBD extends across the entire western half of Wales and around 70% of the coastline is designated in UK law for its environmental quality. From 2015 to 2021, the River Basin Management Plan has ensured that an additional 2% (from 40% to 42%) of water bodies achieved good or better overall status.³⁴
- Natural Resources Wales (NRW) and the Environment Agency (EA) jointly work in the Dee and Severn RBD, as some waters within the RBDs lie within or across the boundary between Wales and England. In the Welsh part of the Severn, water bodies achieving good or overall better status have improved from 33% in 2015 to 35% in 2021 under the plan.³⁵ For the Welsh part of the Dee, the same indicator showed an increase from 28% in 2015 to 38% in 2021.³⁶
- **Freshwater habitat connectivity is decreasing.** Connectivity between rivers and their flood plains is very poor in 42% of flood plains in England and Wales.³⁷ This has resulted in the ecosystem loss of various flood plain habitats (neutral and marshy grassland, swamp, wet woodland, fen and bog), loss of associated ecological networks, disruption to natural riverine processes and vastly reduced resilience to flood risk. Human-induced fragmentation has led to a loss in connectivity between ponds and is reflected in the decline in frog and toad populations.

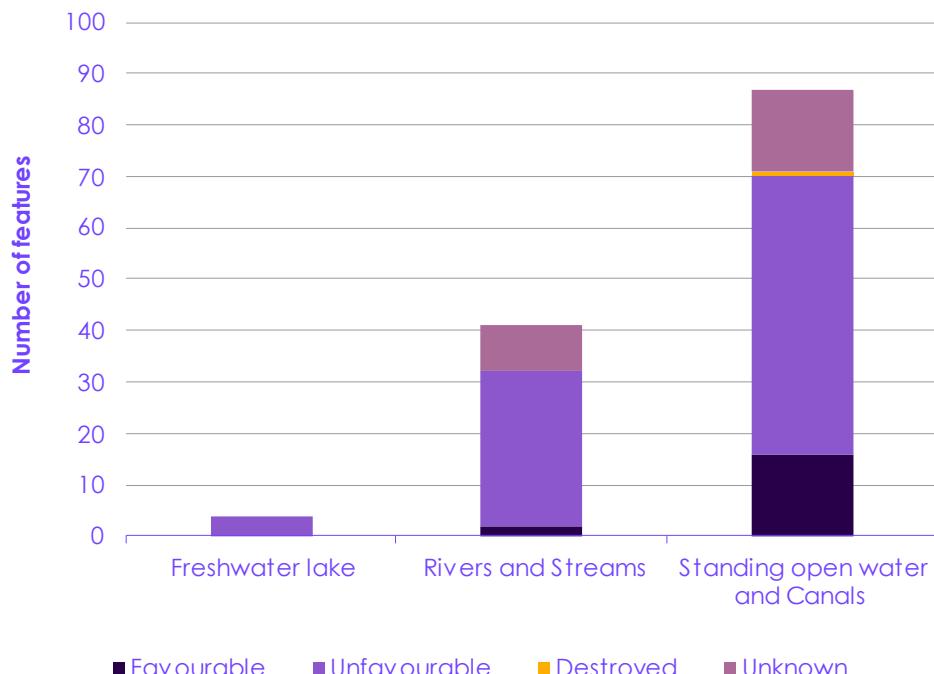
(ii) Outcome 2: Protected and resilient habitats

- **Most freshwater habitat features are in an unfavourable condition.** Out of 132 features assessed in 2020, 14% of freshwater habitat features are in favourable condition, 67% are in unfavourable condition, 1% are destroyed and 19% of features are in unknown condition (Figure 2.6).¹¹
- **There is a marked difference in the condition of upland and lowland lakes.** Most upland lakes are in good condition and improving, while most lowland lakes are in poor condition and deteriorating. This is mainly due to nutrient impacts in lowland areas. Invasive species are also a significant problem in lakes, with pressures occurring disproportionately in lowland lakes. Most lake habitats protected under the habitat regulations are in an unfavourable condition, though the condition of some in upland lake habitat have been assessed as improving.³⁷ More data are needed to determine the extent of lake habitats assessed within the different condition categories over time.
- **Most freshwater habitats under statutory protection are in unfavourable condition.** Monitoring of SSSI lakes show that 21% of 47 lake habitat features were in favourable condition in 2020. While this is a low proportion, trends show improvements since 2014, when only 11% were assessed as favourable.³⁸ Most of the remaining lake habitat features were in unfavourable condition. Forty-four percent of river water bodies are assessed as in good overall status. Data from the most recent full condition assessment of SAC rivers from 2012 show that 65% of the rivers are classified as unfavourable, while the remainder are in favourable condition.³⁹ The condition of SAC rivers show that all features reported, except for otter, have a bad status and are in an unfavourable condition; this has been the case for most features since 2007.
- **There is insufficient evidence on current pond condition.** A 2017 survey of 126 ponds across Wales found that 13 ponds (10%) had been filled in for agricultural cultivation. Some data suggest that less than 10% of farmland ponds are in good condition.³⁷

Most protected freshwater habitats surveyed in Wales are classified as being in an unfavourable condition.

Most features in freshwater habitats under statutory protection are in unfavourable condition.

Figure 2.6 Condition of freshwater habitats in sites under statutory protection, 2020



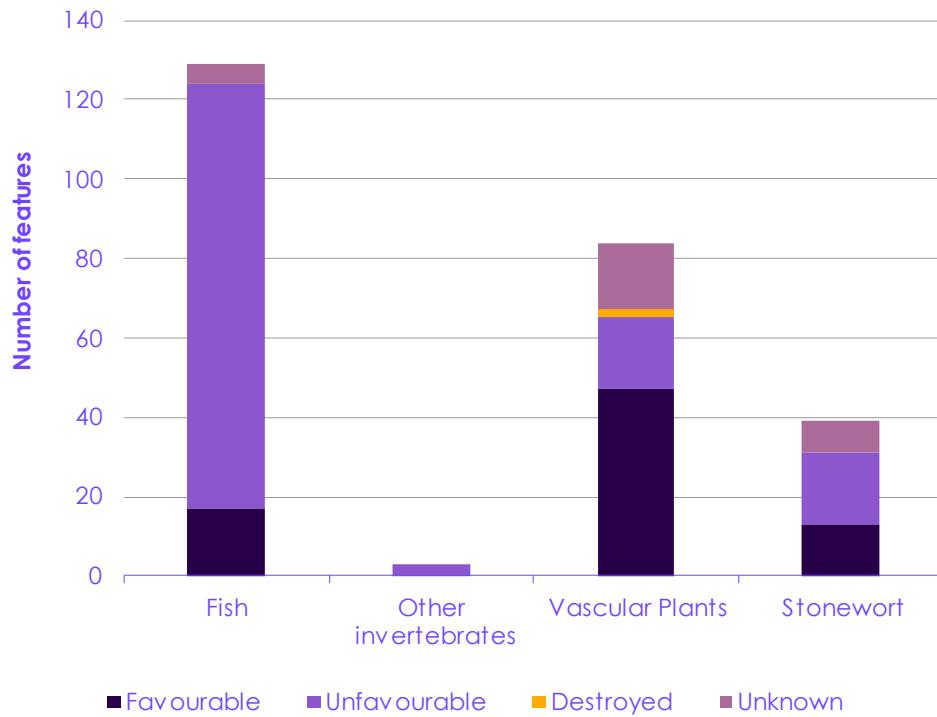
Source: Natural Resources Wales (2021) Protected sites baseline assessment 2020.

(iii) Outcome 2c: Diverse habitats and species

- **Monitored protected and priority species that rely on freshwater ecosystems are in decline.** Around 30% of species in freshwater habitats under statutory protection are in favourable condition, 57% are in unfavourable condition and 12% are in unknown condition (Figure 2.7).¹¹ Invertebrate data from the Glastir Monitoring and Evaluation Programme show that 83% of headwater streams have good or high diversity.⁶
 - Water vole populations have declined by 89% since 1995 in Wales. This is due to habitat loss and predation by invasive non-native American mink.⁴⁰
 - NRW has recorded 1,300 otter road-kills since the late 1980s due to river engineering work causing them to leave the rivers to get around structures.⁴⁰ Otters help mitigate flood risk through the building of natural dams that help regulate water flows.

Most assessed species in freshwater habitats under statutory protection are in unfavourable condition.

Figure 2.7 Condition of freshwater species in sites of under statutory protection, 2020



Source: Natural Resources Wales (2021) Protected sites baseline assessment 2020.

(iv) Outcome 2d: Reduced pressures on ecosystems

Pressures from pollution and INNS continue to affect freshwater ecosystems.

- **Freshwater ecosystems are particularly susceptible to INNS.** This is primarily due to their degree of connectivity and practical difficulties in containing and managing outbreaks in water environments. Examples of INNS causing significant damage in Wales include signal crayfish, topmouth gudgeon, Himalayan balsam, and New Zealand pigmyweed.⁴⁰ INNS pressures are disproportionately high in lowland lakes.
- **Pollution is a key issue in freshwater ecosystems in Wales.** Most reported pollution incidents come from sewage, agriculture, and residential emissions. Pollution from agriculture is mainly from the dairy industry (over 50%), where the lack of good agricultural practices has led to a transfer of sediments and nutrients to waters.⁴⁰
- **Phosphorus concentrations are exceeding targets in most water bodies monitored in Welsh river Special Areas of Conservation (SAC).** This is based on 107 water bodies assessed across the nine SAC sites in Wales from 2017 to 2019. Only 39% passed the Joint Nature Conservation Committee (JNCC) recommended phosphorus targets and 61% failed. Most failing water bodies were in mid and south Wales.⁴¹

(iv) Outcome 2e: Use of nature-based solutions (NbS) for adaptation

- **There is an increase in the uptake in Natural Flood Management grants.** The new Natural Flood Management Programme provided grants totalling £2.46 million in its first two years. The take-up was strong, with 15 schemes approved as of March 2021.⁸

(d) Outcome 3: Marine and coastal habitats are in good ecological health

Mixed progress has been made in building the resilience of marine and coastal habitats, with 45% of habitats assessed as being in unfavourable condition.

Indicators for this outcome show **mixed progress** in reducing vulnerability and exposure of marine and coastal habitats to climate change. While a large area of Welsh seas has statutory protection, 45% of habitats are in unfavourable condition. This suggests that measures delivered within the Marine Protected Areas (MPA) network have had limited impact on managing pressures on marine habitats to date.

(i) Outcome 3a: Larger and more connected habitats

- **Marine Protected Areas (MPAs) cover most of Wales's inshore and offshore waters.** They have been found to make a substantial contribution towards facilitating an ecologically coherent network in the UK. The MPA networks cover 69% of Wales's inshore waters, 50% of all Welsh waters (including offshore) and 75% of the coastline.⁴²
 - Welsh MPAs currently consist of: 107 SSSIs, an increase from 103 in 2012; 13 Special Protection Areas (SPAs), up from 6 in 2012; 15 Special Areas of Conservation (SACs), up from 11 in 2012; 3 Ramsar areas; and 1 Marine Conservation up from zero in 2012.^{43,44} Since 2016, four new MPAs and two extensions to existing sites have been added. There has also been a commission to create three further SACs for the protection of harbour porpoises.⁴⁵
 - The proportion of seabed within MPA protection in the Irish Sea, and the Western Channel and Celtic Sea, is the greatest at water depths above 75m (69.2% and 82.9% respectively). In the Western Channel and the Celtic Sea, 67% of the seabed is between 75-200m water depth, but only 0.9% is currently protected within an existing MPA.
 - MPAs protecting intertidal and subtidal habitats are well connected, with a small gap in habitats consisting of circalittoral rock.*⁴⁶ There is only one MPA present in Welsh offshore waters, resulting in a significant portion of sediment habitats being left unprotected and limiting connectivity to surrounding marine areas.⁴⁶

(ii) Outcome 3b: Protected and resilient habitats

Just under half of marine habitats in Wales are not in a favourable condition, while data suggest the condition of coastal habitats is deteriorating.

- **Almost half of MPAs are not in a favourable condition.** Data from 2018 show that 46% were in favourable condition, 45% in unfavourable condition and 9% were in unknown condition. Previous assessments were carried out

* Circalittoral refers to water depths where the light intensity is reduced to a level where it no longer supports substantial algal growth. The rocks here are instead dominated by animals.

under a different process and the extent of MPAs have grown since, hence it is difficult to provide an overall trend for feature condition.⁴⁵

- **Coastal habitats in Wales are deteriorating.** Most saltmarshes are in an unfavourable condition, with time series data showing a decreasing trend between 2013 to 2018. This is mainly due to inadequate grazing management. Monitored pioneer saltmarsh communities have been assessed as being in favourable condition. Pressure from development, forestry and accelerated succession have resulted in loss of extent of sand dune constituent habitats. The extent of cliff-top coastal grassland and heathland has declined, primarily due to agricultural intensification and abandonment.* The condition of 95% of shingle habitats is unknown and the extent has declined in the long term due to shoreline structures (e.g. groins and sea walls) constraining physical processes.⁴⁷

(iii) Outcome 3c: Diverse habitats and species

- **Marine species show a varying trend in condition and extent.** The species analysed within MPAs in NRW's indicative feature condition assessment found that out of 90 features assessed, 52% were in favourable condition, 41% were in unfavourable condition and 7% were in unknown condition.⁴⁸
 - Grey seal populations show an upward trend in pup production. Pup production at Skomer Marine Conservation Zone has been the highest ever recorded in the past five years since monitoring began in 1976.
 - The most common cetacean species in Welsh waters were given an unknown conservation status at UK level due to data limitations.[†] However, coastal bottlenose dolphin populations in Cardigan Bay are stable and in a favourable condition.
- **Condition assessments for intertidal and subtidal habitats are mostly unfavourable.** Over 60% of habitat features were in unfavourable condition, 28% in favourable condition and the remainder were in unknown condition.⁴⁵

(iv) Outcome 3d: Reduced pressures on ecosystems

Climate change is already impacting marine biodiversity to varying degrees.

- **Climate change is affecting marine biodiversity.** Colonisations by non-indigenous kelp species was recorded for the first time in the Skomer Marine Conservation Zone in 2018. Extensive heatwaves have also caused heat damage to the high shore fucoid[‡] species at sites across UK regional seas.⁴⁹
 - Future predictions of higher sea temperatures will affect marine ecosystems, where cold-water adapted species are at higher risk of potential changes in species distributions. Species distribution changes will also alter the spread of INNS, pests, and diseases. The Pacific oyster, which was introduced to southern England to supplement the shellfish industry, could spread to Wales by 2040, as temperatures rise.⁵⁰

* Cessation of farming and complete withdrawal of agricultural management. Increasing the agricultural resources (seeds, labour, fertilisers, pesticides) to increase the yield.

[†] This class of aquatic mammals includes whales, dolphins, and porpoises.

[‡] This is a type of algae.

- **Water quality assessments found over two-thirds of estuarine and coastal water bodies did not achieve good ecological status (GES).** Out of 55 estuarine and coastal bodies assessed, 36 were below standards required for GES. This is primarily due to high dissolved inorganic nitrogen levels; however, they rarely have negative biological impacts or lead to eutrophication.
- **Invasive species are outcompeting some native marine species.** Several INNS are disrupting and outcompeting native marine life across Welsh waters. For example, slipper limpets in south and southwest Wales or highly invasive sea squirt were found in Holyhead marina.

(v) Outcome 3e: Use of nature-based solutions (NbS) for adaptation

- **The use of NbS to bolster the resilience of marine and coastal habitats to the impacts from climate change is poorly recorded.** We do not currently have access to the information required to confidently assess the scale and effectiveness of NbS activities to adapt marine and coastal environments to changing climatic conditions.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place. It should be noted that this indicative assessment was based on information available in June 2023.

(a) Outcome 1: Terrestrial habitats are in good ecological health

Policies and plans to maintain the health of terrestrial habitats are limited. There is a lack of statutory targets for biodiversity, while plans to replace the EU Common Agricultural Policy remain in development.

There are **limited policies and plans** in place to ensure that terrestrial habitats remain in good ecological health. Plans for the new Sustainable Farming Scheme (SFS) indicate funding for measures that support the land's ability to deliver sustainable and environmental benefits. With farmland dominating land use in Wales, this could potentially provide significant support for the resilience of terrestrial habitats in Wales. However, plans remain in development and the payment rate for given actions is yet to be confirmed.

- **Wales has no statutory targets for biodiversity.** This applies across all three outcomes of the monitoring map and is an issue that requires immediate attention. There are efforts in place to restore biodiversity, for example through the '30x30' target that looks to protect 30% of terrestrial, inland water, and coastal and marine areas by 2030.⁵¹ However, this target is non-statutory.
 - The Environment (Wales) Act 2016 Part 1 – Section 6 outlines the duties of the Welsh Government and other public authorities to maintain and enhance biodiversity.⁵² Public authorities must account for the resilience of ecosystems (including the diversity and connections between and within ecosystems), the condition of ecosystems and their adaptability to climate change.
 - The Nature Recovery Action Plan is Wales's national biodiversity plan. Implemented in 2015, it was refreshed in 2020. The plan has set out actions for maintaining and enhancing ecological networks across terrestrial, freshwater, and marine ecosystems while adapting to climate change.⁵³ We await the latest State of Nature report to be able to assess if the plan is successful in its aims; the 2019 report showed significant declines in biodiversity.²⁴
 - The Nature Networks Programme is a three-year funding programme that aims to build ecosystem resilience through improving connectivity in terrestrial (including freshwater) and marine protected sites network.⁵⁴ Most recently, the Nature Networks Fund has awarded £3.78 million across 17 projects that will improve the condition and resilience of these habitats.⁵⁵
- **Plans in Wales to replace the EU Common Agricultural Policy (CAP) remain in development.** Around 90% of the land area of Wales is agricultural, with the majority used for rearing sheep and cattle. The Welsh Government is developing a new Sustainable Farming Scheme to support farmers in adopting sustainable farming practices, with a focus on payments to produce public goods. The scheme will be designed to meet the principles of sustainable land management, which will provide the long-term framework for future agricultural policy and support. Mitigation and

adaptation to climate change are identified as objectives under the draft plans for the scheme, which include reference to a range of actions that will build resilience of farmland habitats (see also Chapter 3). However, the payment rates for the eligible actions under the scheme are unclear at this stage.

Progress is being made in peatland and woodland restoration, and adaptation is integrated in the Welsh Government's strategic direction on woodlands and trees.

- **A Peatland Action Programme is in place, supported by funding commitments until 2024-25.**
 - The National Peatland Action Programme (NPAP), launched in 2020, is Wales's first five-year restoration programme. Since its implementation, a data portal and distribution map of Welsh peatlands have been developed that provide important information regarding the condition and extent of peatlands in Wales. Funding support beyond 2024-25 is not yet clear; longer-term funding commitments need to be formalised to ensure upscaling plans are realised. This will also help the requirement for a significant capacity building exercise in delivery bodies, sectoral skills, contractor development, landowner engagement and project development (i.e. "shovel-ready" restoration projects). The rewards of peatland restoration in reducing carbon loss and restoring biodiversity are numerous, but the associated costs can be prohibitive.⁵⁶
 - As part of the Biodiversity Deep Dive, the Welsh Government announced a target to increase restoration from 600-800 ha per year to 1,800 ha per year by 2031/32.⁵⁷ Funding has been committed until 2024/25.
 - The Historic Environment Group Climate Change Subgroup has also established a Peatland Working Group to connect the historic environment with the NPAP (See Box 2.4 for information on historic landscapes).
 - Welsh Government is part of the UK Peatland strategy, which sits alongside NPAP and supports the development of future plans and facilitates UK-wide discussion regarding contractors, skills and reporting. The Welsh Government is working with the UK Government to implement a ban on the retail sale of horticultural peat products. The ban will come into effect from 2024.
- **Adaptation to climate change is integrated throughout the Welsh Government's Strategy for Woodlands and Trees.** The strategy aims for woodland cover in Wales to increase by at least 2,000 ha per annum from 2020 to 2030, and beyond. Priority is given to native woodland species when restoring planted woodland on ancient woodland sites.
 - The Woodland Creation Planning Scheme provides grants to develop plans for new woodland creation. Eligible actions under the new Woodland Creation Grant include planting and ongoing maintenance for the first 12 years after planting. Smaller areas of tree planting under two hectares are also eligible for funding under the Small Grants scheme.

– NRW continues to manage and improve the condition of Plantation on Ancient Woodland Sites (PAWS). The sites totalling 11,221 ha are managed to the standard of the UK Forestry Standard.* The aim of PAWS restoration is to preserve, increase and recreate a woodland habitat that supports a diverse array of species and ecosystems.⁵⁸

- **The Welsh Government has funded the Welsh Plant Health Surveillance Network (WPHSN) to monitor native and invasive pests and pathogens in Welsh woodlands.** The WPHSN programme, which is run by Forest Research, monitors and gathers data to build distribution maps of pests and pathogens, and manages sites at high risks of invasion and colonisation.⁵⁹ To prevent the spread of ash dieback, the Welsh Tree Health Steering Group published an action plan in 2017 stating that no ash species should be planted, and that alternative broadleaf species should be used.⁶⁰

Box 2.4

Welsh historic landscapes and climate change adaptation

- The register of landscapes of historic interest in Wales identifies 58 landscapes of outstanding or special historic interest.
- A range of work has been undertaken to understand the potential climate risks to these landscapes.
- The effects and rate of climate change and its impacts on local landscape character, pattern and distinctiveness is also assessed in the Historic Environment and Climate Change Sector Adaptation Plan. This latter includes considerations of the risks, opportunities and adaptation actions for historic landscapes.
- See Chapter 12 on Community for more information on conserving local cultural heritage.

Source: Historic Environment Group (2020) *Historic Environment and Climate Change in Wales Sector Adaptation Plan*.

The Sustainable Farming Scheme has earmarked support towards woodland restoration.

- **The Sustainable Farming Scheme (SFS) provides opportunities for woodland restoration.** One of the universal actions proposed by the Welsh Government is that all farms in Wales have a minimum of 10% tree cover. To support woodland resilience, there is a requirement for the “right tree in the right place”, meaning the type of tree species and the location must be assessed instead of using a blanket approach.⁶¹ The current proposal emphasises planting broadleaves over conifers, with conifers not contributing to the habitat action due to their limited contribution to resilience. There is no mention of restoring peatlands in conjunction with the universal actions. Considering that agriculture covers around 90% of Welsh land area, SFS will be key to the sustainable management of peatland in the long term.
- **Invasive Non-Native Species (INNS) Strategy is in place.** The Wales Biodiversity Partnership INNS Group brings together expert stakeholders to support the Nature Recovery Action Plan in Wales. It acts as the country-level INNS group for Wales under the GB INNS Strategy. The update to the Great Britain (GB) INNS Strategy includes a new target to halve the number of harmful alien species from establishing in GB within the decade. It also sets out a desire to significantly increase the number of inspections and investigations against INNS.

* Plantations on Ancient Woodland Sites are ancient semi-natural woodlands (ASNW) that have been felled and replanted with other tree species, typically non-native ones such as spruce, fir and larch.

- **There are burning practice requirements in place and campaigns to raise awareness of the need to consider wildfires risk.** The 'Heather and grass burning code' sets out the legal requirements and advice on safe burning.⁶² Operation Dawns Glaw, in place since 2016, runs campaigns to raise awareness of grass fires and educating farmers and landowners.⁶³ The Welsh Government has recently funded the Healthy Hillside Project, which provides education and new firefighting techniques to minimise wildfire damage.⁶⁴

(b) Outcome 2: Freshwater habitats are in good ecological health

Some plans are in place to safeguard the condition of freshwater habitats.

There are **partial policies and plans** in place to ensure that freshwater habitats are in good ecological health. The Welsh Government is responsible for the creation and management of policies on water management in Wales and have introduced some policies to protect and improve the status of freshwater habitats.

- **The third cycle (2021-2027) update to the River Basin Management Plans (RBMP) in Wales has been published.** The RBMPs set the legally binding, locally specific environmental objectives that underpin water regulation and are the foundation for delivering the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 aims and objectives. Each management plan covers a specific River Basin District (RBD). There are three in total; NRW manages the Western Wales, and Dee RBDs, while the Environment Agency leads on the Severn RBD.
 - For the 2021 plans, the UK Government and Welsh Government have produced separate ministerial guidance applying to river basin districts within their respective territories. The Welsh Government have issued guidance to NRW to integrate climate change adaptation measures during RBMP planning. This includes assessing how climate change is considered in monitoring, assessment of pressures and the choice of measures.⁶⁵ Preference should be given to measures that provide high levels of climate resilience or flexibility, and additional measures to deal with climate risks should be encouraged where needed.
 - While all three RBMPs outline a range of programmes needed to address and deliver the plan's objectives by 2027, they lack clear and specific adaptation actions to support management in a changing climate.^{66,67,68}
 - The Relieving Pressures on SAC River Catchments to Support Delivery of Affordable Housing: Action Plan build on the RBMPs and set out actions to reduce nutrient runoff, in particular phosphorous pollution in SAC rivers.
- **NRW has implemented the Abstraction Licence Strategies to assess abstraction pressures on water courses.** These strategies ensure that environmental needs are met and calculate the available water resource once abstraction licence allowance has been allocated.
- **Development remains a significant pressure on freshwater habitats.** Despite legislative and policy tools such as the Water Framework Regulations and the Environment (Wales) Act 2016, development continues to cause significant, permanent harm to rivers, flood plains and other water features. New road schemes are of particular concern, with several causing significant damage to rivers in recent years, due to run-off.

- **The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 aim to protect the health of Wales's rivers, lakes, and streams from agricultural pollution.** The statutory regulations apply to all farms in Wales and create new rules on applying and storing nutrients on their land.⁶⁹ Funding is available through the Rural Development Plan's Farm Business Grant (FBG) and Sustainable Production Grant (SPG) schemes to aid farmers through the transition to improve nutrient management.⁷⁰

(c) Outcome 3: Marine and coastal habitats are in good ecological health

Some progress is being made in policy to improve marine and coastal habitats, with emphasis on the management of Marine Protected Areas and the development of Welsh seas. However, more research is needed to bridge evidence gaps.

There are **partial policies and plans** in place to ensure marine and coastal habitats are in good ecological health. Progress has been made in the development and delivery of adaptation plans for marine and coastal habitats, although it is too early to determine their effectiveness. Provisions in place to fill gaps in the evidence base will support efforts to adapt marine and coastal habitats in the future.

- **The Marine Protected Area (MPA) Management Steering Group help provide a national steer for MPA management across the network of MPAs in Wales.** The fifth MPA Network Management Action Plan 2022-2023 sets out the priority network/level actions to improve MPA management and improve and maintain the condition of the network of MPAs in Wales. The plan is produced by the MPA Management Steering Group and sits alongside the MPA Network Management Framework for Wales 2018/2023. The Action Plan and Framework provide a steer for Management Authorities to guide delivery of the long-term vision for the management of the network. It sets out a list of priority actions, ranging from restoring biodiversity, developing a bio-security plan for INNS and improving the condition of existing MPAs.⁷¹ The Plan includes a project to gather evidence to understand the impacts of coastal squeeze on the MPA network. It could be strengthened with the inclusion of broader research into which adaptive actions could increase the resilience of marine habitats and species to impacts from changes in ocean chemistry, temperature and ocean stratification.
- **Welsh National Marine Plan (WNMP) was introduced in 2019 to support sustainable development of Welsh Seas.** The plan area consists of 32,000 km² of sea and 100% of the 2,120 km coastline.⁷² The WNMP states that proposals on the development and utilisation of the marine environment should showcase strategies to mitigate the risk of coastal change. In addition, it encourages implementing measures that work with natural processes, facilitate adaptation to climate change and enhance the resilience of ecosystems and coastal communities.
- **Wales Marine Evidence Strategy 2021-2025 could help inform on issues related to the assessment of marine ecosystem resilience.** This joint initiative between the Welsh Government and NRW has defined high level, strategic marine evidence priorities and developed a framework for collecting this evidence. It emphasises that evidence should prioritise improving the understanding of impacts of climate change on marine ecosystems.
- **The four Shoreline Management Plans cover the entire Welsh coastline, but their non-statutory basis limits their effectiveness.** The plans outline key actions to manage the coast in current and future time periods. They consider other existing planning initiatives and legislative requirements and are intended to inform wider strategic planning. However, they are non-

statutory, making it challenging to effectively monitor their implementation or secure reliable funding. It has been over 10 years since the SMPs for Wales were released over which time new evidence on climate risks to marine has improved; Natural Resources Wales is leading a project with the Coastal Groups to refresh the SMPs to ensure the plans reflect the latest evidence.

Awaiting policies:

- **UK Marine Strategy Part Three update.** The Welsh Government has been engaging on the UK Marine Strategy Part Three update. A consultation was held in 2021; findings will be used to support an update to the programme of measures that the UK intends to use to achieve or maintain good environmental status of UK seas.

(d) Recommendations

Our recommendations for building Welsh nature's resilience.

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for nature (Table 2.2). Primary responsibility is assigned to ministerial portfolios.

Table 2.2
Recommendations - Nature

| Primary responsibility | Recommendation | Timing |
|---|--|---|
| Climate Change | There is a need of better monitoring and evaluation of habitats and species, including their condition and response to climate change. | 2024 |
| Climate Change | Create a coherent and resilient ecological network of protected sites that is resilient to the effects of climate change. | Ongoing |
| Climate Change, Rural Affairs and North Wales | Create statutory targets for biodiversity and mainstream nature recovery and climate adaptation in all relevant Government policies and plans. These should be implemented in plans and policies connected to terrestrial, freshwater and marine ecosystems. | 2024 |
| Rural Affairs and North Wales | Ensure that the new Sustainable Farming Scheme includes opportunities to deliver and restore freshwater ecosystems. This includes reducing pollution from slurry, sewage and agriculture that enters rivers, lakes and groundwater. | 2025 – in line with the SFS being implemented |
| Climate Change | Identify measures and deliver a plan for threatened freshwater species. | 2024 |
| Climate Change | Implement INNS regulations through Wales level contingency plans and deliver collaborative catchment-scale projects through the Area Statement process. | 2025 |
| Climate Change, Rural Affairs and North Wales | There needs to be a proper investigation, monitoring and evaluation of the underlying causes of poor feature conditions and sufficient action taken to address the drivers. Measures to improve the habitats should be identified in the next River Basin Management Plans, Sustainable Farming Scheme and Marine Protected Areas. | Ongoing |
| Climate Change | Integrate climate change adaptation measures into the various steps of the River Basin Management Plans. Example of these measures are outlined in Guidance document No 24 – River basin management in a changing climate. ⁷³ | 2024 |
| Climate Change | Improve incentives for tree planting to dramatically upscale woodland creation efforts to reach future targets, while ensuring the right tree is planted in the right place to minimise maladaptation and increase adaptation co-benefits for nature. | Ongoing |
| Climate Change | Develop and implement a strategy for how Wales will reach the Convention on Biological Diversity (CBD) 30x30 protected area target and the CBD target to halt biodiversity loss by 2030. | 2024 |
| Climate Change | Address causes of reduced connectivity within terrestrial, freshwater and marine and coastal habitats. | 2024 |
| Climate Change | Dramatically increase funding available for addressing the climate and nature emergencies, including schemes for research, monitoring and implementation. | Ongoing |

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Chapter 3

Working land and seas

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Introduction

Table 3.1

Progress summary – Working land and seas

| | Delivery and implementation | Policies and plans | Summary |
|--|-----------------------------|---------------------------------|---|
| Outcome 1: Climate resilient agricultural production | Unable to evaluate | Limited policies and plans | <ul style="list-style-type: none"> There is an insufficient level of data available to conduct a robust assessment of the resilience of Welsh agricultural production to climate change. Proposals for the Sustainable Farming Scheme could form a comprehensive plan to improve the resilience of Welsh agricultural production. However, take-up rates will depend on payments levels for given actions under the scheme, which are as yet unclear. |
| Outcome 2: Climate resilient commercial forestry sector | Mixed progress | Limited policies and plans | <ul style="list-style-type: none"> There is limited data available for commercial forests in Wales. Wales is behind its targets of planting 2,000 ha of new woodland each year. The Woodland for Wales Strategy includes key adaptation goals but lacks clear actions. The Woodland Creation Planning Scheme requires plans be compliant with UK Forestry Standard requirements to be eligible for funding. |
| Outcome 3: Climate resilient fisheries and aquaculture sector | Unable to evaluate | Insufficient policies and plans | <ul style="list-style-type: none"> Key data gaps mean we are unable to robustly assess the resilience of the commercial fisheries and aquaculture sector to climate change. Policies and plans are insufficient to ensure the sector remains resilient to climate change. The majority of fish stocks have limited protections due to them not being subject to fishing quota requirements. |

Relevant risks from CCRA3:

Risks to soils. (N4); Risks and opportunities for natural carbon stores, carbon sequestration and GHG emissions (N5); Risks to agriculture and forestry (N6, N7, N8); Opportunities to agriculture and forestry (N9); Risks to aquifers agricultural land (N10); Risks to marine habitats and species, and fisheries (N14, N16); Opportunities to marine habitats and species, and fisheries (N15).

This chapter considers how climate change could affect the productivity of Welsh working lands and seas (WLS), which includes activities relating to agriculture, commercial forestry, fisheries, and aquaculture. These sectors provide jobs, vital products, inputs to other sectors and bolster resource security. Weather and climate-related disruptions in these sectors can have significant cascading environmental, economic and social impacts.

Climate hazards to WLS are dependent both on risks to the underlying natural systems that these services depend on and the management practices used in the sectors. Other anthropogenic pressures can also impact the sectors and undermine resilience of natural resources to climate change, as well as the ability of these sectors to take advantage of any potential benefits from climate change. These drivers include environmental pressures, such as water pollution and soil degradation, as well as policy-driven risks to international competitiveness and economic resilience.

Climate hazards such as floods, storms, drought and average temperature rise affect the productivity of the agriculture, commercial forestry, fisheries and aquaculture sectors in Wales.

There are many climate hazards affecting these sectors. For example, impacts from floods, storms, drought and average temperature rise are already being felt by agriculture, timber production and fisheries, and these impacts are projected to increase. Less predictable precipitation will also impact planting and harvesting times for agriculture.

The 2021 Independent Assessment of UK Climate Risk by the Climate Change Committee identified three risks directly related to Wales's WLS (Box 3.1):¹

- Risks to crops, livestock, and commercial trees from multiple hazards.
- Risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards.
- Risks to soil health from increased flooding and drought.
- Risks to natural carbon stores and sequestration from multiple hazards leading to increased emissions.

Box 3.1

Climate impacts to WLS in Wales

The third UK Climate Change Risk Assessment (CCRA3) identified:

- There is an increased risk of loss to soil resources where severe degradation of soil quality could potentially have irreversible implications in the UK. Analysis in Wales has indicated that catchment-wide soil structural degradation is estimated to result in a 10 to 20% reduction in soil water storage capacity, and to contribute up to a 10% increase in short term river flow response to rainfall during the field capacity period.
- Future incidence of disease within agriculture is likely to increasingly diverge from present-day patterns, especially at higher magnitudes of warming. Risks from some species and micro-organisms will increase due to warmer and seasonally wetter conditions, most especially in winter months and others will become more constrained. The combined risk factors (climate and non-climate) suggest that the magnitude of this risk is increasing from medium at present to high in the future.
- There is increasing evidence of climate change as a factor increasing the rate at which new tree pests and pathogens are introduced.
- Future risk to agricultural land from seawater saline intrusion is expected to gradually increase with sea level rise. However, current risk at national scale is assessed as low at present and most likely to remain low in future for all UK nations, although potentially higher for Wales by the 2080s in a +4°C global warming scenario by 2100.
- Climate-related changes in UK seas have been especially marked by a warming trend. There is good evidence to suggest major changes will occur to the marine environment under both +2°C and +4°C at 2100 warming scenarios but it is difficult to be precise on specific details due to multiple risk factors and the interconnectivity of marine ecosystems. Changes in fisheries policy, international trade and access to markets resulting from the UK's departure from the EU will likely have major implications for this risk.
- Wildfire risks may increase due to projected changes in temperature and rainfall (hot and dry weather). It is likely that the frequency of moorland, grassland and forest fires may increase with regional differences.

Source: Netherwood, A. (2021) *Evidence for the third UK Climate Change Risk Assessment (CCRA3) Summary for Wales*.

The sectors within Wales's WLS have intersections with climate adaptation outcomes covered in this chapter and elsewhere in the report (Box 3.2).

Box 3.2

Inter-relationships of WLS with other parts of this assessment

The systems within this report where these link to working land and seas are most pronounced include:

- **Nature.** Healthy ecosystems deliver resources (e.g. food, fibre and water) that are fundamental to economic activities in WLS. Healthy ecosystems also provide regulating services (e.g. water filtration, erosion control and flood mitigation) that can protect WLS from the impacts of climate change, and supporting services (e.g. pest control and pollination) that support the delivery of many benefits from the environment.
- **Food.** Effective adaptation by the agricultural and fisheries industries will support a climate-resilient food system producing sustainable, nutritious, and high-quality food.
- **Water supply.** The agriculture and aquaculture sectors abstract freshwater from the environment to support production. For the overall water system, including water used by homes and businesses through the public water system, to be resilient to periods of future drought, actions to use water more efficiently and sustainably in WLS are needed.

Wales's current adaptation plan includes key objectives for making working lands and seas resilient.

The current Welsh adaptation plan Prosperity for All: A Climate Conscious Wales (PfACCW) identified a range of key objectives and indicators to assess progress towards building climate resilience for working lands and seas (Box 3.3).²

Box 3.3

Working Lands and Seas in Prosperity for All: A Climate Conscious Wales

Objectives and indicators.

- Deliver climate change adaptation through the new Sustainable Farming Scheme for Wales, by establishing and delivering a set of agriculture emission reduction and adaptation measures to support the agriculture industry in responding to climate change.
 - Indicators:
 - Environmental and Rural Affairs Monitoring and Modelling Programme (ERAMMP) modelling to assess the contribution of land management to reducing the risk of climate change.
 - Deliver the Capability, Suitability and Climate (CSC) programme.
 - Indicators:
 - Agricultural capability maps under UKCP18.
 - Crop potential maps under UKCP18.
 - Next steps & adaptation research and needs identified.
- Carry out research to better understand the impact of climate change on marine ecosystems, ecosystem services and marine heritage, including collaborating on research to improve knowledge of higher water temperatures on fish stocks and ecosystems, including impacts for fish disease and aquaculture.
- Tackling land management practices that increase flood risk

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for all: A Climate conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress for well-adapted working land and seas

We assess the progress made in making the productivity of the agriculture, commercial forestry, and fisheries and aquaculture sectors resilient to changes in climate conditions.

Well-adapted WLS are those that remain productive and economically sustainable in a changing climate, with businesses that are resilient even during weather extremes. Within each sector of WLS, we identify key adaptation outcomes to deliver this goal (Figure 3.1):

- **Climate-resilient agricultural production.** Agricultural soils need to be in good condition to support production, particularly under future weather extremes. Sustainable soil management techniques on farms (e.g. reduced tillage, the use of cover crops and incorporation of organic matter to reduce erosion) will help deliver this. These actions will also help increase the water-holding capacity within soils, which can be complemented by increasing on-farm water storage capacity (such as via reservoirs) and water-saving farming techniques to fully address drought risks. Healthy pollinator populations are needed to pollinate crops. On-farm flood risk management and contingency planning will need to be in place. Crop selection must be suitable to climate conditions and include greater crop diversity. Increased agroforestry and hedgerows can provide shade and shelter for livestock during heatwaves and offer co-benefits such as natural flood management and (together with species-rich field margins) habitat for pollinators and pest predators. Integrated pest management and improved soil health will help improve resilience to climate change-driven increased risks from pests and diseases.*
- **Climate-resilient commercial forestry sector.** Commercial woodlands should be under sustainable adaptive management (e.g. meeting the UK Forestry Standard) to help build resilience to climate change. They also need to contain climate-appropriate and ecologically suitable trees (e.g. avoiding water-hungry species or trees planted in incorrect soils). Having high species and genetic diversity can help reduce risks from pests and diseases, while wildfire risk can be better contained through adaptation actions to thin dense forests, remove forest fuels and establish fire belts.
- **Climate-resilient commercial fisheries and aquaculture sector.** Harvesting fish stocks must be undertaken sustainably to support resilience to climate change. Preventing water pollution (e.g. from discharge of power station cooling water) and controlling water temperatures where possible (e.g. planting along streams and rivers to improve shading) will help protect and improve the quality of water supplies vital to the aquaculture sector. Restricting ecologically damaging offshore fishing practices (e.g. bottom trawling) will ease pressures on the ability of marine habitats to support production. Fishing operations may need to adjust their locations, the species they harvest and practices to adapt to changing species distributions and disease risk associated with changing water temperatures.

Delivering these outcomes requires enabling factors to be in place, the most critical of which are:

- **Governance and policy coordination.** A comprehensive, joined-up cross-departmental approach to policy is required. This must ensure that climate

* Integrated pest management (IPM) is a coordinated and planned strategy for the prevention, detection and control of pests, weeds and diseases.

Good governance and policy coordination, investment and consistent funding and good data collection, as well as the development of necessary skills are essential to deliver the adaptation outcomes in each sector.

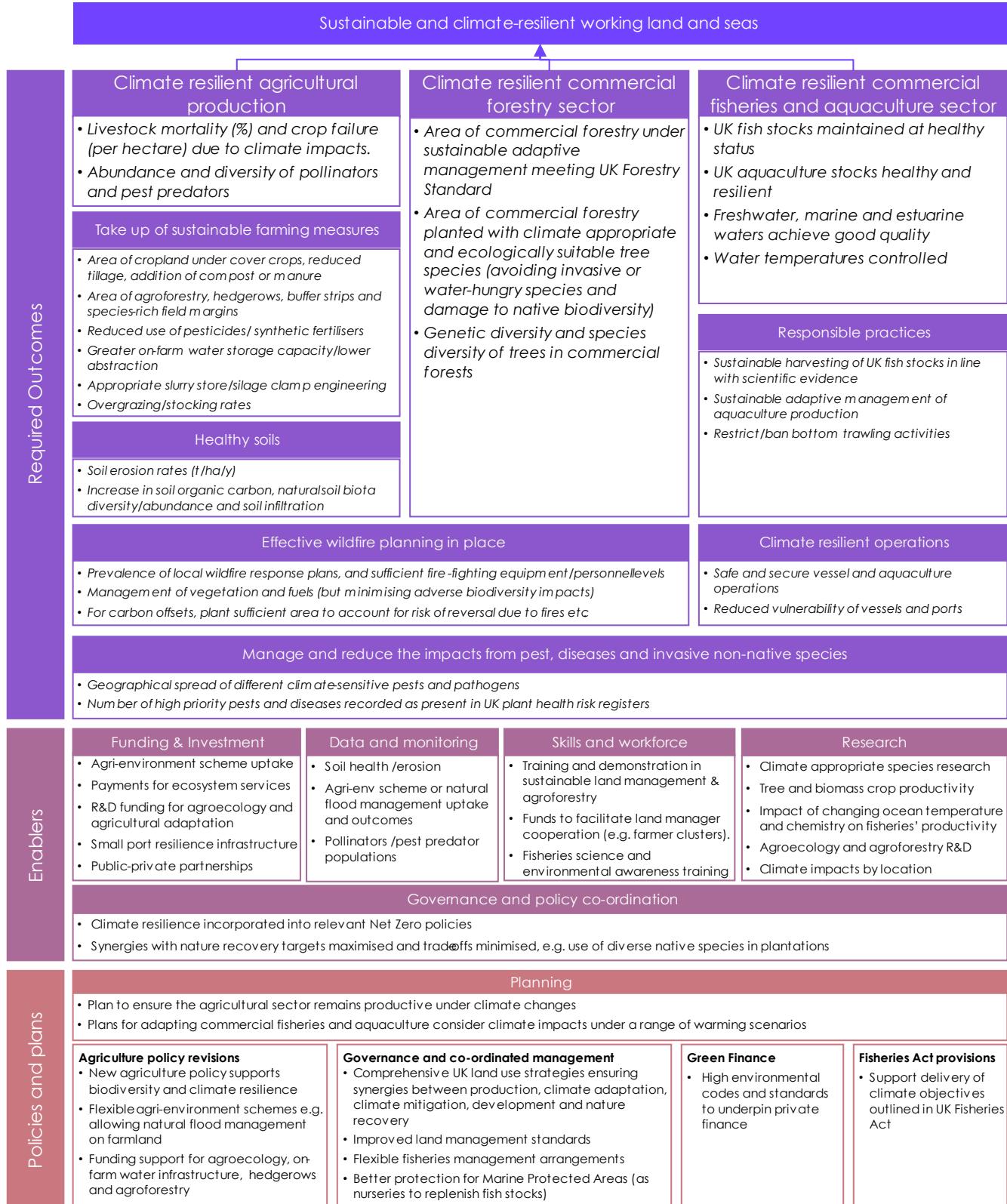
resilience is considered alongside other objectives for WLS, such as contributing to Net Zero, nature recovery and food security.

- **Funding and investment.** Access to finance is needed as actions to support WLS may have high upfront costs with relatively long periods before returns are fully realised. Agri-environment schemes, grants and funding for R&D will be key to support a just transition to sustainable and climate-resilient WLS. Harmful subsidies that compromise adaptation need to be eliminated or carefully repurposed.
- **Data and monitoring.** Robust data are required to track changes in climate risks, hazards and improvements in resilience of WLS, which will help target the most effective interventions. Priorities include metrics to track soil health, impacts of funding interventions on productivity, biodiversity and climate resilience, and data on missing indicators.
- **Research.** More evidence is needed to understand how a changing climate affects productivity across WLS, which can be used to target interventions that build resilience. This includes spatial variability in climate impacts, researching climate-appropriate species/genotypes for different locations, and understanding the impacts of changing ocean temperature and chemistry on fish stocks. Research into how best to balance multiple goals including food security, climate mitigation, adaptation and nature recovery is also vital.
- **Skills and workforce.** More training is needed to build the knowledge, understanding and capacity of practitioners to improve efficiency, sustainability and productivity across the sectors. This includes help with training and demonstration of more sustainable land management methods and new uses of land (such as agroforestry); government schemes to increase recruitment and retention of green jobs such as peatland restorers; and facilitating natural resource manager co-operation and participatory governance, such as land manager clusters and catchment partnerships. Policies and plans needed to build the resilience of WLS to the impacts of changing climatic conditions include:
- **Planning.** The agriculture sector needs a clear plan outlining the steps needed to ensure it remains productive under the shifting threats from climate change. Revisions to plans for adapting commercial fisheries and aquaculture must consider climate impacts under a range of warming scenarios.
- **Agriculture policy update.** Revisions to agriculture policy must consider and support nature recovery and consider climate risks to delivery. Greater flexibility is needed in the range of activities under agri-environment schemes (e.g. explicit funds for climate-resilient actions) and more funding is needed to ensure agriculture is resilient to climate change.
- **Governance and co-ordinated management.** Land management standards must be strengthened, while fisheries management arrangements must be made more flexible to ensure effectiveness under a changing climate.
- **Green Finance.** Finance schemes such as carbon credits and nature offsets must adhere to high environmental standards and codes. Government should clarify where it expects adaptation actions will be funded through public sources and where private investment is expected.

Updates in key policy areas, including agriculture and fisheries, as well as a coordinated approach to land management, are needed to support adaptation outcomes.

- **Delivery of the Fisheries Act objectives.** Sufficient support must be made available to improve the ability of the fisheries and aquaculture sector to adapt to climate change.

Figure 3.1 Monitoring map for working land and seas



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes for WLS identified in the previous section.

(a) Outcome 1: Climate resilient agricultural production

Gaps in data prevent us from robustly evaluating the resilience of Welsh agricultural production to climate impacts.

There are too few suitable datasets to robustly assess the resilience of the agricultural sector to changing climatic conditions in Wales. Significant gaps remain in the suite of indicators required to monitor key interventions, such as on-farm water efficiency measures and water storage capacity, and climate impacts including losses of livestock/crops due to extreme weather events. We are therefore **unable to evaluate** this outcome.

- **The condition of Welsh soils has remained stable since the 1980s.** Soil carbon concentration in the topsoil across arable as well as improved and semi-improved grassland, appear to be stable, with no significant changes since the 1980s.³ Arable land has the lowest carbon concentrations, which is largely due to the removal of organic matter (OM) and soil disturbance during the agricultural intensification process.⁴ Datasets are only available for the top 15cm; therefore the absolute total OM of soils cannot be measured.
- **Soil formation and erosion rates in Wales have not been directly measured and quantified.** Most literature reports erosion rates for both England and Wales, so it is not currently possible to disaggregate data for Wales.^{5,6,7,8}
- **The area of farm woodland has increased from 63,000 ha in 2012 to 124,000 ha in 2021.**⁹ Farm woodland is a cost-effective way of providing shelter for buildings and livestock.¹⁰ In addition, sustainable woodlands play an important role in improving biodiversity on farmland. Consideration should be given to the types and location of woodland creation to avoid deleterious impacts on the most productive land and ensure species planted support agricultural and environmental sustainability.
- **It is not possible to assess pesticide use in Wales.** Data to support measurement of this indicator is not currently available on a devolved administration level. Overuse of pesticides harms pollinators, which can affect crop production. Projected increases in the frequency of winter floods and summer droughts are likely to lead to a greater volume of pesticides being lost to watercourses as well as a higher risk of erosion occurring on exposed soils.
- **There is an absence of time series data on agricultural water abstraction.** Agriculture accounts for the larger proportion of abstraction licences, although the quantity of water abstracted is less than 1% of the overall total.¹¹ The majority of these abstractions is for irrigation, a highly consumptive activity. Further work is needed to understand changes in the volume of water abstracted from the environment by agriculture and the extent and effectiveness of adaptation actions to improve water efficiency on farms.

- **Data to support the assessment of changes in the level of on-farm water storage capacity in Wales is not collected.** Building on-farm water storage capacity (e.g. reservoirs) is a key tool for building agricultural resilience to risks from current and future water scarcity. Extensive and systematic surveying is required to develop data on these indicators, such as number of reservoirs.
- **Increasing research into improving agricultural resilience/Genetically Modified Organisms.** Research and development into increasing efficiency and improving environmental outcomes of agricultural production has been mainly taking place through the Knowledge Transfer Programme, Farming Connect. The Programme focuses on a number of relevant areas, including improving land conditions and livestock genetics. Farms benefiting from the Programme collect data on the relevant areas of focus to inform decisions. Separately, Welsh Government have, over five years, funded a programme supporting and encouraging farmers in utilising and improving flock genetics through the Hill Ram Scheme, delivered by Hybu Cig Cymru – Meat Promotion Wales. As this programme has come to an end, a further, enhanced provision of support is now being offered through Farming Connect - the Welsh Sheep Genetics Programme. The Welsh Government should consider expanding Farming Connect and the accompanying data collection methods to new areas of research.

(b) Outcome 2: Climate resilient commercial forestry sector

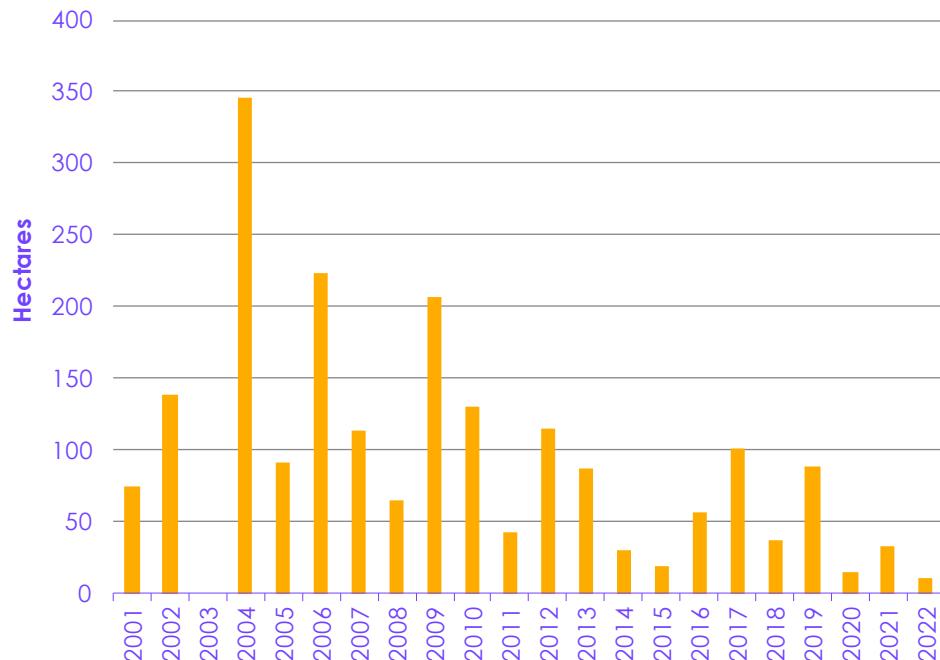
There has been mixed progress in reducing the vulnerability and exposure of the commercial forestry sector.

There are limited data that differentiate commercial forestry from broader woodlands and forests in Wales; therefore, we are unable to evaluate commercial forestry trends over time. Indicators for woodlands as a whole show **mixed progress** in reducing vulnerability and exposure to climate change.

- **Nearly half (47%) of woodlands in Wales are managed under the requirements of the UK Forestry Standard (UKFS).** This includes 117,000 ha of Welsh Government Woodland Estate (WGWE) and 29,000 ha of certified private woodlands.¹²
- **Current management of Welsh Woodlands is split into four categories.** Around 24% of woodlands is managed by clearfell, 12% is managed for timber products without using clearfell, 12% is managed as a natural reserve meaning little to no harvesting activity, and the management of the remaining 52% is unknown as it is not in a current grant scheme.¹³ Across the UK, clearfell / restock (CF/R) accounts for the overwhelming majority of production forest management by both government and private owners.¹⁴ Whilst this has enabled successful afforestation and harvesting, it is increasingly recognised that such disturbances can damage the soil, making them unsustainable in the long-term.¹⁵ For the healthy functioning of the soil and for the continued storage of carbon, soil disturbance must be minimised, and this aspect of forestry practice must be revisited.¹⁶
- **Area of certified woodland has stayed relatively stable since 2004, fluctuating between 130,000 ha to 150,000 ha.**¹⁷ Woodland certification suggests that a forest is being managed to maintain its biological diversity. This is specific to certifications from the Forest Stewardship Council (FSC) scheme or the Programme for the Endorsement of Forest Certification (PEFC) scheme.¹⁸
- **Forest fires were responsible for 3.5% of tree cover loss in Wales between 2001 and 2021.** According to recent research, between 2001 to 2022, Wales

lost 2,029 ha of tree cover from wildfires, with 2004 recording the highest tree cover losses (346 ha, Figure 3.2).^{19,20}

Figure 3.2 Tree cover loss due to wildfires in Wales between 2001 and 2021



Source: Global Forest Watch (2023) Fires in Wales, United Kingdom. Tyukavina et al. (2022) Global trends of forest loss due to fire, 2001-2019.

Notes: Tree cover is defined as vegetation greater than five metres in height. Resolution is 30 x 30 metres and includes areas with >30% tree canopy. No data available for 2003.

- **New planting rates have increased in the past three years**, from 80 ha in 2020 to 1190 ha in 2023.²¹ It is unclear what portion of this is within the forestry sector plantations and what relates to creating natural woodlands. To support resilience, tree planting must be carefully considered to ensure that the right trees are planted in the right places under changing climate. Failure to do so can jeopardise tree's ability to reach maturity and in some cases result in maladaptation.
- **There are limited data on species diversity in Welsh forests and woodland.** A NRW report from 2017 stated that the forest in Wales is dominated by a limited range of species and that many plantations are single-species monocultures.²² Proportionally, 42% of the woodlands are conifers and 44% are broadleaves, with the remaining woodland habitat characterised as felled/open areas. The dominant broadleaved species are oak (10%), ash (7%) and hazel (5%), while Sitka spruce (29%) represents the largest proportion of conifers species.^{23,24} It is understood that Welsh Government is restructuring forestry to deliver more diverse and larger habitats, however, data to assess this was not accessible for the assessment.
 - Increasing the diversity of tree species in new planting schemes is an important adaptation strategy to help reduce threats from pests and diseases, as well as manage uncertainties around the suitability of species to future climate conditions.

- **Absence of data on the rates of high-priority pests recorded in Welsh forests.** At a UK level, the number of high-priority* forest pests in the UK Plant Health Risk Register have flatlined recently, after an increase between 2016 and 2020 (from 12 to 19). It was not possible to obtain disaggregated data at a devolved administration level to support this assessment.
 - Pests, pathogens and invasive non-native species present serious risks to forest productivity, with consequences for livelihoods and businesses, as well as for the multiple ecosystem services that forests provide.

(c) Outcome 3: Climate resilient commercial fisheries and aquaculture sector

Gaps in the datasets required on commercial fisheries and aquaculture in Wales mean we are not able to conduct a robust assessment of progress in the sector.

A lack of relevant indicators for this outcome mean we are **unable to evaluate** progress in reducing vulnerability and exposure of the commercial fisheries and aquaculture sector to climate change. More resources must be allocated towards monitoring the scale and effectiveness of actions taken if progress by the sector is to be robustly assessed.

- **We are unable to determine whether the extraction of fisheries' resources in Welsh inshore waters is being carried out sustainably.** Total landings in 2020 was reported at 5,000 tonnes, a decrease from 20,900 tonnes in 2005.^{t,25,26} However, it is not possible to determine whether stocks are being caught within sustainable limits. Most of the Welsh fleet targets shellfish species that are not managed through quota limits.²⁷ Furthermore, over 90% of Welsh registered fishing boats are under 10 metres meaning they have no statutory requirement to declare their catches.^{28,29} In addition, most of Welsh fish and shellfish is exported, which increases the level of uncertainty in stock estimates. To support a robust assessment of progress, data is needed on:
 - Welsh commercially important fish stocks maintained at healthy status: Without an understanding of current stocks, it will be hard to maintain a sustainable yield. Research suggests that marine ecosystems around Wales have among the most overexploited fish stocks in the Northeast Atlantic.^{30,31}
 - Tracking populations of commercially important fish stocks in Welsh waters to determine their responses to climate change: This has proven difficult for fin fish and elasmobranch[‡] species in Welsh waters. The high mobile nature of many species makes it hard to establish accurate count data. They are also subject to natural cycles and fluctuations and influenced by a complex interrelationship of factors such as climate change, reproductive success, predation, and prey availability.
 - Percentage of fish caught using sustainable harvesting methods consistent with scientific evidence: Sustainable fishing measures are vital to ensure productive fisheries rebuild overfished stocks, safeguard supply and promote healthy and resilient ecosystems. Measures include the type of gear used and information on the target species

* Pests are ranked as high priority if they are assessed as having a mitigated relative risk rating of 15 or more.

^t Fish brought to shore for commercial sale.

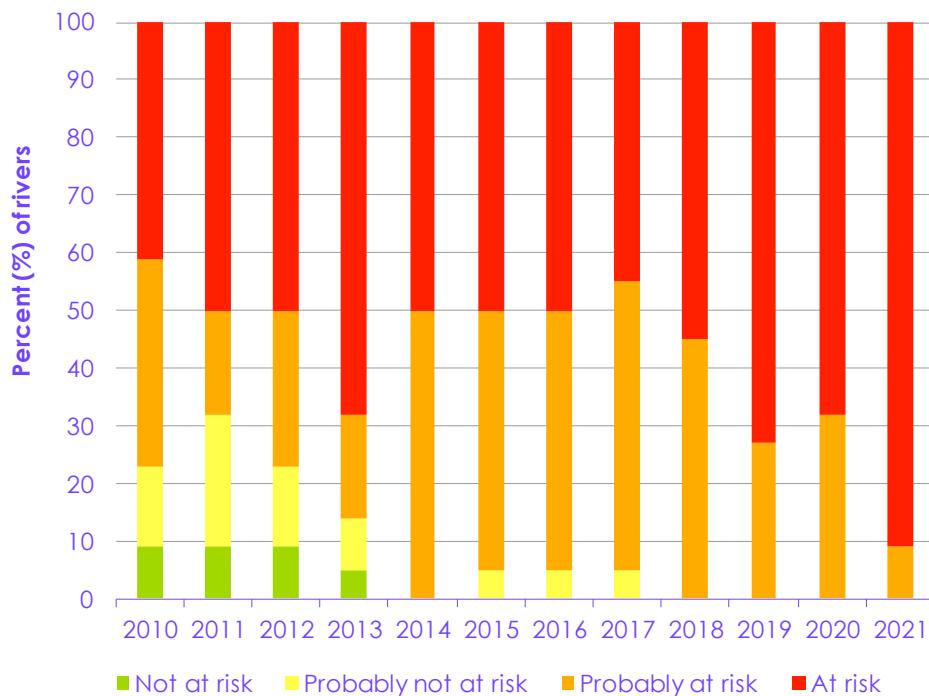
[‡] Shark, rays and skates.

that is being fished (e.g. stock estimates, vulnerability). Most importantly, the measures are updated as to consider new evidence on changes in pressures and threats to species over time.

Fish populations across species in Wales are declining at an unprecedented rate.

- **Atlantic salmon and sea trout in Wales are declining at an unprecedented rate.** Salmon are a good indicator of ecosystem health due to their sensitivity to various pressures and the only group of fish to live in both marine and freshwater ecosystems. Currently, all 22 principal salmon rivers in Wales are graded as either 'At Risk' (91%) or 'Probably at Risk' (9%) of failing to achieve their management targets until at least 2024. This is an increase since 2010 when 41% of rivers were 'At Risk' and 36% were 'Probably at Risk' (Figure 3.3).³² Over two-thirds of Welsh sea trout stocks are similarly classified, with no recovery predicted until at least 2024.³³
 - A recent study showed that Atlantic salmon populations have been declining over the past two decades and that the observed decline in marine survival is highly likely to be attributed to the impacts of climate change.³⁴
 - NRW has advised fisheries and anglers to stop fishing for salmon when water temperatures reach 20°C. Salmon are known to be stressed by warmer water temperatures and, as temperatures exceed 20°C, mortality increase, even with proper fishing techniques.³⁵

Figure 3.3 Percentage of principal salmon rivers in each risk category in Wales, from 2010 to 2021



Source: Environment Agency (2022) Salmonid and fisheries statistics for England and Wales 2021.

Shipping and boating operations in Welsh marinas have been identified as major transmission pathways for INNS.

- **Invasive Non-Native Species (INNS) risks are becoming a serious risk.** A 2020 study assessing the impact of 16 key marine INNS across 41 MPAs on fisheries and aquaculture found that 26 out of the 41 assessed MPA features were at massive risk from at least one INNS.³⁶ However, it found minimal evidence on the effects on fish stocks and fishing operations. While INNS are

unlikely to prevent mobile fishing gear to operate, they could be clogged by aggregations of INNS present currently in Welsh waters. Aquaculture operations were at higher risk from INNS than fisheries operations due to the presence of biofoulers, with shellfish species at most risk. Shipping and boating have been identified as major transmission pathways for INNS.* They affect commercial marine fisheries through biofouling.^{†,37} Over 10,000 INNS have been identified in marine areas.³⁸

- **Fish farming remains a significant user of water from the environment compared to the agriculture sector.** A total of 63,494 megalitres was abstracted by the agriculture sector in 2018, of which only 2,997 megalitres was consumed, leaving the rest for non-consumptive uses like flow-through for fish farms.³⁹

* A pathway is the route an INNS can be introduced or spread.

† A process where microorganisms, plant, algae or small animals grow on marine structures and boats.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place. It should be noted that this indicative assessment was based on information available in June 2023.

(a) Outcome 1: Climate-resilient agricultural production

Some policies that support resilience of the agricultural sector are in development, but confirmation is needed as to the details of the plans.

There are **limited policies and plans** in place to ensure the agricultural sector remains productive as the climate changes. Details released from Government indicate careful consideration of changing climate impacts, however, it is as yet unclear which adaptation actions will be eligible for support.

- **The Sustainable Farming Scheme (SFS) has the potential to build the resilience of the agricultural sector to climate change.** The new Agriculture (Wales) Bill is set to come into force later in 2023. The Bill adopts Sustainable Land Management (SLM) as the framework for future agricultural support and regulation within Wales. The Bill's powers enable the introduction of the SFS, which will help create a sustainable and resilient agriculture sector in Wales for future generations.
 - Details on the SFS proposals indicate participating farmers will have to undertake specific actions to be eligible to receive payments. A range of actions to foster resilient and productive farms is outlined in the plans, including those relating to improved resource efficiency, pests and disease control, and reducing pollutant emissions. Work on payment rates for given actions is ongoing, but it is recognised that this will influence the take-up rate by farmers.⁴⁰
- **Usage of pesticides and mineral fertiliser.** The Welsh Government's adaptation plans indicate an intention to keep pesticide use to the lowest possible levels,⁴¹ but a robust data collection strategy on the topic needs to be implemented to help monitor progress.
- **Funding for new research into improving sustainable practices on farms.** Farming Connect, a knowledge-sharing platform, has received a two-year funding commitment of £23 million to support knowledge transfer to drive sustainability and improved environmental performance.⁴² The new programme will be drawing on the findings from the evaluation of the current Farming Connect to provide an advisory service to Farmers. It will also manage a Research, Development and Innovation programme, which will draw on academic research and translate it into useable advice.
- **Higher payment rates announced for farmers creating woodland.** Payment rates will be uplifted to pay 100% of 2023's actual costs as part of the drive to plant 86 million trees by the end of the 2020s. New woodland must adhere to UK Forestry Standard requirements, including requirements around the diversity of species planted.⁴³
- **Funding to support the resilience of the Welsh rural economy and natural environment.** The £227 million of funding aims to ensure continuity of support following the ending of the EU Rural Development Programme (RDP) in 2023. Funding will be available to support farmers, foresters, land

managers and associated rural sectors and will be delivered across a range of themes, including towards actions that support on farm efficiency and diversification, and environmental improvements.

- **No recent update to the Action Plan for Pollinators.** An 'Action Plan for Pollinators (APP) in Wales was launched in 2013, covering the 2013-2018 period. A Pollinator Task Force was created to support delivery of the plan, with duties for setting the strategic vision, outcomes and areas for action to halt and reverse pollinator decline in Wales. It is understood the Plan was updated by members of the Taskforce in 2018, to account for emerging policy requirements and new evidence on emerging risks to pollinators, such as the Asian hornet. It is unclear if plans are in place to update the APP, notably following the release of CCRA3 in 2021.

(b) Outcome 2: Climate resilient commercial forestry sector

Some policy and financial support are in place to deliver woodland creation promises, however, the sector will be affected by the end of Glastir funding this year.

There are **limited policies and plans** in place to ensure a climate resilient commercial forestry sector.

- **The Woodland for Wales Strategy outlines key goals to adapt to climate change but lacks specific actions.** The strategy highlights that Welsh woodland ecosystems need to be diversified in terms of species composition to ensure that the forestry sector is resilient to future climate risks, including pests and diseases. It emphasises that the nature of diversity will vary across ecosystems and application can happen at different scales. However, the strategy lacks a clear set of actions that link directly to the delivery of targets.
 - The strategy also set a goal to enhance the proportion of woodlands managed through low-impact silvicultural systems. Aligning this objective with a 'no-regrets' climate change adaptation strategy brings several benefits. It promotes management practices that have a reduced environmental impact on forest sites, mitigates the risk of climate impacts through diverse species and age class distributions, and enhances the overall resilience of woodland ecosystem to climate change.⁴⁴
- **The Forestry Industry Recovery Scheme offered a £1.55 million capital investment from the Welsh Government to help increase capacity in the forestry sector.** Applications ran from August to October in 2020, with specific support made available for projects that aimed at undertaking tree safety works for trees affected by Ash Dieback.⁴⁵
- **The Welsh Government contributes funding to research on tree pests and diseases that can affect commercial forestry.** In work led by Forestry Research as part of their Core Research Programmes 2021-2026, Programme 7 Tree health and biosecurity aims at understanding pest threats exacerbated by changes in climate and host availability. It also seeks to support sector preparedness and guide environmental resilience. Information on the amount of funding was not available for the assessment.⁴⁶
- **Woodland creation targets in Wales are implemented with UKFS in mind.** The first Welsh statutory climate mitigation plan outlined that Welsh Government is targeting tree planting to 2,000 ha per year, with an increase to 4,000 ha as rapidly as possible. The UKFS has established a set of guidelines aimed at enhancing the sustainability and biodiversity of

commercial woodland. These guidelines encompass various aspects, including regulatory measures that promote the creation of woodlands designed to foster habitat diversity and the introduction of more varied diverse age structures to existing even-aged woodlands.⁴⁷

- **Several funding mechanisms are in place to encourage woodland creation across Wales, but planting rates remain low due to a range of barriers.** It is not explicitly specified in the policy if this funding is to promote commercial forestry, for nature, or other uses.
 - The Woodland Creation Planning Scheme ensures that plans for woodland creation are compliant with UKFS before any funds are allocated.
 - Grant funding of £32 million to increase woodland creation has been committed for the period between 2022/23 and 2024/25 across three main schemes: the existing Woodland Creation Planning Scheme; the new Woodland Creation Grant (WCG); and a Small Grants Scheme.
 - But challenges remain in encouraging landowners and managers to take up the offer due to both lack of user-friendly guidance but also in response to ongoing uncertainty around incentives for the SFS as interested parties wait to see what is being offered prior to deciding land-use.
 - We have been informed that Welsh Government is creating a Timber Strategy aiming to reduce the reliance on imported timber. We await its publication in order to assess it properly.
 - Glastir agri-environment funding has now ceased. The final planting covering 5,284.92 ha of the Glastir Woodland Creation scheme was selected for support in the 2022/23 planting season; a further 1,800 ha of new planting is yet to be completed.⁴⁸

(c) Outcome 3: Climate resilient commercial fisheries and aquaculture sector

There is insufficient action to build the resilience of fisheries and aquaculture, with strategies lacking specific implementation plans to deliver their targets.

There are **insufficient policies and plans** in place to ensure a climate resilient commercial fisheries and aquaculture sector. Marine ecosystems around Wales (Irish Sea and Celtic Sea) have among the most overexploited fish stocks in the Northeast Atlantic. Effective management of these ecosystems requires a comprehensive understanding of the fishing industry, the surrounding ecosystem, and their intricate interactions. In Wales, fisheries primarily target non-quota species, which poses a significant knowledge gap compared to quota species targeted in other regions of the UK. Addressing these challenges is vital for sustainable fisheries management in Wales.

- **The Welsh National Marine Plan (WNMP) include sector policies and objectives to achieve the desired future state of the fisheries and aquaculture sector.** Current and future acts which affect whole, or any part of the Welsh marine area must take authorisation or enforcement decision in accordance with the WNMP. The WNMP covers 32,000 km² of inshore and offshore regions and has a 20-year outlook. The plan acknowledges the importance of fostering sustainable diversification of fisheries and enhancing the value of current activities and catch, while promoting the need for future planning to tackle climate risks. Risks from climate change are considered in the plans, and the need to build evidence is highlighted

as a supporting policy aim, however, there is a lack of detail as to the specific actions that are needed to help the sector adapt (see Figure 3.1).

- **The Welsh Marine and Fisheries Scheme provides £3 million to support adaptation within the fisheries and aquaculture sector.** Launched in late 2022, the scheme funds projects that support coastal communities, the marine environment, and fisheries. The Welsh Government are keen to support research into adapting of the effects of climate change within the marine and fisheries sector.
- **The Joint Fisheries Statement (JFS) acknowledges the importance of addressing climate risks but falls short in providing specific action plans.** Under the Fisheries Act 2020, fisheries policy authorities are required to develop a JFS that outlines the policies for achieving the Act's eight fisheries objectives, including climate adaptation. The JFS commits to identifying climate risks to fisheries and aquaculture, as well as making this information available to relevant stakeholders and incorporating it into decision-making processes. However, it lacks comprehensive detail regarding the actions the industry needs to take to ensure productivity in the face of changing climate conditions.
 - Marine ecosystems around Wales (Irish Sea and Celtic Sea) have among the most overexploited fish stocks in the Northeast Atlantic.⁴⁹ Effective management of these ecosystems requires a comprehensive understanding of the fishing industry, the surrounding ecosystem, and their intricate interactions. In Wales, fisheries primarily target non-quota species, which poses a significant knowledge gap compared to quota species targeted in other regions of the UK.⁵⁰ Addressing these challenges is vital for sustainable fisheries management in Wales.
- **Update to Welsh seafood strategy.** The Welsh Seafood Strategy was introduced initially in 2013, with the goal of doubling aquaculture by 2020. However, this target was not met.⁵¹ A revised version of the strategy has been developed, aiming to achieve 30% sustainable growth in the Welsh seafood industry by 2025. This new iteration aligns with the principles outlined of the Well-being of Future Generations (Wales) Act 2015.⁵² The strategy's primary objective is to foster the growth of the industry while simultaneously preserving and enhancing biodiversity and ecosystem health. While the strategy does include some actions, it is not clear which actions will be implemented to support climate resilience of the sector.
- **Launch of Great Britain INNS Strategy - 2023 to 2030.** The Strategy covers INNS in the terrestrial, freshwater, and marine environments and species native to one part of a country that become invasive in areas outside their natural range.⁵³ The 'Check, Clean, Dry' campaign is a collaborative project from the GB Non-native Species Secretariat (N NSS) to help stop invasive plant and animals in aquatic environments.⁵⁴ There is specific guidance outlined for anglers fishing in freshwater and marine environments.⁵⁵

(d) Recommendations

Our recommendations for building resilience across the sectors are numerous, including significantly more investment in data, monitoring and skills.

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for WLS (Table 3.2). This should be read in conjunction with the recommendations in the Nature and Food chapters given their interdependencies. Primary responsibility is assigned to ministerial portfolios.

Table 3.2

Recommendations - Working land and seas

| Primary responsibility | Recommendation | Timing |
|---|--|---------|
| Rural Affairs and North Wales | Welsh Government should ensure there is provision to address the policy gap between the cessation of the current Glastir agri-environment scheme arrangements, due to end in 2023, and the implementation of the Sustainable Farming Scheme, in 2025. | Q3 2023 |
| Rural Affairs and North Wales | Significantly more investment is needed in data, monitoring, innovation, skills training, advisory services, and R&D in the agricultural, forestry and fisheries sectors to improve climate resilience. In particular, increase investment in the collection of data to help assess the extent and effectiveness of actions taken by the individual sectors to adapt to the impacts of climate change. | Ongoing |
| Rural Affairs and North Wales | Undertake risk assessments of the agriculture, forestry, and fisheries sector dependencies on internationally sourced inputs and how these could change under various climate scenarios and develop plans to mitigate supply chain risks. | Ongoing |
| Climate Change, Rural Affairs and North Wales | Welsh Government should implement key actions in the Woodland for Wales Strategy to ensure that the commercial forestry sector is resilient to future climate risks, including improving species diversity of tree planting and dealing with wildfire risk. | 2024 |
| Rural Affairs and North Wales | Welsh Government need to progress on initiatives that aim to understand and urgent address the status of fish and shellfish stocks and the environmental impacts of fisheries. | 2024 |

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Chapter 4

Food security

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Introduction

Table 4.1

Progress summary – Food security

| | Delivery and implementation | Policies and plans | Summary |
|---|-----------------------------|----------------------------|---|
| Outcome 1: Disruption to food and feed import supply chains due to climate change is minimised | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> Minimal private sector reporting means that we are unable to evaluate progress in reducing vulnerability and exposure of food and feed import supply chains to climate change. The vision for the food and drink industry in Wales does not consider adapting to climate change. There is ongoing consultation on a community food strategy. Most of the policy levers for this area are reserved. The CCC's 2023 UK progress score for this outcome was insufficient policies and plans. |
| Outcome 2: Vulnerability to food price shocks is reduced | Insufficient progress | Limited policies and plans | <ul style="list-style-type: none"> Indicators demonstrate some household vulnerability to food price shocks, with food insecurity increasing in recent years. Committed funding is in place to support food insecure households but it appears to fall short of demand. |

Relevant risks from CCRA3:
ID1 Risks to UK food availability, safety, and quality from climate change overseas; ID2 Opportunities for UK food availability and exports from climate impacts overseas; ID6 Opportunities from climate change on international trade routes; ID7 Risks associated with international trade routes; H9 Risks to food safety and food security; B6 Risks to business from disruption to supply chains and distribution networks; N4 Risk to soils from changing climatic conditions, including seasonal aridity and wetness; N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion.

This chapter considers how domestic and international food and feed supply chains for Wales can be made resilient to climate change. Access to high quality and reasonably priced food despite climate and weather extremes is also covered here, as well as climate-related changes in nutritional quality of food and food-borne diseases. Climate risks to domestic food production (agriculture, fisheries, and aquaculture) are covered in depth in Chapter 3.

Food security can be impacted by increases in extreme weather, changes in rainfall patterns and changing annual temperatures which can impact domestic production of food and imported food and feed.

Food security can be impacted by increases in extreme weather patterns, annual variations in rainfall and changing annual temperatures that can affect food quality with implications for domestic production of food and imported food or feed. Reliance of the UK food supply chain on international markets increases exposure of the food system to climate hazards overseas and systemic risks. Diversity of supply can also improve resilience by allowing one production area to substitute for another.

Food and drink supply chains have a turnover of £19.1 billion, with more than 240,000 people employed in catering, retail and wholesale, agriculture and manufacturing. The value of Welsh food and drink exports in 2018 was £539 million, an increase of 32% since 2014.¹

Responsibility for the food system cuts across multiple areas of policy. Responsibility for food is largely devolved to Wales. International trade policy is reserved to the UK Government, while matters relating to agriculture and fisheries are mostly

devolved.* The role of government includes setting standards for food quality and environmental impact; supporting domestic food production as part of food security; and supporting access to food, particularly for vulnerable groups. Outside of these roles, government does not directly participate in the food system with most roles falling to the private sector.

Food security has little consideration within the current national adaptation plan, Prosperity for All: A Climate Conscious Wales (PfACCW) (Box 4.1).

Box 4.1

Food security within Prosperity for All: A Climate Conscious Wales

Recognised as an urgent risk area:

- Risks and opportunities from long-term, climate-related changes in global food production.

Sub-actions:

- AN6: Develop Sustainable Brand Values for food products to earn market recognition for delivering environmental outcomes.

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for all: A Climate conscious Wales: monitoring and evaluation framework*.

Box 4.2

Changes to the climate in Wales affecting food security and CCRA findings

The third UK Climate Change Risk Assessment (CCRA3) found that climate change will likely pose risks to food availability, safety and quality in the UK, including in Wales. The potential for systemic risks is growing through a more interconnected world, where risk cascades can lead to global food system-wide consequences. The resulting risks to food security in the UK will be varying access to food associated with supply-side disruptions and the potential for cascading and interacting risks, resulting in food price spikes. Food system interconnectedness can also improve resilience by allowing one production area to substitute for another. The risk to UK food availability, safety, and quality from climate change impacts overseas was scored as high in the present day and medium to high under future conditions, with more action needed to address the risk over the next five years.

Research on impacts of climate change on the probable future risks and their impact on food safety in the UK is limited. WWF Cymru commissioned research on Welsh food systems suggested that a new approach was needed in Wales based on agroecology, localisation of food systems and factoring environmental, social, and human capital potential to strengthen food security in response to climate change and other pressures.

Source: Netherwood, A. (2021) *Food safety and food security*. In: *The Third UK Climate Change Risk Assessment Summary for Wales*.

* Fisheries are legislated under the UK Fisheries Act 2020 and through the joint fisheries statement, but licensing for fishing boats is devolved and fisheries management plans may be published by Devolved Administrations under the Act. UK Parliament legislates for offshore waters.

1. Monitoring progress towards a well-adapted food system

The food system is key to achieving a wide range of societal goals. These include improving public health, reducing greenhouse gas emissions, and restoring nature. In this chapter, we consider the requirements for a food system to be well adapted to climate risks, while recognising the importance and synergies with other goals for the food system (Figure 4.1).

We identify several key outcomes needed to deliver climate resilience:

- **Disruption to food and feed import supply chains due to climate change is minimised.** Large companies within Wales's food supply chains need to manage their operations and dependencies to address climate risks, including building capacity along the supply chain (domestic and international), diversifying sourcing regions and suppliers, increasing redundancy and undergoing contingency planning. A key part of this is also UK international trade agreements upholding high food standards, to reduce food safety and quality risks.
- **Vulnerability to food price shocks is reduced.** The impact of climate change on food in Wales will most likely be through food price spikes and temporary reduced availability of particular products. Low-income households, some households with children and other vulnerable groups are likely to be most impacted by these price shocks. Reduced vulnerability of society to these price shocks is part of holistic resilience to climate impacts on the food system.
- **Domestic food production and supply chains are resilient to climate shocks.** Outcomes required to ensure that domestic food production is climate resilient are covered in Chapter 3. Welsh supply chain resilience is covered (for all sectors) in Chapter 13. We therefore do not assess this outcome within this chapter.

Enabling factors that need to be in place to deliver these outcomes will include:

- **Data and monitoring.** As much of the food system relies on the private sector, information on the performance of the food system will be particularly important to understand and guide how well-adapted it is to climate change. Food quality monitoring can provide information on any changes in nutrition or prevalence of food-borne pathogens. Climate stress testing by large food and feed companies would also provide important information on the resilience of the system to climate hazards.
- **Governance.** Monitoring of food quality and surveillance of climate-sensitive food-borne diseases should be undertaken by respective Food Standards Agencies. Regional and local food strategies can also support local resilience. Food security should also be included on the national risk register to ensure appropriate oversight and monitoring, given its critical importance.
- **Engagement and education.** Climate risk assessment and supply chain management skills will be needed across large food and feed companies. For small and medium-sized enterprises (SMEs), guidance and tools to

Food price spikes may occur as a result of climate change. Low-income households are likely to be impacted more by any price volatility.

Regional and local food strategies can support local resilience.

support climate resilience would enable better management of their climate risks.

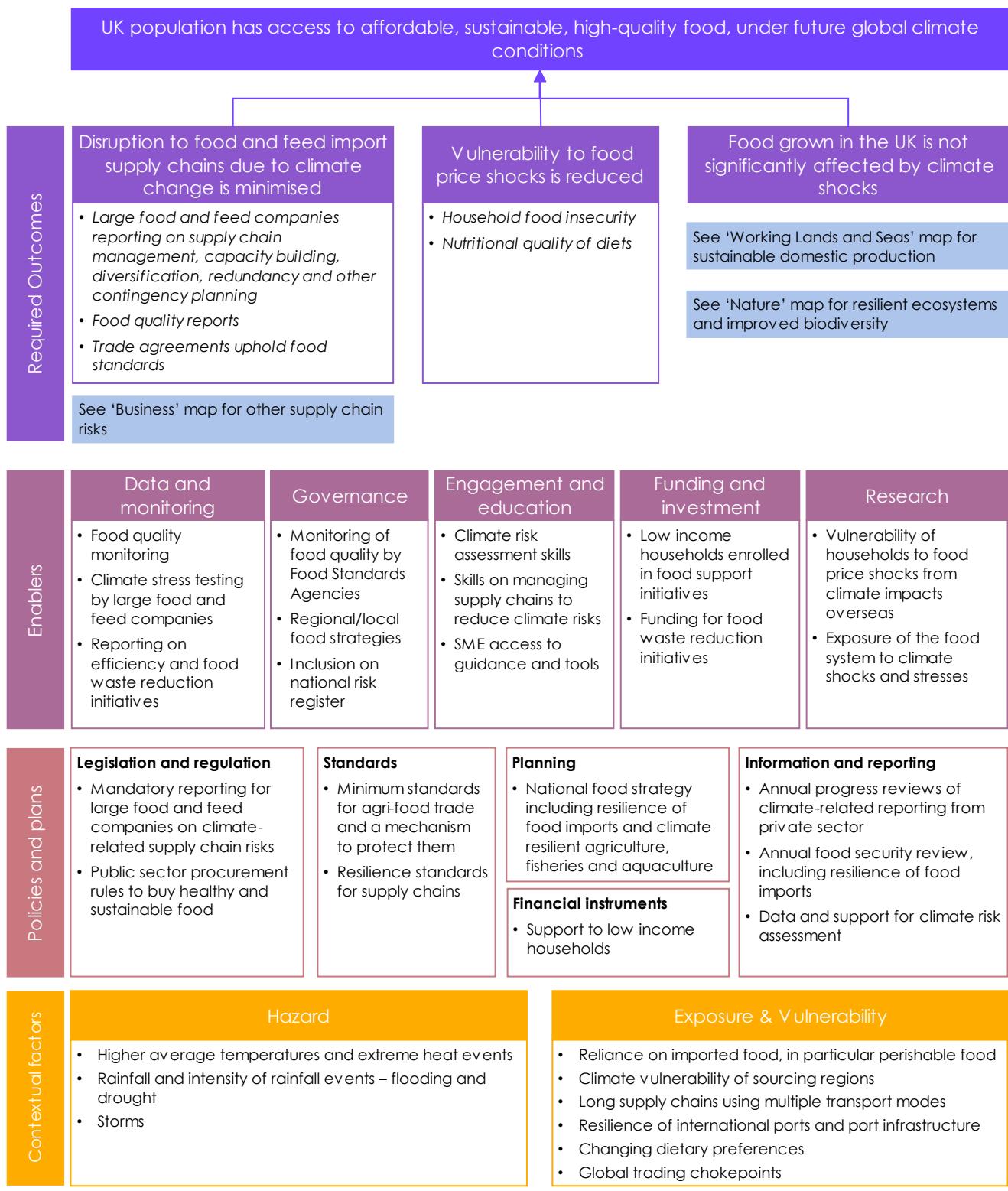
- **Funding and investment.** To reduce vulnerability to food price shocks, low-income households may need to be financially supported through food support initiatives, either at local or national level.
- **Research.** Further research is needed on the vulnerability of different households to price shocks from climate impacts across food supply chains. Exposure of the food system and key food staples to climate shocks and stresses outside Wales and the UK also needs to be better understood.

To deliver the identified outcomes and help put in place their enabling conditions, there are several key policies and plans that will need to be implemented:

- **Legislation and regulation.** Mandatory reporting by large food and feed companies (involved in processing, importing and food retail) is needed to understand to what extent climate risks are being considered and addressed across key private sector actors.
- **Standards.** Minimum environmental and animal welfare protection standards for future free trade agreements is needed to support domestic food production and avoid further exposure to climate risks by encouraging cheaper (and potentially more climate vulnerable) imports. Robust resilience standards for supply chains would also be helpful for businesses to manage their climate risks.
- **Planning.** Key Government strategies for the food system, such as a national food strategy should include consideration of the resilience of food imports to climate risks as well as climate resilient agriculture, aquaculture and fisheries.
- **Financial instruments.** Targeted support to low-income households will be required to reduce vulnerability to food price shocks, requiring public funding. While there are many possible policy mechanisms for this kind of support, the mode of delivery is not a critical factor for responding to the climate risk.
- **Information and reporting.** Information on food and feed companies' exposure and vulnerability to climate risks and adaptation actions being taken to address these could help to inform long-term supply chain planning. Regular reporting on this information from large companies, if reviewed by Government, would build a greater understanding of the resilience and potential fragilities of food and feed supply. An annual food security review could include this information as well as considering other data on the resilience of food imports, for example resilience of transport infrastructure.

Regular reporting from food and feed companies could build a greater understanding of the resilience of food and feed supply chains.

Figure 4.1 Monitoring map for UK food security



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Disruption to food and feed import supply chains due to climate change is minimised

Minimal private sector reporting means that we are **unable to evaluate** progress in reducing vulnerability and exposure of food and feed import supply chains to climate change.

Limited public reporting from large food and feed companies of their monitored risks and contingency planning makes it difficult to assess how widely such measures are adopted across Wales.

- **Reporting from large food and feed companies is limited.** There is a limited overview of supply chain preparedness against climate risks to food as private sector reporting is not mandated nationally. Large food and feed companies can monitor disruptions from climate change through assessments on supply chain resilience or going forward through the Task Force on Climate-related Disclosures (TCFD). Such companies in Wales may have existing mechanisms to manage domestic and international supply chain risks. However, the sector's limited public reporting of their monitored risks and contingency planning limits ability to assess how widely such measures are adopted across Wales.
- **Food product shortages in supermarkets in Wales point towards shortcomings in the existing supply chain management for food and feed imports.** In recent years (2021-2023), Wales has faced a shortage of supply across supermarkets for products such as poultry, tomatoes, cucumbers, peppers, lettuce, salad leaves, broccoli, cauliflower, eggs, and raspberries.² The most recent shortage, in February 2023, of produce in supermarkets across Wales, and in parts of the UK, is attributed to unusual bad weather in Africa and Europe.³ Other non-climate induced factors (such as disruption to transport, higher energy and fertiliser prices leading to reduced domestic production) are likely to have contributed to the shortages as well, demonstrating the complexity of interacting risks in the food system.

(b) Outcome 2: Vulnerability to food price shocks is reduced

There is **insufficient progress** towards meeting this outcome.

- **Household food insecurity in Wales has increased in recent years.** In 2016, 74% of households in Wales were living with high food security, 17% were considered marginally food secure, and 9% were reported to be living in households with low or very low food security.⁴ By 2021, households with high food security had reduced to 70% and low or very low food security had doubled to 18%.⁵ Indicators to assess contributions of climate change to household food insecurity are not available in Wales. While current trends in food insecurity are not driven by climate change, household food insecurity still provides an indication of the vulnerability of households to food price shocks overall, including food price shocks from climate-related disruption.

(c) Progress on enablers

There are very limited data available relating to enabling factors.

A training course is being developed for the food and drink industry to help businesses prepare for risks and opportunities from climate change.

- **Engagement and education.** A training course on sustainability, tailored to the Welsh Food and Drink industry, has been developed and rolled out for free to Welsh Food and Drink manufacturing businesses. Plans for 2023-24 include to develop and roll out a training course and handbook on Climate Adaptation and Resilience Training tailored to the Food & Drink Industry. The training will equip businesses with the knowledge and skills to develop practical actions and systems to prepare for the risks and opportunities of climate change.
- **Funding and investment.** A challenge fund to improve local food production and supply in the Cardiff capital region was launched in 2022, with a total of £2.1 million to invest in successful projects. The challenge is a partnership between Cardiff Council, Monmouthshire County Council, Welsh Government and the Small Business Research Initiative, running to 2025. As part of the launch, climate change and food security concerns were referenced as key drivers for the project.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

(a) Outcome 1: Disruption to food and feed import supply chains due to climate change is minimised

Key policy milestones for this outcome are largely outside of the Welsh Government's direct control, for example, mandatory reporting, minimum food standards for trade and resilience standards for supply chains. This outcome is therefore **not scored**.

- **There is a central vision for Welsh food and drink industry in place, but it does not adequately consider climate change adaptation.** Welsh Government published its 'Vision for the food and drink industry' in 2021. This sets out the Government's mission for the Welsh food and drink sector across manufacturing, processing, retail, and import/export businesses. It focuses on economic growth and fair work.⁶ It does not include any substantial consideration of climate risks to Welsh food manufacturers and processors.
- **There is ongoing consultation for the Wales Community Food Strategy, but it is not clear yet how adaptation will be considered.** The Welsh Government's Programme for Government 2021 to 2026 and the Co-operation Agreement, commits to developing a Wales Community Food Strategy (CFS) to encourage the production and supply of locally sourced food in Wales.⁷
- **A proposed Food (Wales) Bill has not been taken forward.** The Bill was voted down in May 2023 after being introduced in 2021 with a purpose to establish a more sustainable food system in Wales.
- **A socially responsible public procurement duty is in place, but it is not specific on requirements for healthy and sustainable food.** The public sector in Wales spends around £94.4 million on food.⁸ The Social Partnership and Public Procurement (Wales) Act was passed in 2023 and places a statutory duty on certain public bodies to consider socially responsible public procurement when carrying out procurement, to set objectives in relation to well-being goals, and to publish a procurement strategy.⁹ Encouragingly 'resilience to the impact of climate change' is included within the 'environment' category.
- **Climate-related reporting from private food sector companies is in its infancy in Wales.** A sustainability self-assessment online questionnaire has been developed and tested on a sample of 78 businesses (representing just under 10% of businesses). The survey provides baseline information on the strengths and areas for improvement for the industry. It did not include questions on climate-related supply chain risk management. Mandatory reporting which will soon come into force for large UK companies is unlikely to apply to many food sector companies in Wales, due to the eligibility criteria for size and turnover.¹⁰

Consultation is ongoing for the Wales Community Food Strategy, but it is unclear to what extent adaptation will be included.

(b) Outcome 2: Vulnerability to food price shocks is reduced

Low-income households and other vulnerable groups are likely to be most impacted by potential food price volatility from climate change.

Climate change may affect food production and supply chains, leading to food price spikes and temporary reduced availability of particular products. Low-income households and other vulnerable groups are likely to be most impacted by these price shocks.

Policies to reduce vulnerability of households to food price volatility are in place but may be insufficient to fully insulate vulnerable groups from price shocks. This outcome is scored **limited policies and plans**.

- **Committed funding is in place to support food insecure households but may not be meeting demand.** The Welsh Government has allocated £4.9 million in the 2022-23 financial year to help alleviate food poverty and tackle the root causes of food poverty. The funding will support community food organisations to overcome barriers to accessing sufficient supplies. It can also support initiatives which will help families save money on food by building their food knowledge and skills. The funding can also be used to support action to maximise income and increase the uptake of benefits such as Healthy Start vouchers and initiatives which support households to pay essential bills.¹¹ The Welsh Government and Plaid Cymru's Co-operation Agreement commits to providing free school meals to all primary school children during term time by 2024 and also has provided eligible pupils a free school meal during certain holiday periods.¹²

(c) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for food security (Table 4.1). Responsibility for recommendations is assigned to ministerial portfolios.

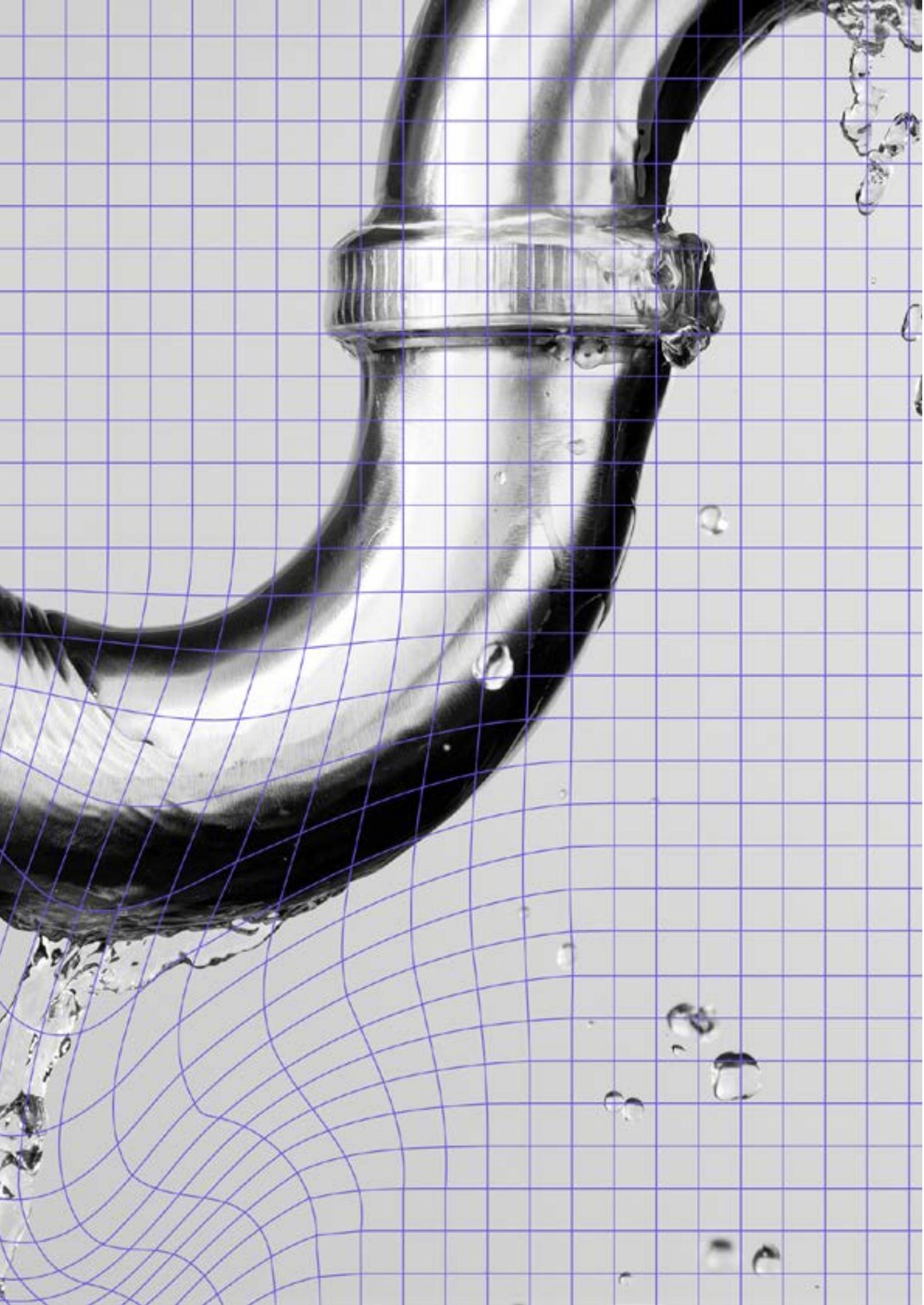
Table 4.2

Recommendations

| Primary responsibility | Recommendation | Timing |
|--|--|--------|
| Rural Affairs and North Wales; Economy | Include consideration of climate risks to food security in the development of the community food strategy. | 2026 |
| Climate Change | Review the potential to require reporting on how climate risks are being managed from large food and feed companies operating in Wales as part of other climate change reporting mechanisms. | 2024 |

Endnotes

- ¹ Welsh Government (2020) *International Strategy*, <https://www.gov.wales/international-strategy-for-wales-html>.
- ² Wales Online (September 2021) *We went to Wales' biggest supermarkets to see how bad the empty shelves and food shortages really are*, <https://www.walesonline.co.uk/whats-on/shopping/wales-supermarkets-shortages-covid-shelves-21117135>.
- ³ Wales Online (February 2023) *The empty shelves in Welsh supermarkets as shortages take hold*, <https://www.walesonline.co.uk/whats-on/shopping/empty-shelves-welsh-supermarkets-shortages-26292791>.
- ⁴ NatCen (2018) *Food Security in Wales*, https://www.food.gov.uk/sites/default/files/media/document/foodsecurityinwales_0.pdf.
- ⁵ Food Standards Agency (2022) *Food and You 2: Wave 3 Key Findings*, <https://www.food.gov.uk/research/food-and-you-2/food-and-you-2-wave-3>.
- ⁶ Food and Drink Wales (2021) *A Vision for the Food & Drink industry from 2021*, https://www.gov.wales/sites/default/files/publications/2021-11/vision-food-drink-industry-2021_1.pdf.
- ⁷ Food and Drink Wales (2021) *Community Food Strategy*, <https://businesswales.gov.wales/foodanddrink/community-food-strategy>.
- ⁸ Welsh Parliament (2022) *Food (Wales) Bill: Explanatory Memorandum*, <https://senedd.wales/media/ehkbafbn/pri-l1d15535-em-e.pdf>.
- ⁹ Welsh Parliament (2023) *Social Partnership and Public Procurement (Wales) Act 2023*, <https://business.senedd.wales/mglssueHistoryHome.aspx?lId=39479>.
- ¹⁰ Welsh Parliament (2022) *Social Partnership and Public Procurement (Wales) Bill*, https://senedd.wales/media/s5wp2r1u/sppp3_en.pdf.
- ¹¹ Welsh Government (2022) *Written Statement: Funding for Tackling Food Poverty*, <https://www.gov.wales/written-statement-funding-tackling-food-poverty>.
- ¹² Welsh Government (2023) *Free school meals extended for April and May holidays*, <https://www.gov.wales/free-school-meals-extended-april-and-may-holidays>.



Chapter 5

Water supply

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Introduction

Table 5.1

Progress summary – Water supply

| | Delivery and implementation | Policies and plans | Summary |
|--|-----------------------------|---------------------------------|---|
| Outcome 1: Reduced household demand | Insufficient progress | Limited policies and plans | <ul style="list-style-type: none"> Per capita water consumption for households is high. Metering of customers remains lower than industry average for Great Britain. Building regulations are in place for water efficiency of dwellings but there is no regulatory Welsh Government per capita consumption target. |
| Outcome 2: Improved system performance | Mixed progress | Credible policies and plans | <ul style="list-style-type: none"> Leakage reduction levels have shown improvement since 2019-20. There are risks of surface water flooding to water and sewerage sites. There are statutory targets for reducing leakage and resilience requirements for water company drainage and wastewater management plans. |
| Outcome 3: Increased supply | Insufficient progress | Limited policies and plans | <ul style="list-style-type: none"> The two most populous zones covered by Dŵr Cymru Welsh Water are not resilient to a 1 in 200 year level of drought resilience under a medium emission climate change scenario within the 25-year period to 2050. The Welsh Government does not specify a level of resilience for system supply, but water companies in Wales have a statutory duty to prepare, consult, publish and maintain a drought plan. Supply-side solutions are proposed within draft water resource management plans. |
| Outcome 4: Interdependencies identified and managed | Insufficient progress | Insufficient policies and plans | <ul style="list-style-type: none"> There is some consideration of interdependency risks by one of the water companies. Welsh Government guidance for water resource management plans (WRMP) includes considerations of interdependencies on natural infrastructure. |
| <p>Relevant risks from CCRA3:</p> <p>Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures (I1); Risks to infrastructure services from river, surface water and groundwater flooding (I2); Risks to infrastructure services from coastal flooding and erosion (I3); Risks to subterranean and surface infrastructure from subsidence (I7); Risks to public water supplies from reduced water availability (I8); Risks to health from poor water quality and hou</p> | | | |

This chapter covers adaptation to climate change for public and private water supplies. Public water supplies account for around 95% of total water supply by volume, but at least 77,000 people across Wales rely on private water supplies (PWS), with 94% of these supplies dependent on groundwater.¹ Assessment scores are given for public water supply outcomes, with consideration of policies in place for private supplies.

The uninterrupted provision of clean water to households and businesses is key to comfortable homes, functioning business premises, and public health – this needs to be maintained despite the range of current and future weather hazards that could be experienced.

As much as 76% of consumptive water abstraction is by water companies for supply to both domestic and non-domestic customers. The approximate remaining 24% is abstracted directly for use by other sectors: industry, commerce, business, public services, environmental activities and agriculture.²

This means that the resilience of the public water system is inherently coupled to water management practices in these other areas and a whole system approach is required to assess the water system's climate resilience. The public water system will be affected by several expected changes in climate hazards.

The current climate risk to public water supplies in Wales is low.

The current climate risk to public water supplies in Wales is low (Box 5.1). The vast majority of zones in the UK projected to be in water deficit in the future are in England. However, future demands may be placed on Welsh water resource zones to provide inter-regional water transfers to address deficits elsewhere in the UK.³ Furthermore, under certain warming scenarios there are deficits in populous areas in south-east Wales and neighbouring resource zones in England (Figure 5.1).

Box 5.1

Climate risks to the water supply system in Wales

All water resource regions in Wales currently have supply-demand surplus, giving a low magnitude score for climate risk in the most recent risk assessment.

This rises to medium in future scenarios (using central population growth estimates and an assumption of 'no additional adaptation'), as although the majority of Wales remains in surplus, supply-demand deficits are apparent in the south-east of Wales under all future scenarios.

Between March and August 2022, Wales received just 56.7% of its expected rainfall with heatwaves across the country. This led to very low reservoir storages across most of south Wales and parts of north-east Wales, culminating in the first restrictions placed upon Dŵr Cymru Welsh Water customers since 1989.

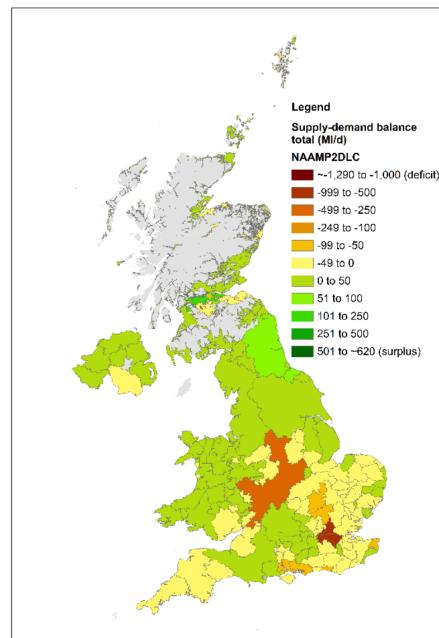
Source: HR Wallingford (2020) *Updated projections of future water availability for the third UK Climate Change Risk Assessment*; Dŵr Cymru Welsh Water (2022) *Draft Water Management Plan*.

Exposure of the water supply system to climate risks is influenced by the age, condition, and location of water supply infrastructure. Population growth, changes in water needs and usage patterns, and pressure to manage the cost of water for consumers are among the key factors that will make us more vulnerable to water shortages.

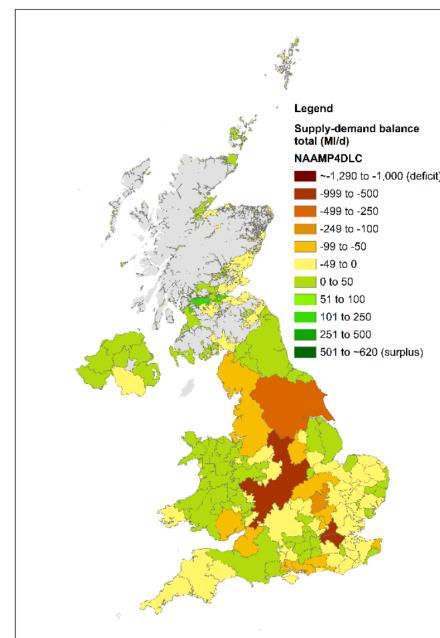
Figure 5.1 Supply-demand balance in late century under 2°C and 4°C for Wales



a) 2°C



b) 4°C



Source: HR Wallingford (2020) Updated projections of future water availability for the third UK Climate Change Risk Assessment.

Notes: Scenario assumes central population projection and no additional adaptation action.

Responsibility for the water system is shared across several organisations.

Policies related to water supply in Wales are devolved, but with a high alignment to England due to shared regulation by Ofwat and some water companies operating across England and Wales. Responsibility for the water system is shared across several organisations:

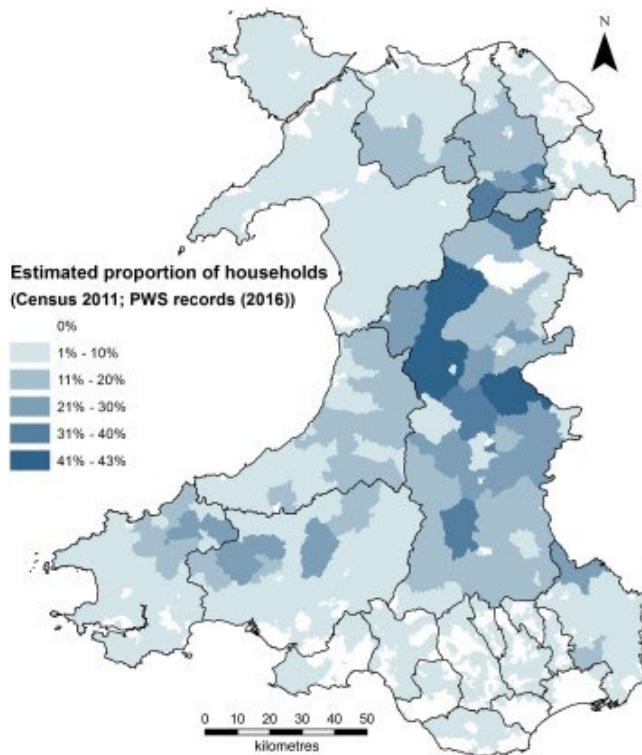
- Ofwat is responsible for economic regulation of the water and sewerage sector. The Drinking Water Inspectorate is responsible for providing independent reassurance that water supplies are safe and drinking water quality is acceptable to consumers. Natural Resources Wales (NRW) is the environmental regulator and are responsible for technical review of water company water resource management plans and drainage and wastewater management plans. The abstraction, storage, and use of water is regulated by NRW through routine abstraction licensing, asset inspection, water sampling and analysis.⁴
- Welsh Government is responsible for providing strategic direction for water policy, and water and sewerage companies are responsible for providing water supply and sanitation, including infrastructure delivery.⁵ The Consumer Council for Water (CCW) represents the interests of water customers in England and Wales.
- Dwr Cymru Welsh Water covers the majority of water supply in Wales, providing for over three million people.⁶ There are four water companies operating in Wales (Dwr Cymru Welsh Water, Hafren Dyfrdwy (part of Severn Trent Water), Albion Water, and SSE Water).⁷ There are some customers in England who use water supplied from Wales (through United Utilities and Severn Trent Water) with a small number of customers in Wales supplied from sources in England.⁸

Certain areas in Wales have high numbers of private water supplies.

- Analysis of properties that do not fall within the public water mains supply area suggest that there could be as many as 41,760 private water supplies (PWS) in Wales covering potable water, agriculture, tourism, and commercial uses. Of these estimated supplies, it is thought that 14,846 are unlicensed supplies that abstract relatively small volumes of water. Supplies that abstract more than 20 m³ per day are licensed by Natural Resources Wales. Private supplies use an estimated c.50% of volume of groundwater abstracted in Wales.⁹

- The spatial distribution of potable PWS disaggregated within local authority areas is shown in Figure 5.2. There is considerable variation in the number of records and estimated proportion of households, with higher numbers and percentages of PWS recorded in mid, west, and north Wales where populations are more rural and dispersed.

Figure 5.2 Spatial mapping of potable private water supplies



Source: Farr, G. et al (2022) Revealing the importance of groundwater for potable private supplies in Wales.

Climate risks and adaptation for the water system are well covered within Prosperity for All: A Climate Conscious Wales (PfACCW) (Box 5.2).

Box 5.2

Water supply within Prosperity for All: A Climate Conscious Wales

Actions in adaptation plan:

- Short term actions:
 - New Water Resource Management Plans in 2020.
 - Research to increase our understanding of the impacts of climate change on water availability to inform the climate change risk assessment in 2021.
- Medium term actions:
 - The Welsh Government will publish new guidelines for Water Resource Management Plans by 2025.
 - Ofwat has set water companies a minimum target to reduce water leakage.

Indicators from Monitoring and Evaluation framework:

- HP2: Ofwat water leakage reduction reporting.
- HP3: Review of drainage and Water Management Plans produced and examples of how they are tackling climate risks.

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for all: A Climate conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress towards a well-adapted water system

A package of demand and supply side actions are needed to make the public water supply system more resilient to climate change.

Successful adaptation within the water supply system aims to ensure a plentiful supply of water despite future climate change. This means there is sufficient water for public supply, sustainable energy, industry and agriculture (see Chapter 6 (Energy), Chapter 13 (Business) and Chapter 3 (Working Land and Seas), as well as sufficient water left to support the natural environment (see Chapter 2 (Nature)).

In Figure 5.3, we set out a monitoring map for assessing adaptation progress in the water system. We have identified four key outcomes that are needed for this goal of climate resilience to be delivered:

- **Reduced demand** through behaviour change, more efficient appliances and building standards.
- **Improved system performance** to reduce water lost through leaks and bursts. Reducing water lost through leaks will make water supplies less vulnerable to drought, as well as supporting environmental goals by enabling reduced abstraction from rivers.
- **Increased supply** by increasing reservoir capacity and enabling transfer of water between water regions in times of drought.
- **Interdependencies identified and managed.** Maintaining a sufficient water supply requires reliable energy, telecoms, and transport services, which are similarly exposed to climate risks. Water companies must know and manage their risks from reliance on other infrastructure networks to be resilient to climate change overall. This includes managing supply chain risks.

Effective governance, data and monitoring and investment are needed to enable this.

There are several categories of enabling factors that will be needed to implement the outcomes identified above:

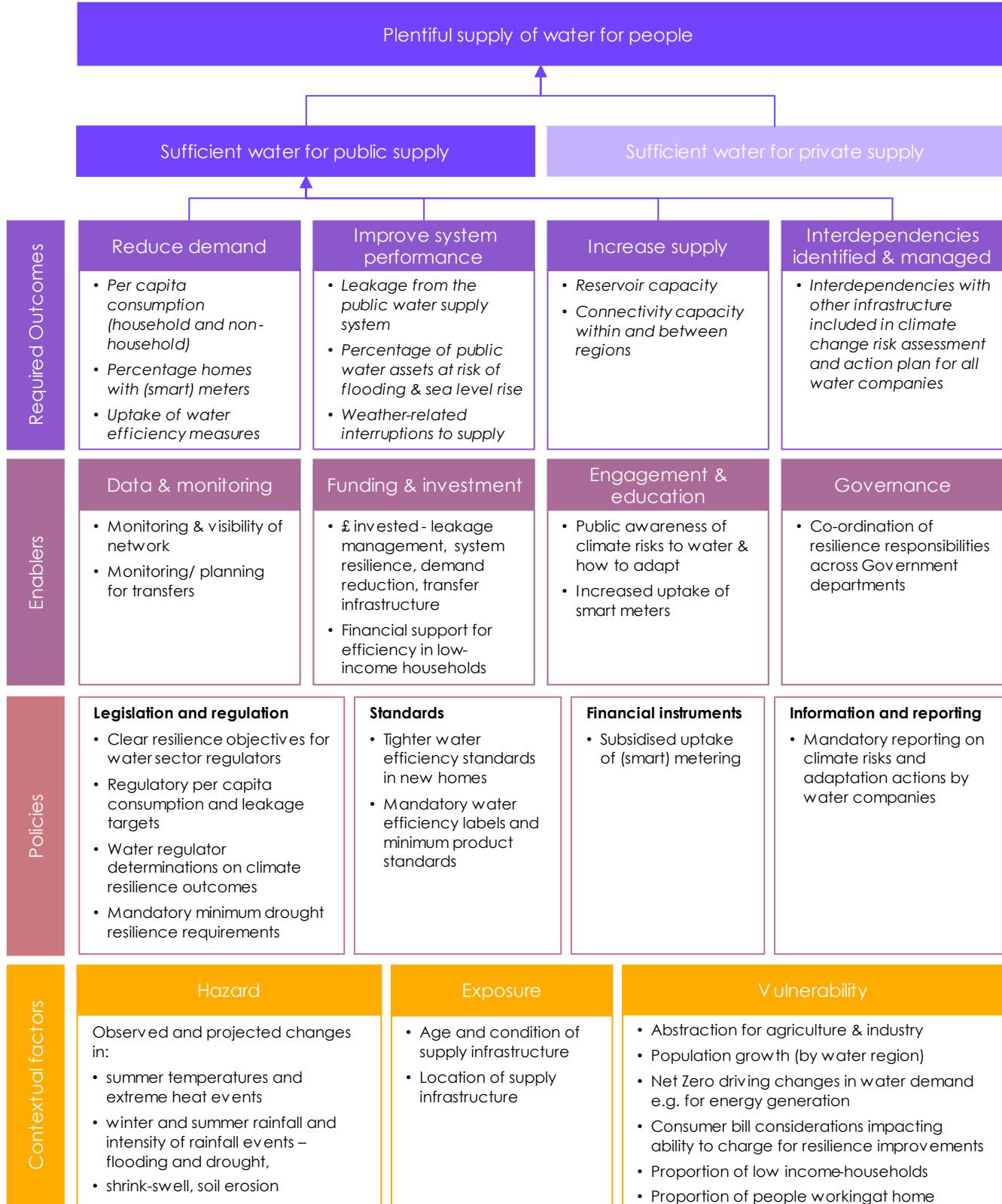
- **Data and monitoring.** Effective monitoring and visibility of the water network enables better identification of where water is going and who is using it, allowing interventions on demand and leakage to be better targeted.
- **Funding and investment.** Delivering the outcomes identified above will require appropriately sized investment that is well-targeted. Investment in the water supply system is delivered by the private water companies, funded by customer bills, and regulated by Ofwat. Outcome-based regulation (which enables flexibility in which actions are undertaken to achieve the desired outcomes) can be useful here as it will likely help foster cross-company and cross-sector collaboration on the resilience investment required to ensure the whole infrastructure system is resilient.
- **Engagement and education.** There is a need for greater public awareness of the risks of future water shortages and actions people can take to reduce their use of water.

Our monitoring framework highlights policy milestones which must be in place to help achieve these required outcomes for a well-adapted water supply and associated enabling factors. These fall under the following categories:

Policy must provide the mechanisms to deliver the required outcomes.

- **Legislation and regulation.** National policy must create legislation which enforces sustainable long-term plans for water management and provides appropriate frameworks for regulation. Planning must span across water catchments to ensure it is at a suitable scale to manage national water shortages. Legislation should also ensure that funding allocation is appropriate to meet adaptation goals.
- **Standards.** A well-adapted water supply will require policy to deliver and extend resilience standards, which deliver a water supply system compatible with future climate conditions.
- **Financial instruments.** Fiscal policy should incentivise adaptation actions (such as reducing demand, minimising losses from the supply system, and building system level resilience to climate change) by water companies, homeowners, and residents. Extra financial support may be needed to enable low-income households to understand and reduce their water use.
- **Information and reporting.** Reporting on some aspects of risk and adaptation planning and delivery should be mandatory. This will improve understanding of the national picture of adaptation in the public supply system, as well as in other sectors upon which the water system relies, including energy, transport, and telecoms and ICT.

Figure 5.3 Monitoring map for water supply



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

A package of demand-side, supply-side, and system-level adaptation measures is needed to ensure sufficient water supply under a changing climate. Significant progress in one outcome may allow for less action in others. Decision makers need to continue monitoring progress and set policies to deliver the most effective combination of measures.

(a) Outcome 1: Reduced household demand

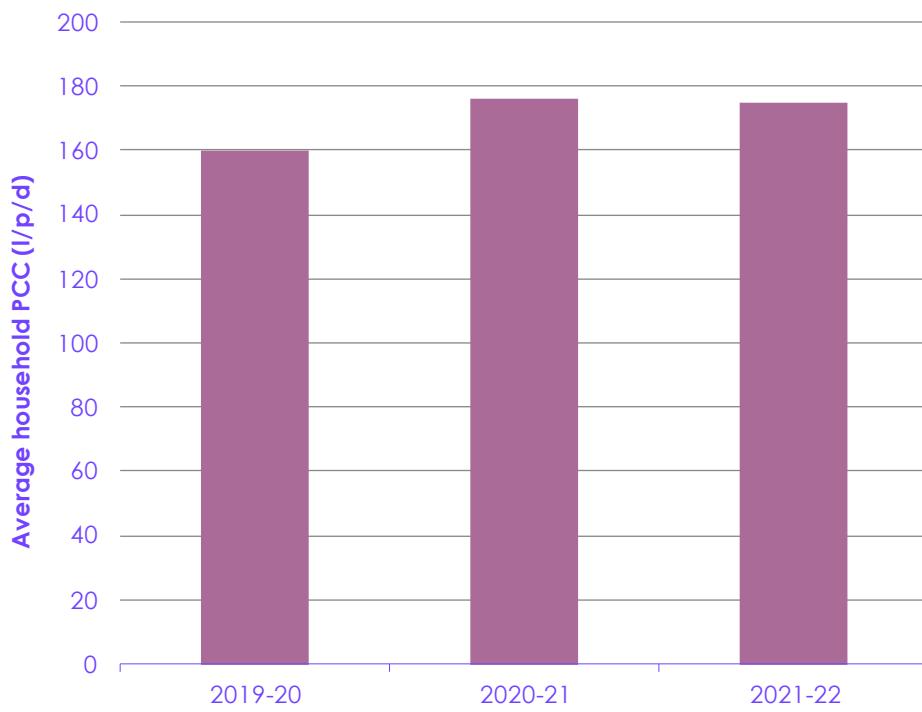
Indicators for this outcome show **insufficient progress** in reducing household demand for water.

Household demand for water is not falling.

- **Average household water use has increased in provisional data for Dŵr Cymru Welsh Water's upcoming water resource management plan (WRMP24).*** Household per capita consumption (pcc) reached 175 litres per day (l/p/d) in 2021/22, up from 160 l/p/d in 2019/20 (Figure 5.4).¹⁰ This is higher than pcc in England, which stands at 144 litres per person per day.¹¹ It is noted that these figures are being reviewed at time of writing. The increase is attributed to impacts from the pandemic, such as increased home working, schooling, and related behavioural change.¹² The draft WRMP24 identifies that demand patterns are returning towards pre-pandemic levels. There is a current lack of central analysis into the drivers of higher per capita consumption across Wales.
- **Total household water consumption is not yet declining.** Household demand in 2020 – 2022 shows increasing household consumption of water in Dŵr Cymru Welsh Water's provisional resource planning figures (Figure 5.5).¹³
- **Around 47% of Dŵr Cymru Welsh Water's customer base is metered, compared to an industry average across England and Wales of 63%.**¹⁴ The water company plans to install smart meters with Automated Meter Reading on unmeasured properties, aiming to increase the level of metering to 95% by 2050.¹⁵ The provisional metering strategy forecasts reductions in overall demand of 96 million litres per day (Ml/d) by 2050, however, this is expected to change in the finalised WRMP.¹⁶
- **Data on uptake of water efficiency measures is held by water companies and overseen by the Wales Water Efficiency Group under Welsh Government, but not published.** Dŵr Cymru Welsh Water runs the Cartref programme targeting plumbing leaks, water efficiency guidance, in-person visits, and free access to water saving products.¹⁷ The company is also undertaking water efficiency audits and fit outs at 200 schools per annum.¹⁸

* Final per-capita consumption figures will be available after the July 2023 publication of the WRMP24. Ofwat has defined annual average per capita consumption as the sum of measured household consumption and unmeasured household consumption divided by the total household population.

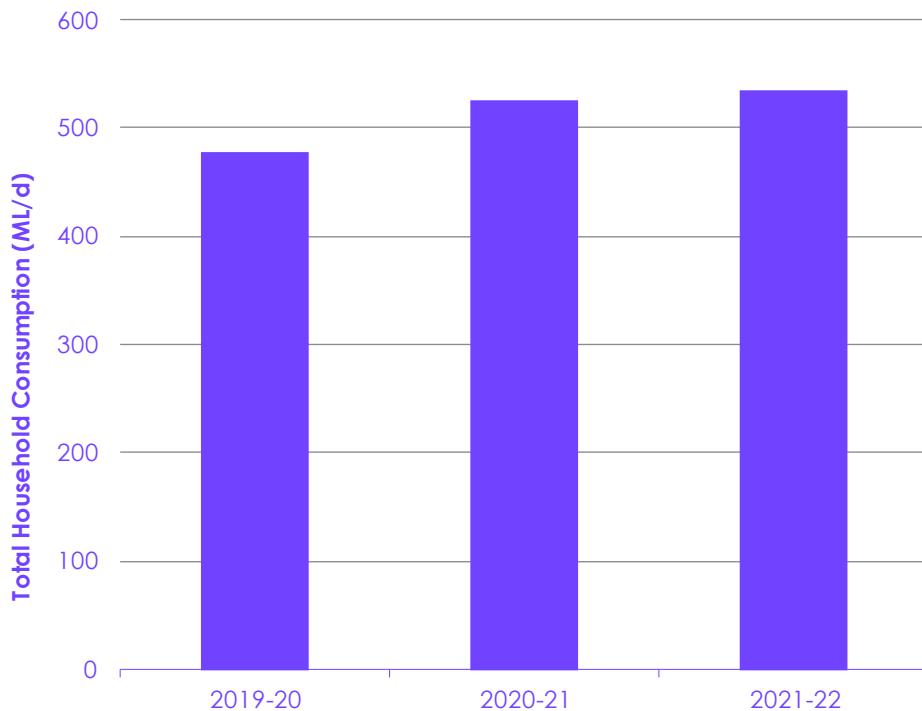
Figure 5.4 Per-capita water consumption for Dŵr Cymru Welsh Water



Source: Dŵr Cymru Welsh Water (2022) *Draft Water Resources Management Plan 2024*.

Notes: Metrics used is litres per person per day. At time of writing, figures are being reviewed ahead of final plan publication.

Figure 5.5 Total household water consumption for Dŵr Cymru Welsh Water



Source: Dŵr Cymru Welsh Water (2022) *Draft Water Resources Management Plan 2024*.

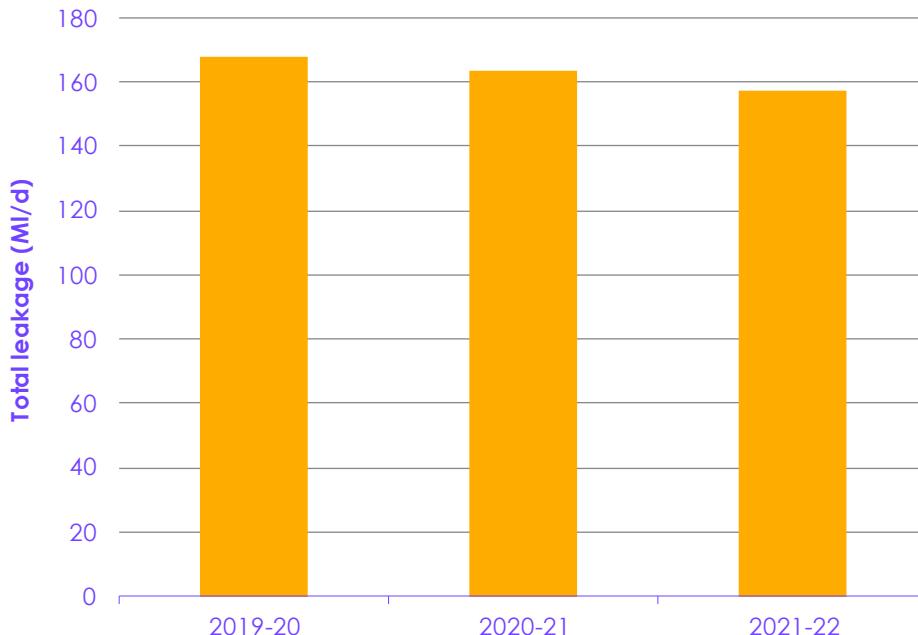
(b) Outcome 2: Improved system performance

Indicators for this outcome show **mixed progress** in improved system performance.

Leakage levels have been reducing.

- **Leakage levels have reduced since 2019-20, and Dŵr Cymru Welsh Water has set a leakage reduction target.** Average annual leakage for Dŵr Cymru Welsh Water was 157 Ml/d in 2021-22, down from an average of 166 Ml/d between 2019 and 2021 (Figure 5.6). Similar to industry standards in England, Dŵr Cymru Welsh Water will deliver a 15% leakage reduction commitment in 2020-25 with a further 10% reduction (compared to 2024-25 position) across the 2025-2030 period.
- **Public water and sewage treatment sites in Wales are currently at greater risk from surface water flooding than fluvial or coastal flooding.** According to CCRA3 flood risk analysis, 62 water sites are exposed to surface water flooding (1:30 or greater), whereas 35 water sites are exposed to river flooding (1:75 or greater). 126 sewerage treatment works are exposed to risks from surface water flooding (1:30 or greater) and 60 are exposed to river flooding risk (1:75 or greater).¹⁹
- **The number of water and sewage sites at risk of surface water flooding is projected to increase by 2050 under 2°C and 4°C warming scenarios.** The number of water sites at significant risk of surface water flooding is projected to increase by 18% by 2050 under 2°C of warming and by 24% under 4°C. The number of sewage treatment works at significant risk of surface water flooding is projected to increase by 13% by 2050 under 2°C of warming and by 17% under 4°C.²⁰

Figure 5.6 Level of leakage for Dŵr Cymru Welsh Water between 2019-20 – 2021-22



Source: Dŵr Cymru Welsh Water (2022) Data derived from draft Water Resource Management Plan (WRMP24).

(c) Outcome 3: Increased supply

Indicators for this outcome show **insufficient progress** for increased supply.

Populous water resource zones in Wales are at risk of drought conditions under climate change.

- **The two most populous zones from Dŵr Cymru Welsh Water are not resilient to a 1 in 200 year level of drought resilience** under a medium emission climate change scenario within the 25-year period to 2050. The South-East Wales Conjunctive Use System (SEWCUS) and Tywi Gower are the most populous zones.²¹ It is noted that the draft plan is being reviewed at time of writing.
- **Hafren Dyfrdwy draft water management plan projects that their supply area remains in surplus throughout the planning period.**²²
- **There are network connectivity limitations under extreme drought and climate change conditions in the Tywi Gower zone.** The baseline supply-demand deficit for the Tywi Gower zone is around 20 Ml/d by 2050 due to localised water resource deficits prior to interventions. However, proposals in the draft WRMP made suggestions to reinforce the region through increased connectivity to the Felindre system and acknowledge that demand management by itself is not sufficient to overcome the deficits.
- **Drought conditions in 2022 saw reservoir stocks under severe pressure and unprecedented demand.** The Llyn Brân reservoir was returned to nature in 2021/22. In addition, use of the latest UK Climate Projections (UKCP18) projections show reduced inflows to Dŵr Cymru Welsh Water's reservoirs under drought conditions, indicating a potential failure through lack of storage in Taff Fawr and Taff Fechan reservoirs in future.*
- **In times of drought many of Wales' low-storage aquifers can experience supply challenges.** During 2018, reports of at least 132 dry supplies were recorded, with many cases likely to not have been reported.²³

(d) Outcome 4: Interdependencies identified and managed

There has been **insufficient progress** towards this outcome.

Understanding of interdependency risks is improving but more detailed planning is needed.

- **Third round of Adaptation Reporting Power (ARP3) submissions cover some select water companies with operations in Wales.** Severn Trent Water's submission quantified risks from interdependencies in only a limited way such as energy supply chain risks and with a lack of information on risks specific to Wales. Dŵr Cymru Welsh Water are not requested to provide an adaptation report, but have provided a 2022 climate risk report which is aligned with Task Force on Climate-Related Financial Disclosures (TCFD) principles. This includes information on scenario analysis that considers risks to infrastructure supply chains during extreme weather events, but there is little on quantification and management of interdependent infrastructure climate risks.²⁴

* Based on a supply-demand balance model that also includes other long-term trends such as population growth and consumer behaviour changes.

(e) Progress on enablers

To achieve these outcomes for well-adapted water supplies, multiple enabling factors must be in place.

- **Education.** NRW provide resources to enable water companies to conduct risk assessments such as their 'Addendum on UKCP18 scenarios for use in WRMP 24 (Wales)' for use in water resource management planning. Water companies Dŵr Cymru Welsh Water and Hafren Dyfrdwy offer advice to customers on their websites and run campaigns to share tips on how to save water.
- **Research.** There has been limited work on the hydrogeology of many Welsh aquifers.²⁵ More groundwater monitoring and research is needed for these groundwater sources in Wales. Dŵr Cymru Welsh Water are undertaking work to develop more sophisticated modelling of climate change impacts to improve planning, particularly regarding wastewater and drainage.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

A package of demand-side, supply-side and system-level adaptation measures is needed to ensure sufficient water supply under a changing climate.

A package of demand-side, supply-side and system-level adaptation measures is needed to ensure sufficient water supply under a changing climate. Significant progress in one outcome may allow for less action in others. Decision makers need to continue to monitor progress and set policies to deliver the most effective combination of measures.

(a) Outcome 1: Reduced household demand

There are **limited polices and plans** in place to ensure reduced household demand. Once WRMPs are finalised and follow the guidance, the score might improve.

There is no per capita consumption target in Wales.

- **Welsh Government requirements for water company WRMPs include setting per capita consumption reduction targets and monitoring levels of metering, but plans are still in draft.** WRMP guidance includes requirements to set 'challenging' per capita consumption reduction targets. The guidance also requires estimates of the proportion of domestic properties with a meter. Dŵr Cymru Welsh Water have a metering strategy in their draft water resource management plan that aims to increase the level of metering to 76% by 2025 and 95% by 2050, projected to reduce overall demand by nearly 35 MI/d at the end of 2030 and 96 MI/d by 2050.²⁶ These figures are being revised ahead of publication of final water resource management plan.
- **Regulatory per capita water consumption targets do not exist in Wales.** But Ofwat have also stated that companies should have the strongest possible incentives to deliver reductions in per capita consumption.
- **Water efficiency standards in building regulations should contribute to demand reduction in future.** Approved document part G sets a water consumption limit of 110 l/p/d for new dwellings and 125 l/p/d for changes to existing dwellings.²⁷
- **A specific funding allocation for metering programmes would stimulate greater uptake.** Metering is a useful tool to help encourage lower water consumption by helping customers understand their usage. Ofwat has proposed a new allocation of £100 million for demand reduction in the next performance cycle (PR24) across a range of efficiency approaches.²⁸
- **Consultation responses for mandatory water labelling across all UK nations are being reviewed.** Defra concluded a consultation on the introduction of mandatory water efficiency labelling for products that utilise water (e.g. taps, showers, toilets, dishwashers and washing machines) in late 2022.²⁹ A response has not yet been published at time of writing.

(b) Outcome 2: Improved system performance

There are **credible policies and plans** in place to ensure improved system performance.

There are statutory targets and planning requirements for reducing leakage.

- **There are statutory targets and planning requirements for reducing leakage.** Ofwat have set performance commitments to cut leakage by 16% by 2025 on 2017/18 levels. Welsh government guidance for WRMPs required demonstration of how the WRMP will continue to reduce leakage by 2030 and how this will contribute to an overall reduction of leakage by at least 50% by 2050, in line with the water industry target.³⁰
- **Welsh water company Drainage and Wastewater Management Plans must consider resilience,** including possible flood risk to sewerage assets from climate change, urban creep, and population growth.³¹ But there is a lack of additional guidance on what level of flood resilience is required. Water companies also have a responsibility as risk management authorities (RMA) in the Welsh national flood and coastal erosion risk management (FCERM) plan to manage flooding from water and sewage systems. Water and sewerage companies in Wales are producing Drainage and Wastewater Management Plans (DWMPs), which must assess capacity, pressures, and risks to their networks. The plans are being produced on a non-statutory basis. See Chapter 9 (Towns and Cities) for more information.
- **The Welsh Government's long-term water strategy and guidance for WRMP heavily emphasises need to deliver on climate and nature emergencies,** along with broader well-being goals.³²
- **Water quality measures are in place for private supplies.** Environmental health officers at 22 local authorities are responsible for recording, risk assessing and testing the water quality of private water supplies in line with the requirements of The Private Water Supply (Wales) Regulations (2017).
- **Dŵr Cymru Welsh Water have conducted flood risk assessment of assets and completed site visits to those identified at highest risk.**

(c) Outcome 3: Increased supply

There are **limited policies and plans** in place to ensure increased supply. Whilst the current climate risk to public water supplies in Wales is low, there is still the need to actively plan for future climate conditions.

Whilst the current climate risk to public water supplies in Wales is low, there is still the need to actively plan for future climate conditions

- **Welsh Government does not specify a level of resilience for system supply.** Companies in England must plan so that their system is resilient to a 1 in 500 year level of resilience, whereas for companies in Wales this is not set.³³ Instead, companies are asked to plan for the worst drought in their historic record, as a minimum.³⁴ Dŵr Cymru Welsh Water have a target to meet resilience to a 1 in 200 year drought. Through implementation of planned actions, the company has an objective to move to a 1 in 500 drought resilience position by 2040.³⁵ WRMP guidelines require water companies to set out how they intend to maintain the balance between supply and demand for water over a minimum of a 25-year period.
- **Water companies in Wales have a statutory duty to prepare, consult, publish, and maintain a drought plan.** Welsh Government guidance sets out that the plans should detail the short-term operational steps the water

company will take as a drought progresses. The plan should also inform the companies' asset management plans.³⁶

- **There is no requirement for a regional water resource plan to be produced in Wales, but strong guidance around water transfers between Wales and England.** WRMP guidance states that any proposal for a new or modification to an existing water transfer agreement from a water resource zone in Wales to England, or a water resource source which might be transferred through Wales, should be subject to detailed analysis. It should also plan for resilience to at least a 1 in 500 year drought for those resource zones affected and consider any risk of deterioration of water body status, adverse effects to designated sites, and loss of biodiversity and resilience of ecosystems.³⁷
- **Large scale water supply infrastructure projects in Wales can be submitted through a RAPID accelerated process.** Wales is part of the Regulators' Alliance for Progressing Infrastructure Development (RAPID) which is set up to help facilitate the development and funding of new large-scale strategic water supply solutions by the water companies. There are currently 17 solutions in the RAPID programme, with only one, the Vyrnwy reservoir source solution, currently most affecting Wales.³⁸
- **The SEWCUS water resource zone has supply-side measures planned, but requires further demand-side management to deliver 1 in 200 year drought resilience by 2030.** Dŵr Cymru Welsh Water's preferred management plan includes two supply-side measures – increasing the capacity of the Memorial pumping station and associated network, and safely reducing the flow down the Llwynon trunk mains to zero – thus preserving storage in the Taff reservoirs. However, alone these are insufficient to provide zonal resilience. They must be delivered in line with further demand management schemes.³⁹
- **There are also supply-side solutions in Dŵr Cymru Welsh Water's draft plan for the Twyi-Gower zone** alongside proposed demand reductions, including increasing capacity of pumping station and flow reversal schemes.⁴⁰
- **Some resilience policies are in place for private water supplies (PWS) across Wales.** PWS records are maintained by local authorities, and compiled annually into a national dataset by the Drinking Water Inspectorate (DWI). There is a PWS task and finish group in Welsh Government as part of the Water Health Partnership for Wales. A local authority representative sits on drought liaison groups, and guidance documents are provided on what to do regarding PWS during droughts.

(d) Outcome 4: Interdependencies identified and managed

There are **insufficient policies and plans** in place to ensure interdependencies are managed.

- **Welsh Government guidance for water resource management plans includes consideration of interdependencies on natural infrastructure,** although draft plans remain under consultation at the time of writing. Welsh government guidance for WRMPs require demonstration of how plans support the delivery of the objectives of the River Basin Management Plans, highlighting any potential competing priorities between the plans, and aligning with the River Basin Management Plans.⁴¹

- **ARP3 submissions cover some select water companies with operations in Wales.** Severn Trent Water's submission quantified risks from interdependencies in a limited way such as energy supply chain risks. Dŵr Cymru Welsh Water is not requested to provide an adaptation report. See Chapter 1 for consideration of Welsh adaptation reporting powers.

(e) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for water supply (Table 5.2). Primary responsibilities are assigned to ministerial portfolios, unless stated otherwise.

Table 5.2
Recommendations

| Primary responsibility | Recommendation | Timing |
|--|--|--------|
| Climate Change, Natural Resources Wales | Conduct research to understand household water use profile and consider setting a target to reduce consumption. | 2025 |
| Climate Change | Review whether it would be appropriate to introduce a 1 in 500 year drought resilience target. | 2025 |
| Climate Change | Embed latest UK Climate Projections (UKCP18) into all long-term water strategies and project planning, to inform a refreshed and coherent Water Strategy that achieves reduced household demand, improved system performance and increased supply. | 2024 |
| Climate Change | Contribute to the evidence base on the level and end-use of private water supply and on vulnerability assessments to inform multi-sector and regional water resources planning. | 2024 |

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Chapter 6

Energy

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Introduction

Table 6.1

Progress summary - Energy

| | Delivery and implementation | Policies and plans | Summary |
|---|-----------------------------|--------------------|--|
| Outcome 1: Reduced vulnerability of energy assets to extreme weather | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> Surface water flood risk is expected to increase for Welsh electricity substations, but decreases for fluvial and coastal flooding. The age and poor condition of overhead poles have contributed to recent weather-related electricity network damage. Energy generators and network operators in Wales have climate resilience plans to support their business plans, with good assessment of current and future risks but less detail on adaptation action plans. Much of this policy area is reserved to UK Government. The latest CCC 2023 adaptation progress report to Parliament score for this outcome was partial policies and plans. |
| Outcome 2: System level security of supply | Mixed progress | Mostly reserved | <ul style="list-style-type: none"> More research is needed to understand possible climate impacts on the energy system, and this must be integrated into system design and investment processes. The UK Net Zero strategy set out several pathways to achieve a decarbonised energy supply by 2035, taking into account security of supply objectives. The majority of policy milestones for this outcome are reserved to UK Government. The latest CCC 2023 adaptation progress report to Parliament score for this outcome was limited policies and plans. |
| Outcome 3: Interdependencies identified and managed | Insufficient progress | Mostly reserved | <ul style="list-style-type: none"> Operators are starting to consider their interdependencies with other infrastructure systems but there are limited actions in place to quantify or manage risks. The majority of policy milestones for this outcome are reserved to UK Government. The latest CCC 2023 adaptation progress report to Parliament score for this outcome was insufficient policies and plans. |

Relevant risks from CCRA3:

Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures (I1); risks to infrastructure services from river, surface water and groundwater flooding (I2); risks to infrastructure services from coastal flooding and erosion (I3); risks to bridges and pipelines from flooding and erosion (I4); risks to hydroelectric generation from low or high river flows (I5); risks to subterranean and surface infrastructure from subsidence (I7); risks to energy generation from reduced water availability (I9); risks to energy from high and low temperatures, high winds, lightning (I10); risks to offshore infrastructure from storms and high waves (I11); risks and opportunities from summer and winter household energy demand (H6).

This chapter covers adaptation to climate change for the energy system in Wales. This includes the generation of electricity and gas, and the operation of the electricity and gas grid to distribute energy to end users.

Access to reliable and plentiful energy is essential for the functioning of the economy in Wales and for the wellbeing of its population. Critical services such as health, telecoms, and infrastructure are already dependent on the functioning of the energy system. Continued digitalisation of the economy in coming years will further increase the scale of potential impacts arising from electricity system failures, as will increasing use of electricity for road transportation and household heating. Energy systems are undergoing a large-scale transformation to reduce and eliminate greenhouse gas emissions. This requires major investment and turnover of assets and networks which make up the energy system, creating the opportunity to improve resilience to climate change in the energy system at the same time.

Multiple climate hazards can cause large scale outages to the power network and the risk of many of these will increase due to climate change.

Climate change will alter the frequency and intensity of weather hazards in Wales that the energy system will face. Annual temperatures in Wales are expected to rise by approximately 1.2°C by the 2050s and between 1.3°C and 2.3°C by the 2080s from a 1981-2000 baseline.¹ Projected risks to the energy system include:

- Higher summer temperatures and more intense heatwaves, leading to generation and transmission efficiency losses, faults from overheating components and increasing electricity demand for cooling.
- Increased risk and severity of summer drought, affecting water supply for cooling, hydro generation and hydrogen production. The risk of drought in Wales is lower than in other parts of the UK, particularly England, however there are supply-demand deficits in the southeast of Wales under future climate scenarios modelled for the third UK Climate Change Risk Assessment (CCRA3).
- Increased winter rainfall and flooding, leading to risks of capacity loss due to inundation and flood damage.

Snow and ice related events are currently important sources of weather-related power supply disruption. As Wales's climate continues to warm these will become less common but will still occur. Changes in some potentially important weather hazards remain uncertain, including wind strength, wind regimes, storminess and lightning. These hazards can all potentially cause large scale outages and loss of network capacity and are some of the key system-level hazards. More evidence is needed to understand changes in these hazards, given the growing reliance on generation from weather-dependent renewable sources for Net Zero.

Exposure of the energy system to climate risks is influenced by the age, condition and location of infrastructure and the criticality of individual assets – the number of connections or the nature of the services they support. Changes in energy supply and an increasing reliance on electricity during the transition to a Net Zero Wales will both make the power system more vulnerable to outages, necessitating high levels of resilience and reliability, and increase the extent of cascading impacts from power system failures across society. Climate resilience in energy is strongly linked to resilience across several other sectors including Water supply, Telecoms and ICT and Transport. All other infrastructure systems depend on energy supply to operate effectively. Failures in electricity supply will also impact on buildings heated by boilers and heat-pumps and will increasingly impact on transportation as the uptake of electric vehicles increases over coming years.

Policy levers in relation to energy are largely reserved.

Policy levers in relation to energy are largely reserved. Emergency response to electricity system failures is largely devolved in practice. Governance for climate resilience in the energy system is complex, with several government divisions and organisations playing a role.

- **Ofgem.** Ofgem is Great Britain's independent energy regulator that operates in a statutory framework set by UK Parliament. It has no statutory remit for climate resilience. It is invited to report a climate change risk assessment and adaptation plan to Defra every five years under the Adaptation Reporting Power (ARP) but declined to report in the most recent round in 2021 (ARP3).
- **National Grid.** National Grid is responsible for providing a resilient and reliable electricity transmission grid. It is responsible for the development of transmission network reinforcement strategy and for maintenance of a number of key industry standards and codes that have a major influence on resilience of electricity supply. It reported its climate risk assessment and adaptation plan under ARP3 for electricity and gas.
- **Infrastructure, Resilience and Security Working Group (IRSWG).** The Welsh Government is a member of the UK Cabinet Office-led IRSWG and works closely with the UK Government, other devolved administrations and Local Resilience Forums in Wales on risks to energy infrastructure.
- **Distribution Network Operators (DNOs).** For Wales, there are three licensed areas operated by two companies: SP Energy Networks and Western Power Distribution (part of National Grid Group).² These operators reported their climate risk assessments and adaptation plans under ARP3. The electricity transmission system is joined between England and Wales.
- **Natural Resources Wales.** Natural Resources Wales have responsibilities including land management, advisory and regulatory roles regarding environmental impacts related to the energy system.³

Coverage of adaptation for energy within Prosperity for All: A Climate Conscious Wales (PfACCW) focused on collaboration and further research (Box 6.1).

Box 6.1

Energy in Prosperity for All: A Climate Conscious Wales (PfACCW)

Identified research priorities:

- Risks to energy, transport and digital infrastructure from high winds and lightning.
- Further modelling is needed on the increased risk of tree-related faults to energy and rail networks due to projected increases vegetation growth rates.

Objectives/actions:

- Strengthen our preparedness against multiple risks to interdependent infrastructure networks.
- Work with utility companies specifically to address the risk of a total failure of the UK's national electricity transmission network.
- Complete delivery of pilot exercise to improve emergency response to threats to infrastructure.
- Roll out new infrastructure emergency response processes across all Local Resilience Forums.

Indicators:

- Utility companies in Wales with adaptation measures in place.

Source: Welsh Government (2019) *Prosperity for All: Climate Conscious Wales: A climate change adaptation plan for Wales: Technical Annex*.

1. Monitoring progress towards a well-adapted energy system

Resilience can be delivered through reduced vulnerability of assets, security of supply and effective management of interdependencies with other systems.

Successful adaptation aims to ensure a reliable power supply in a Net Zero economy, despite climate change. This means that the number of homes and businesses affected by power outages is minimised and when outages occur their impact and duration is minimised, particularly for critical national infrastructure and essential services such as medical care.

We have identified three key outcomes that will achieve this goal for improved climate resilience (Figure 6.1):

- **Reduced vulnerability of energy assets to extreme weather.** Increased frequency of extreme weather events poses significant risks to energy assets (power generation plants, electricity and gas transmission and distribution networks). The monitoring of asset-level resilience to floods, overheating of infrastructure and overall conditions is necessary to minimise the impact of climate change on the energy system.
- **System-level security of supply.** Weather and climate can impact energy asset performance, and lead to costly disruption or in severe cases, loss of energy services entirely. Increased reliance on weather-dependent sources of generation necessitates robust system planning to deliver a reliable supply. Increased reliance on electricity supply increases consequences of power outages.
- **Interdependencies with other systems are known and managed.** Infrastructure services are increasingly dependent on one another. Risks of cascading failures from another service, such as transport, water or digital, also increase the risk of power outages. The energy system also relies on key infrastructure services to operate effectively. These interdependencies need to be accounted for in climate assessments and adaptation actions for all major electricity and gas producers, as well as transmission and distribution system operators.

A number of enabling factors are needed if the outcomes identified above are to be implemented at appropriate scales:

Governance arrangements for climate resilience in the energy system are complex and not always clear.

- **Governance.** Arrangements for governance of climate resilience in the energy system are complex and span both UK and Welsh Governments. Many government departments, divisions and organisations have a role in ensuring resilience, though their remits are not always clear. Clear designation of responsibilities for resilience across the energy system is needed. All actors will need to collaborate and communicate more effectively to deliver a resilient, decarbonised energy supply.
- **Data.** National data on weather and climate related impacts on the energy system, and the extent of adaptation actions being delivered, will enable a better understanding of how climate resilient the energy system is. Consistent reporting and collation of data on weather-related outages, including the cause, duration and magnitude, would provide a meaningful indicator of how climate-related impacts on the energy system are changing. This should be combined with improvements in reporting on climate risks and adaptation plans by network and system operators, as

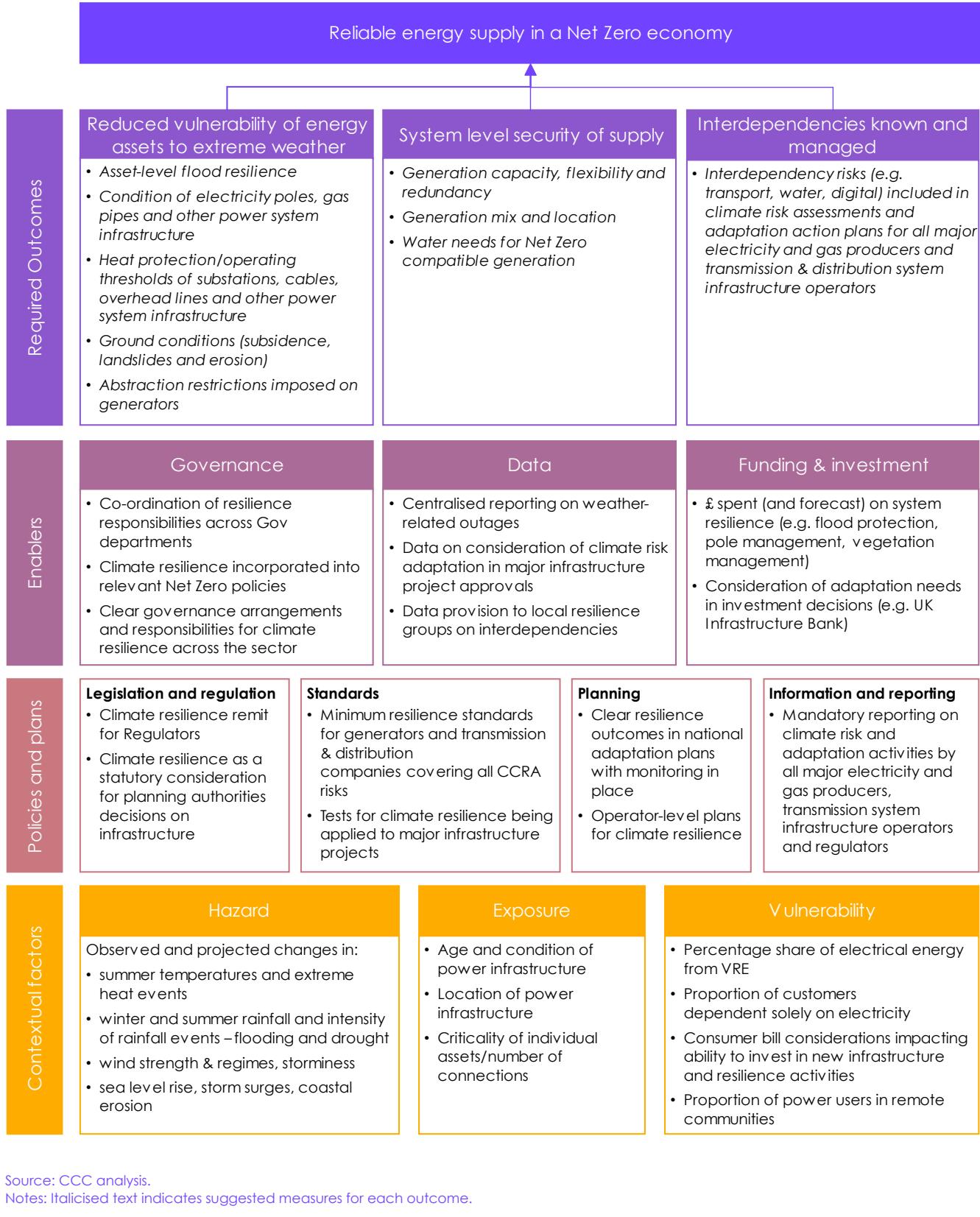
recommended to Defra in our evaluation of the Adaptation Reporting Power (ARP3) in 2022.

- **Funding and investment.** Climate resilience needs to be formally integrated into investment processes and long-term decisions. This includes large national-scale infrastructure projects and company-level investment cycles.

To deliver the identified outcomes consistent with a well-adapted energy system, we have identified a number of key policy milestones that are required. These will relate to a mixture of devolved and reserved powers. For our assessment we focus on policy levers in the control of Welsh Government but consider reserved policy where relevant for adaptation implementation.

- **Legislation and regulation.** UK policy must create legislation which enforces sustainable long-term plans for a resilient energy system and provides appropriate frameworks for regulation. Statutory resilience duties are needed for regulators and key system operators. Legislation should also ensure that investment allocation is appropriate to meet adaptation goals.
- **Standards.** A well-adapted energy system will require UK policy to implement and extend resilience standards, which deliver an energy system compatible with future climate conditions.
- **Planning.** Wales's national adaptation plans must have clear resilience outcomes with monitoring in place. At a UK level, all key operators in the energy system must produce climate change risk assessments and adaptation plans which demonstrate progress in making the energy system more climate-resilient.
- **Information and reporting.** At a UK-level, reporting on some aspects of risk and adaptation planning and delivery should be mandatory. This will improve understanding of the national picture of adaptation in the energy system, as well as in other sectors upon which the energy system relies, including transport and telecoms and ICT.

Figure 6.1 Monitoring map for energy



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Reduced vulnerability of energy assets to extreme weather

A lack of indicators for this outcome means we are **unable to evaluate** progress in reducing vulnerability and exposure of energy assets to climate change.

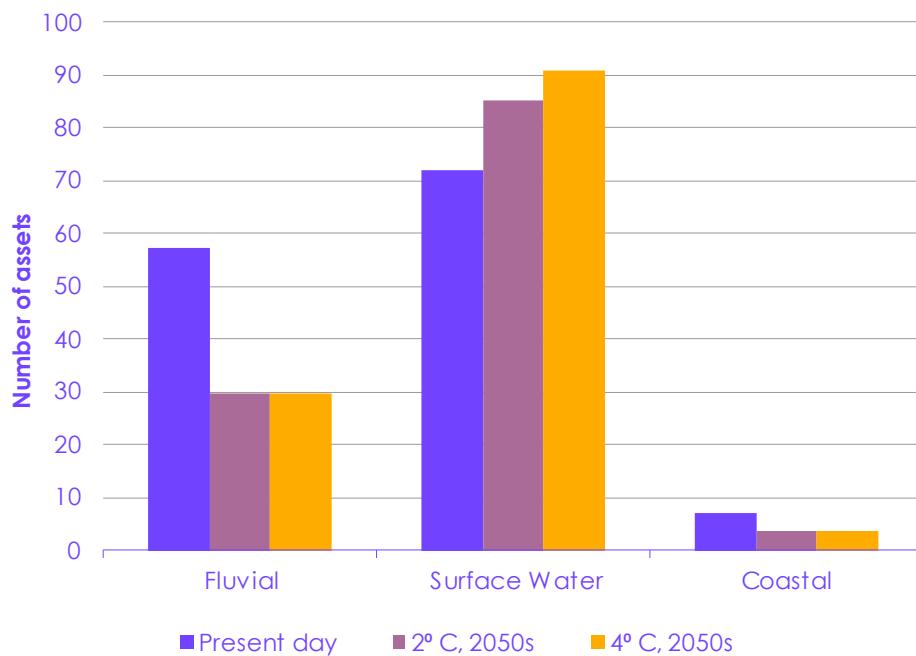
- **Surface water flood risk is expected to increase for Welsh electricity substations, but decreases for fluvial and coastal** (Figure 6.2). Research conducted for CCRA3 indicates an 18% increase in the number of substations at significant risk of surface water flooding by 2050 under a 2°C climate scenario (assuming current levels of adaptation and low population growth in the mid and late century). Under the same scenario, the number of substations at significant risk of fluvial flooding decreases by 48%, and for coastal flooding decreases by 50%.⁴
- **Across England and Wales, the majority of critical electricity substations are flood-proofed and plans are in place to deliver the rest by 2026.** However, we were unable to source a specific breakdown for Wales alone. Around three-quarters of National Grid's critical (high and medium risk) substations identified in the current regulatory period (2013-2023) as at risk of flooding, have been protected to a 1 in 1000 year flood.⁵ Flood defences at the remaining critical sites are planned to be implemented by 2026. In parallel, Ofgem collect data annually from distribution network operators on compliance with the ETR138 flooding standard, however, they do not compile or report on these data.
- **The age and poor condition of overhead poles have contributed to recent weather-related electricity network damage.** Age and condition of overhead line poles were found by Ofgem to be contributing factors to the power network damage caused by Storm Arwen. For areas in Wales, 80% of damaged poles for SP Energy Networks (covering areas in North Wales) and 55% for Western Power Distribution (covering areas in central and south Wales) were over 40 years old.⁶ Ofgem's final report identifies the need for further work to understand the correlation between pole age and damage, and to identify improvements in pole condition reporting.
- **Data on abstraction restrictions imposed on power generators was not available.** The largest proportion of overall water abstractions in Wales are for energy production (78%), at over 8,280,000 ML/year.⁷ These licences are mostly for hydropower and are considered to be non-consumptive, meaning that the water is returned to the local environment. See Chapter 5 (Water supply) for further assessment of drought risks in Wales.

There is a lack of available information on energy asset resilience to climate hazards across Wales.

⁴ Under ETR: 138 the target is to achieve a 1 in 1000 year resilience level for all new and existing substations (as defined in UKCP18 (UK Climate Projections 2018)). To account for data errors and uncertainties in modelling, the flood depth is increased by 300 mm.

- There is a lack of available information on heatwave risk to energy assets in Wales.

Figure 6.2 Number of electricity substations in Wales at significant risk of flooding under different climate scenarios



Source: Sayers et al (2020) Third UK Climate Change Risk Assessment (CCRA) Future flood risk.

Notes: Data extracted for the CCRA3 technical chapters from the results database available at www.ukclimaterisk.org. The climate scenarios presented above assume current levels of adaptation and low population growth in the mid and late century.

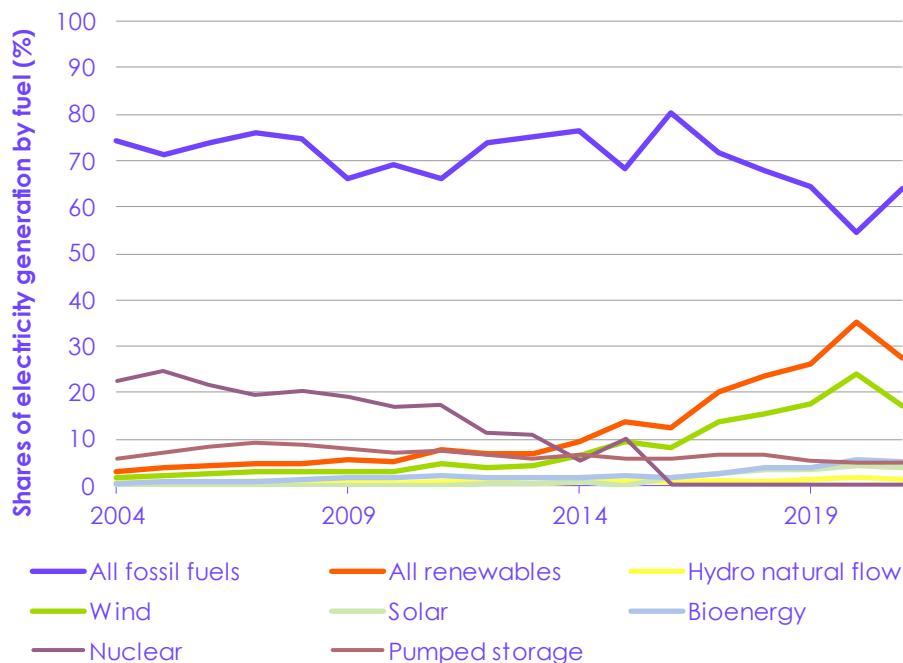
(b) Outcome 2: System-level security of supply

Indicators for this outcome show **mixed progress**.

- **Welsh Government has committed to Net Zero by 2050 and a move towards a decarbonised power supply, which can create greater weather-dependence (particularly wind) and increased exposure to outages due to weather extremes.** By 2030, Wales aims to generate renewable electricity equal to 70% of its electricity consumption.⁸ Wales's electricity generation mix is increasingly reliant on wind. Wind accounted for 17% of total Welsh electricity generation in 2021, compared to 5% just 10 years earlier (Figure 6.3).
- **The UK Net Zero strategy, encompassing reserved energy powers affecting Wales, set out several pathways to achieve a decarbonised energy supply by 2035, taking into account security of supply objectives.** It is important for pathways to take into account the capacity, flexibility and redundancy to respond to changing weather conditions, as part of delivering security of supply.
- **There is considerable uncertainty in future energy sector water needs at regional geographic scale.** 6% of electricity generation in 2021 was from either natural or pumped storage hydro schemes.⁹ The Welsh Government

has committed to establish at least one renewable hydrogen production site of at least 10 MW by 2023-24, scope large-scale hydrogen production sites and support local projects, which could be a further driver of future water needs.¹⁰

Figure 6.3 Shares of electricity generation in Wales over time by fuel type



Source: Department for Business, Energy & Industrial Strategy (2022) *Electricity generation and supply in Scotland, Wales, Northern Ireland and England, 2017 to 2021*.

(c) Outcome 3: Interdependencies with other systems known and managed

There is **insufficient progress** in identifying and managing interdependencies.

- Operators are starting to consider their interdependencies with other infrastructure systems but there are limited actions in place to quantify or manage risks. Energy generators and network operators within Wales provided some information in the third round of the Adaptation Reporting Power but often the assessment of interdependent risks lacked quantification.¹¹

(d) Progress on enablers

There is limited information available to assess progress on enablers for a well-adapted energy system.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

We have provided an assessment of policies and plans in this area, but not formally scored them as most policy areas for energy are reserved to UK Government.

Where there are policies or plans within the Welsh Government's control, we have highlighted these potential opportunities for consideration of climate risks.

(a) Outcome 1: Reduced vulnerability of energy assets to extreme weather

Key policy milestones for this outcome are largely outside of the Welsh Government's direct control. This outcome is therefore **not scored**.

High-level policy consideration of extreme weather events is given to renewable energy generation in the Welsh Government's Net Zero Wales plans.

- **High-level policy consideration of extreme weather events is given to renewable energy generation in the Welsh Government's Net Zero Wales Carbon Budget 2**, along with a commitment to build climate resilience and reduce emissions in complementary ways.¹²
- **Welsh Government planning policy is a key lever for considering major infrastructure but is currently limited on consideration of climate risks in relation to the energy system.** National Plan 2040 sets out planning objectives for heat networks and identifies priority areas. Policy 17 covers renewable and low carbon energy and associated infrastructure but does not consider climate risk in location. Policy 18 covers renewable and low carbon energy developments of national significance* but does not consider climate risks.¹³ Energy projects over 350MW capacity are required to provide a climate change risk assessment under the Planning Act (2008).¹⁴
- **Energy generators and network operators in Wales have climate resilience plans to support their business plans, although the quality is variable.** Energy UK responded to ARP3 on behalf of energy generators that participate in Great Britain's electricity market but did not present a detailed risk assessment. There were no case studies in Wales and a detailed action plan was not provided.¹⁵
- **The energy network operators in Wales responded individually to ARP3 (Table 6.2).**¹⁶ Across the three network operators there was a good level of consideration of climate risks and actions in place to manage them.

Energy generators and network operators in Wales have climate resilience plans to support their business plans, although the quality is variable.

* Large-scale energy developments include all on shore wind generation of 10 or more megawatts. Other energy generation sites with generating power between 10 and 350 megawatts.

Table 6.2

CCC assessment of Adaptation Reporting Power third round submissions across energy network operators

| | Robust assessment of current and future risks | Specific risk management actions described | Appropriate monitoring and evaluation in place |
|---|--|---|---|
| Western Power Distribution (part of National Grid Group) | Yes | No | Not stated |
| SP Energy Networks | Yes | Yes | Yes |
| Wales and West Utilities | Yes | Yes | Yes |

Source: CCC analysis.

- **At a UK level for reserved policies, the CCC's recent progress report assessed this outcome as partial policies and plans.**¹⁷ Some of the key policy milestones required to ensure generation and network assets are resilient to extreme weather are not in place. Climate change is a consideration in statutory planning applications for new infrastructure, and reports submitted under ARP3 demonstrate progress in some areas, but there is a need for minimum resilience standards and a clearer climate resilience remit for regulators.

(b) Outcome 2: System level security of supply

Key policy milestones for this outcome are largely outside of the Welsh Government's direct control. This outcome is therefore **not scored**.

The Welsh Government has supported the development of four regional energy strategies.

- **The Welsh Government has supported the development of four regional energy strategies** that identify the scale of change needed to reach a low carbon energy system and establish regional priorities for energy. This work models future demand for power, heat and transport, and assesses the economic impact of delivering the proposed ambitions.¹⁸ In addition, the Welsh Government is facilitating local energy planning to create a National Energy Plan by 2024.¹⁹
- **UK Government has committed to fully decarbonise energy supply by 2035 and make it resilient.** The Net Zero Strategy acknowledges the need for incorporating adaptation into decarbonisation policy. This needs to be followed by implementation of integrated policy decisions which address both mitigation and adaptation challenges together.

(c) Outcome 3: Interdependencies with other systems known and managed

Key policy milestones for this outcome are largely outside of the Welsh Government's direct control. This outcome is therefore **not scored**.

- **Coverage of interdependency risks has improved in adaptation plans.** Energy UK's submission under ARP3 indicates consideration of interdependencies, largely regarding the role of electricity in other sectors, but does not quantify any cascading risks. National Grid identifies and quantifies interdependencies in their risk assessment approach. SP Energy

Networks identified interdependent risks namely from telecommunications and transport but no quantification. Wales and West Utilities identify interdependent risks and outline some mitigation measures in place to address them e.g. back-up generators.²⁰

(d) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for the energy system (Table 6.3). Primary responsibilities are assigned to ministerial portfolios, unless stated otherwise.

Table 6.3
Recommendations

| Primary responsibility | Recommendation | Timing |
|---|--|--------|
| Climate Change | Include actions to embed climate resilience into planning for energy infrastructure in next national adaptation plan. | 2024 |
| Climate Change | Collate national data on weather-related outages, including the frequency and duration of outage and the number of properties and businesses affected. | 2024 |
| Climate Change, Rural Affairs and North Wales | Work with UK Government on recommendations from CCC's Progress in adapting to Climate Change 2023 Report to Parliament as they relate to Wales. | 2025 |

Endnotes

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- ² Ofgem (2022) GHD - Storm Arwen Review Main Report, <https://www.ofgem.gov.uk/sites/default/files/2022-06/GHD%20%20Storm%20Arwen%20Review%20Main%20Report.pdf>.
- ³ Natural Resources Wales (2017) Energy Guidance Note, <https://cdn.cyfoethnaturiol.cymru/media/684911/energy-guidance-note-eng.pdf?mode=pad&rnd=13169556837000000>.
- ⁴ Sayers, PB., Horritt, M, Carr, S, Kay, A, Mauz, J., Lamb R, and Penning-Rowsell E (2020) *Third UK Climate Change Risk Assessment (CCRA3): Future flood risk. Research undertaken by Sayers and Partners for the Committee on Climate Change.* Published by Committee on Climate Change, London.
- ⁵ National Grid (2022) Re-opener Report MSIP– Extreme Weather, <https://www.nationalgrid.com/electricity-transmission/document/140911/download>.
- ⁶ Ofgem (2022) GHD - Storm Arwen Review Main Report, <https://www.ofgem.gov.uk/sites/default/files/2022-06/GHD%20%20Storm%20Arwen%20Review%20Main%20Report.pdf>.
- ⁷ Natural Resources Wales (2021) State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Resource Efficiency Water, <https://cdn.cyfoethnaturiol.cymru/media/693313/sonarr2020-theme-resource-efficiency-water.pdf>.
- ⁸ Welsh Government (2023) Consultation Document: Review of Renewable Energy Targets, https://www.gov.wales/sites/default/files/consultations/2023-01/consultation-document-review-of-renewable-energy-targets_0.pdf.
- ⁹ Department for Business, Energy & Industrial Strategy (2022) Electricity generation and supply in Scotland, Wales, Northern Ireland and England, 2017 to 2021, <https://www.gov.uk/government/statistics/energy-trends-december-2022-special-feature-article-electricity-generation-and-supply-in-scotland-wales-northern-ireland-and-england-2017-to-20>.
- ¹⁰ Climate Change Committee (2023) Progress Report: Reducing Emissions in Wales, <https://www.theccc.org.uk/publication/2023-progress-report-reducing-emissions-in-wales/>.
- ¹¹ Climate Change Committee (2022) Understanding Climate Risks to UK Infrastructure: Evaluation of the Third Round of the Adaptation Reporting Power, <https://www.theccc.org.uk/publication/understanding-climate-risks-to-uk-infrastructure-evaluation-of-the-third-round-of-the-adaptation-reporting-power/>.
- ¹² Welsh Government (2021) Net Zero Wales: Carbon Budget 2 (2021-25), [https://www.gov.wales/sites/default/files/publications/2021-10/netzero-wales-carbon-budget-2-2021-25.pdf](https://www.gov.wales/sites/default/files/publications/2021-10/net-zero-wales-carbon-budget-2-2021-25.pdf).
- ¹³ Welsh Government (2021) Future Wales: The National Plan 2040, <https://www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf>.

- ¹⁴ Energy UK (2023) *Climate Risks & Adaptation Report*, https://www.energy-uk.org.uk/wp-content/uploads/2023/03/EnergyUKClimateRisksAdaptationReport_08.07.21-FINAL.pdf.
- ¹⁵ Climate Change Committee (2022) *Understanding Climate Risks to UK Infrastructure: Evaluation of the Third Round of the Adaptation Reporting Power*,
<https://www.theccc.org.uk/publication/understanding-climate-risks-to-uk-infrastructure-evaluation-of-the-third-round-of-the-adaptation-reporting-power/>.
- ¹⁶ Welsh Government (2022) *Prosperity for All: Climate Conscious Wales Progress Report*,
<https://www.gov.wales/prosperity-all-climate-conscious-wales-progress-report>.
- ¹⁷ Climate Change Committee (2023) *Progress in Adapting to Climate Change: 2023 Report to Parliament*, <https://www.theccc.org.uk/publication/progress-in-adapting-to-climate-change-2023-report-to-parliament/>.
- ¹⁸ HM Government (2021) *Net Zero Strategy: Build Back Greener*,
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf.
- ¹⁹ Welsh Parliament (2022) *Renewable energy in Wales*, <https://senedd.wales/media/sdudz5hj/crl15125-e.pdf>.
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<https://www.theccc.org.uk/publication/understanding-climate-risks-to-uk-infrastructure-evaluation-of-the-third-round-of-the-adaptation-reporting-power/>.



Chapter 7

Telecommunications and ICT

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Introduction

Table 7.1

Progress summary – Telecommunications and ICT

| | Delivery and implementation | Policies and plans | Summary |
|--|-----------------------------|--------------------|--|
| Outcome 1: Vulnerability of assets reduced | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> No evidence was found on whether network operators met the flood defence requirements in the National Flood Resilience Review. A number of planning policies are in place regarding development of telecommunications infrastructure, but they currently do not include consideration of climate risks. Telecoms and ICT networks adaptation policy is mainly reserved to the UK Government, so policy scores are not given to Wales. For the UK, the latest CCC 2023 adaptation progress report to Parliament scored this outcome as limited policies and plans. |
| Outcome 2: System level resilience | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> Digital infrastructure services are privately operated and there is no overview of the extent to which climate change risks have been adequately identified and how these risks are being managed within the sector. There is a lack of data to evaluate progress. There is a Digital Strategy for Wales that includes a mission for fast and reliable digital infrastructure. However, the actions embedded in this do not consider the need for climate adaptation. Telecoms and ICT networks adaptation policy is mainly reserved to the UK Government, so policy scores are not given to Wales. For the UK, the latest CCC 2023 adaptation progress report to Parliament scored this outcome as insufficient policies and plans. |
| Outcome 3: Interdependencies identified and managed | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> Data on interdependency risks were not available. Telecoms and ICT networks adaptation policy is mainly reserved to the UK Government, so policy scores are not given to Wales. For the UK, the latest CCC 2023 adaptation progress report to Parliament scored this outcome as insufficient policies and plans. |

Relevant risks from CCRA3:

Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures (I1); Risks to infrastructure services from river, surface water and groundwater flooding (I2); Risks to infrastructure services from coastal flooding and erosion (I3); Risks to bridges and pipelines from flooding and erosion (I4); Risks to subterranean and surface infrastructure from subsidence (I7); Risks to digital from high and low temperatures, high winds, and lightning (I13).

This chapter covers adaptation to climate change for telecommunications (telecoms) and information communications technology (ICT) network infrastructure. This is infrastructure for the provision of telephone, mobile

communications and internet services, including data centres and extensive networks of optical fibres, cables and masts.

Telecoms and ICT infrastructure will be affected by flooding, increased temperatures and occurrence of heatwave events, storms and winds. Many of these hazards are already affecting services today (Box 7.1) and will increase in frequency and intensity, with greater impact on the provision of telecoms and ICT services than we see today.

Box 7.1

Changes in hazard and impacts on telecommunications and ICT infrastructure

High summer temperatures, as well as rapid fluctuations in temperature and humidity, pose challenges particularly to data centres, which need to be kept cool to operate. Data centres are also vulnerable to floods, high winds, wildfire, and droughts as well as loss of supporting power supply.

An increase in the frequency or intensity of storms could increase the risk of wind, ice and snow damage to overhead cables and damage from wind-blown debris. These fixed line services are being replaced by wireless services (4G and 5G) from the nearest fibre node, and direct connection to fibre networks. During periods of severe cold, snow or flooding, telecoms providers can be affected by the denial of access to affected sites, or loss of power. These risks decline as more robust, underground, fibre optic cables parallel or replace aerial cables and wireless links. Fibre and cables are vulnerable to flooding damage where they use bridges to cross rivers.

More intense or longer droughts and heatwaves can affect a range of ICT infrastructure because ground shrinkage can lead to failure of electrical, gas and water pipes, thereby damaging co-sited ICT infrastructure. The Third Climate Change Risk Assessment (CCRA3) concluded that further attention to the climate resilience of this sector and quantitative information on current and future risks under climate change is needed to better assess its vulnerability and exposure to climate change.¹

Source: Jaroszowski, D., Wood, R., and Chapman, L. (2021) *Infrastructure*. In: *The Third UK Climate Change Risk Assessment Technical Report*. [Betts, R.A., Haward, A.B., Pearson, K.V. (eds)] Prepared for the Climate Change Committee, London.

Exposure to these hazards is influenced by the age, condition and location of telecoms and ICT infrastructure. Continued digitalisation of key functions in society means our dependence on digital infrastructure is growing, and therefore the impacts of climate-related events causing outages are likely to increase over time. The ownership of a large proportion of ICT infrastructure, particularly data centres, base stations, and network connections, is private. For commercial or sensitivity reasons, information on location and connectivity is often not publicly available, meaning it can be difficult to assess vulnerability to extreme events across the system. Remote communities and vulnerable groups such as those who rely on digitally operated health equipment are likely to be more vulnerable to climate risks affecting digital infrastructure. The removal of copper lines, upon which many critical functions are reliant (traffic lights, lifts, communications for healthcare), risks increasing vulnerability when replaced with less climate-resilient alternatives.

Telecommunications policy is not devolved to Wales. The UK Government Department for Science, Innovation and Technology (DSIT) is responsible for Government regulation related to the telecoms and ICT sector in Wales. Ofcom regulates operations in the sector but has no statutory remit for climate resilience. Regulation of telecoms is carried out through the Electronic Communications Code.² This is the UK-wide legal framework that regulates the relationship between network operators and site providers to ensure rollout and maintenance of physical networks for telecoms and ICT services. The Welsh Government works closely with

the UK Government, telecommunications operators and Ofcom on telecommunications and ICT network policy and delivery.

Broadband and mobile network connectivity is widespread across Wales with UK-wide providers forming a significant part of service delivery. Currently, OpenReach is the largest broadband provider in Wales, with a Virgin Media presence mainly in the south-east corridor.

The telecoms and ICT system is inherently linked to several other systems. All other infrastructure systems depend on telecoms and ICT to operate effectively (see Chapter 5 on Water supply, Chapter 6 on Energy and Chapter 8 on Transport).

The Welsh National Adaptation plan Prosperity for All: A Climate Conscious Wales (PfACCW) sets a research objective for digital infrastructure (Box 7.2) but provides limited actions for telecoms and ICT specifically.³

Box 7.2

Telecommunications and ICT within Prosperity for All: A Climate Conscious Wales

Identified urgent risk and research priority

- Risks to energy, transport and digital infrastructure from high winds and lightning.

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for all: A Climate conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress towards well-adapted telecomms & ICT

Successful adaptation of telecoms and ICT networks to climate change aims to ensure that reliable services are maintained despite the range of present and future extreme weather events. To deliver on this ambition for climate resilient telecoms and ICT networks we have identified key outcomes that need to be achieved (Figure 7.1).

Achieving climate resilience means reduced vulnerability of telecoms and ICT assets, system level resilience and management of interdependencies with other systems.

- **Reduced vulnerability of assets to extreme weather.** Telecoms and ICT assets will be exposed to an increased frequency of extreme weather events due to climate change. Assets must be designed and operated to be resilient to the range of climate hazards they will be exposed to over their lifetime, including flooding, overheating of infrastructure and deterioration of asset condition. Monitoring is necessary to identify and minimise the impact of climate change on these systems.
- **System level resilience.** Increased digitalisation means the consequences of network failures due to extreme weather will be greater. Telecoms and ICT systems must be designed to operate in these changing conditions and have plans in place to respond quickly and effectively when outages occur. This includes redundancy in system design and operation, diversity of technologies and contingency plans for weather-related events (see Chapter 12 (Community preparedness and response) for emergency response).
- **Interdependencies with other infrastructure services are identified and managed.** Infrastructure services are increasingly dependent on one another. These interdependencies need to be accounted for in climate assessments and adaptation plans for major operators.

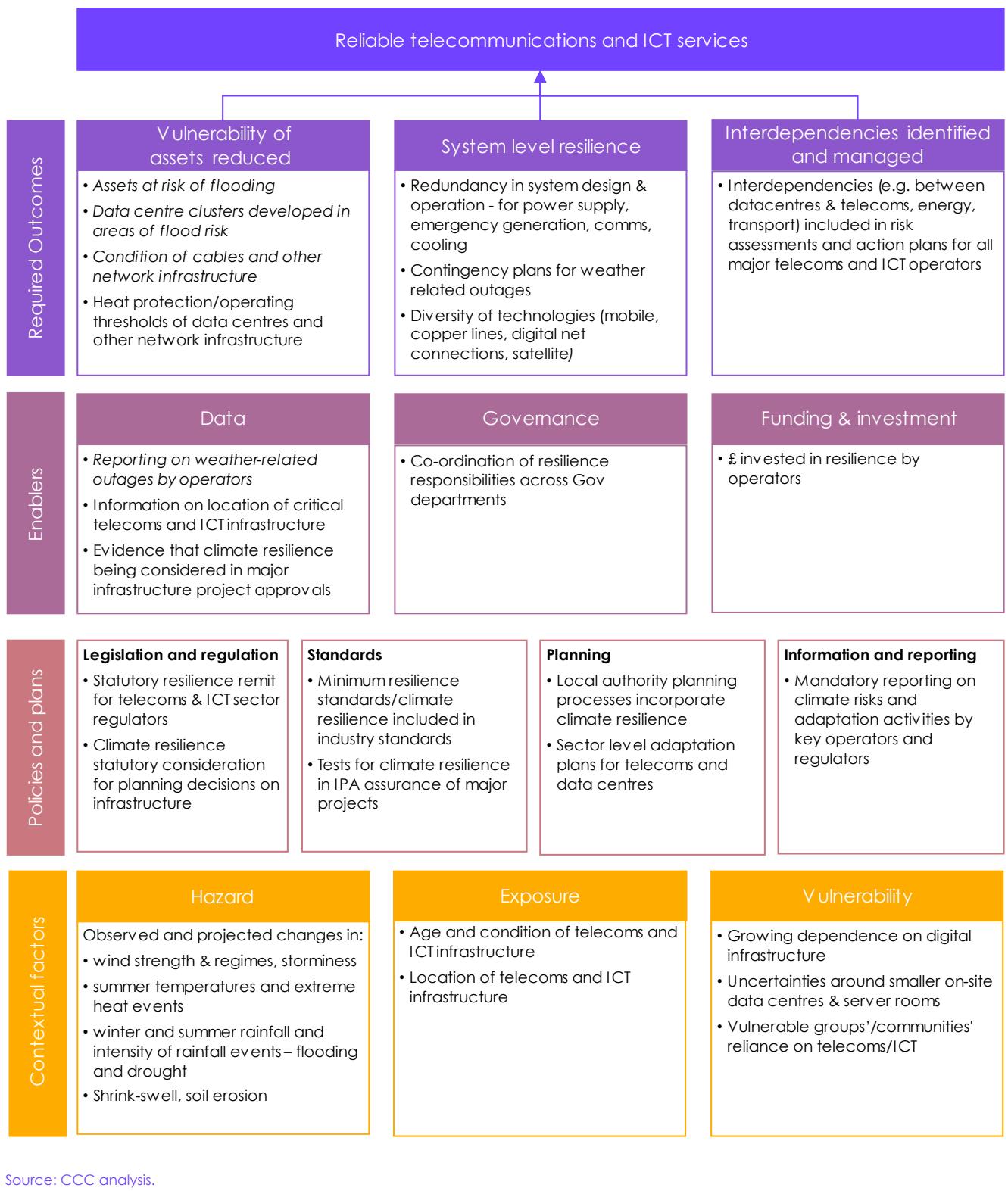
A set of enabling factors need to be in place to support the delivery of these outcomes:

- **Data.** Data on weather and climate related impacts on telecoms and ICT networks, and on the extent of adaptation actions being delivered, will enable a better understanding of how climate resilient the system is.
- **Governance.** Clear, mandated remits for climate resilience and appropriate co-ordination across interdependent sectors are needed, to ensure that the identified outcomes can be delivered, particularly around interdependencies.
- **Funding and investment.** Climate resilience needs to be formally integrated into investment processes and long-term decisions. This includes for large national infrastructure projects and company investment plans.

To increase the prevalence of the enabling factors and deliver the identified outcomes consistent with well-adapted telecommunications and ICT, we have identified key policy milestones. These relate to a mixture of devolved and reserved responsibility. For our assessment we focus on policy levers in the control of Welsh Government but consider reserved policy where relevant for adaptation implementation.

- **Legislation and regulation.** Engage at UK level to develop legislation that integrates long-term planning for resilient telecoms and ICT networks and to provide appropriate frameworks for regulation. Legislation should also ensure that investment allocation is appropriate to meet adaptation goals. Statutory resilience duties are needed for regulators.
- **Standards.** Engage at a UK level to develop new minimum resilience standards or update existing industry standards. This will be necessary to set expectations for operators and ensure the system continues to operate under a changing climate.
- **Planning.** National adaptation plans must have clear resilience outcomes, with monitoring in place and reflecting vulnerabilities in Wales. All key operators must produce climate change risk assessments and adaptation plans which demonstrate progress in making telecoms and ICT networks more climate resilient.
- **Information and reporting.** Reporting on some aspects of risk and adaptation planning and delivery should be mandatory. This will improve understanding of the national picture of sectoral adaptation, as well as in other sectors upon which telecoms and ICT networks depend, including energy and transport.

Figure 7.1 Monitoring map for telecommunications and ICT networks



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Reduced vulnerability of assets

There is a lack of data to evaluate progress on key indicators for reduced vulnerability of assets to climate change, therefore we are **unable to evaluate** progress on this outcome.

Quantitative data on climate change related outages in data centres are not available.

- **No evidence was found on compliance of network providers in Wales to flood defence requirements in the UK National Flood Resilience Review.** Flood resilience of telecoms infrastructure is not known in Wales. Quantitative data on climate change related outages in data centres are not collected by the Data Centre Incident Reporting Network (DCIRN), which restricts visibility on sectoral preparedness across the United Kingdom, including Wales. There have been no publicly reported events of outages in data centres caused by extreme weather events thus far.

(b) Outcome 2: System level resilience

There are no suitable indicators to assess the progress on system level resilience, which means we are **unable to evaluate** progress for this outcome. There may be relevant adaptation measures being implemented for this outcome, but information is not publicly available.

- **Metrics are needed for measuring adaptation progress.** Indicators that would be useful include: level of redundancy in system design and operation for power supply, emergency generation, comms, cooling, extent of contingency plans for weather related outages and diversity of technologies (mobile, copper lines, digital, satellite).

(c) Outcome 3: Interdependencies identified and managed

Data on interdependency risks were not available, therefore we are **unable to evaluate** progress.

There is no systematic assessment of interdependency risks at the operator level or set of plans to manage interdependencies.

- **There is a lack of data to evaluate progress in this outcome.** Adaptation Reporting Power third round (ARP3) reports do demonstrate an awareness of interdependencies at an overall sector level, with Tech UK and the Electronic Communications Resilience and Response Group (ECRRG) identifying their main sources of interdependency risk as reliance on power supply; transport networks; and “pinch points” such as bridges that carry multiple utilities. However, there is no systematic assessment of interdependency risks at the operator level or set of plans to manage those risks.

(d) Progress on enablers

Key enablers to deliver well-adapted telecoms and ICT services are largely contingent upon the relationship between UK and Welsh governments.

- **Governance.** There is an established sharing of information between Welsh Government policy leads and UK Department for Science, Innovation and Technology on telecoms and ICT matters and event responses. However, Ofcom has no statutory remit for climate resilience.
- **Data.** Welsh Government have conducted a scenario exercise to understand a loss of power and impacts across networks. However, more data on weather and climate-related impacts on telecoms and ICT infrastructure is needed, as well as better data on steps being taken to improve resilience.

3. Policy and planning progress

We have provided an assessment of policies and plans in this area, but not formally scored them as regulation of telecommunications and ICT is reserved to UK Government. Where there are policies or plans within the Welsh Government's control, we have highlighted these potential opportunities for consideration of climate risks.

Most key policy milestones required across the UK to ensure telecoms and ICT networks are resilient to extreme weather are not yet in place. Policies and plans for this system are assessed together as the key policy milestones are largely the same across the three outcomes.

(a) Legislation and regulation

Welsh scope.

A number of planning policies are in place regarding development of telecommunications infrastructure, but they currently do not fully consider climate risks.

- **A number of planning policies are in place regarding development of telecommunications infrastructure, but they currently do not fully consider climate risks.** The National Development Framework for Wales recognises the importance of reliable digital infrastructure.⁴ While climate resilience is included as a key objective for the strategy, it is not specifically addressed with regards to digital infrastructure development. Technical Advice Note 19 (TAN19) for 'telecommunications' is in place since 2002. The environmental considerations listed do not include climate risks. The purpose of TAN 19 is expected to be reviewed in light of the new Code of Best Practice on Mobile Phone Network development published in February 2021.⁵

UK-wide.

Ofcom does not have a statutory duty for climate resilience.

- **Ofcom does not have a statutory duty for climate resilience.** Ofcom has powers to take any measures in response to 'anything that compromises the availability, performance or functionality of the network or service'.⁶ However, climate change parameters are not explicitly stated.
- **Ofcom has powers under the Communications Act 2003 to investigate and fine operators that do not meet flood resilience standards,** though the level of expected flood resilience is unclear. There is no discussion of climate change or plausible changes in climate hazards that may lead to an increase in these incidents in future.

(b) Standards

UK-wide.

- **There is limited consideration of climate resilience in existing industry standards.** Even where standards exist, they can be unclear (e.g. Ofcom's flood resilience standards) or may be inadequate (e.g. design standards for cables).⁷
- **The UK Government has committed to new standards for resilience by 2030** under the new UK Resilience Framework.⁸ This presents an opportunity to

ensure that the telecoms and ICT system is resilient to future climate conditions.

(c) Planning

Welsh scope.

There is a Digital Strategy for Wales that includes a mission for fast and reliable digital infrastructure.

- **There is a Digital Strategy for Wales that includes a mission for fast and reliable digital infrastructure.⁹** However the actions here do not currently consider the need for climate adaptation. As delivery plans are developed, include an action to assess climate risk to current and planned infrastructure.
- **Each of the four Local Resilience Forums consider risks to telecoms infrastructure in their community risk registers.¹⁰** Central Welsh Government teams support local resilience forums with consideration of telecom risks in community risk registers, see Chapter 12 (Community preparedness and response) for more information on community risk registers. Currently it is mainly technology driven but this could be widened to include climate-related impacts.

UK-wide.

- **There remains no visible plan or process by the industry or UK Government with actions to manage long-term climate risks to the sector.** Resilience planning in the data centre sector is conducted at corporate level by individual private operators, who compete on their ability to ensure business continuity for their customers. At present, there is not enough information presented in adaptation reports for this sector to understand its preparedness for climate change.¹¹

(d) Information and reporting

UK-wide.

- **Participation in the Adaptation Reporting Power is voluntary, and the information reported in the most recent round does not provide sufficient detail.** More detail is required on the extent of climate risk and progress in adaptation plans at the operator level.
- **There is limited information to understand climate resilience across the telecoms and ICT sector.** Tech UK and the Electronic Communications Resilience & Response Group (EC-RRG) reported on their climate risks and adaptation plans in the third round of the ARP.¹² However, there is not enough information to understand the sector's climate change preparedness across Wales, and the UK. It is important for representatives from the Welsh Government to be represented within the Electronic Communications Resilience and Response Group (EC-RRG).

(e) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for telecoms and ICT networks (Table 7.2). Primary responsibilities are assigned to ministerial portfolios, unless stated otherwise.

Table 7.2

Recommendations

| Primary responsibility | Recommendation | Timing |
|------------------------|--|--------|
| Climate Change | Ensure that the next adaptation programme includes consideration of telecoms and ICT networks within its infrastructure objectives. | 2024 |
| Climate Change | Conduct research to identify telecoms and ICT infrastructure assets at risk from extreme weather and understand adaptation progress. | 2024 |
| Climate Change | Engage with UK Government to ensure that Ofcom is given a climate resilience remit across the UK, including all devolved administrations. | 2024 |
| Economy | In coordination with DSIT, advocate to set minimum resilience standards for operators in Wales to streamline the adaptation objectives in highly privatised sectors. | 2025 |
| Economy | Integrate adaptation into the delivery of the Digital Strategy for Wales. | 2024 |

Endnotes

¹ Jaroszweski, D., Wood, R., and Chapman, L. (2021) *Infrastructure*. In: *The Third UK Climate Change Risk Assessment Technical Report*. [Betts, R.A., Haward, A.B., Pearson, K.V. (eds)] Prepared for the Climate Change Committee, London.

² *The Electronic Communications Code*, Communications Act 2003, Schedule 3(a).

³ Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*, <https://www.gov.wales/prosperity-all-climate-conscious-wales>.

⁴ Welsh Government (2021) *Future Wales: the national plan 2040*, <https://www.gov.wales/future-wales-national-plan-2040>.

⁵ Welsh Government (2022) *National Infrastructure Commission for Wales report on digital infrastructure: Welsh Government response*, <https://www.gov.wales/sites/default/files/publications/2022-09/national-infrastructure-commission-for-wales-report-on-digital-infrastructure-welsh-government-response.pdf>.

⁶ Telecommunications (Security) Act 2021, s 105A(2)(a).

⁷ Climate Change Committee (2023) *Progress in adapting to climate change - 2023 Report to Parliament*, <https://www.theccc.org.uk/publication/progress-in-adapting-to-climate-change-2023-report-to-parliament/>.

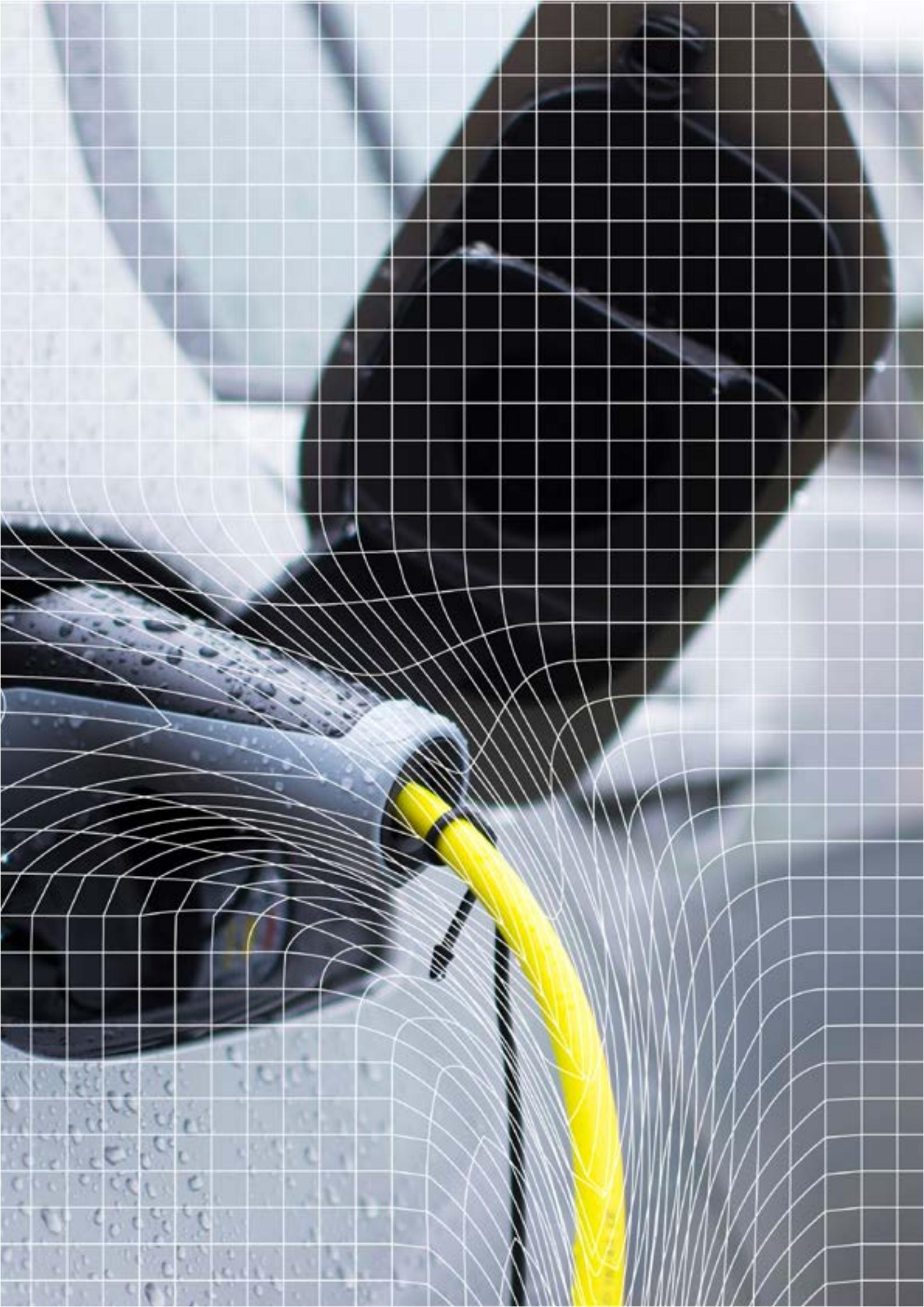
⁸ UK Government (2022) *The UK Government Resilience Framework*, <https://www.gov.uk/government/publications/the-uk-government-resilience-framework/the-uk-government-resilience-framework-html>.

⁹ Welsh Government (2021) *Digital Strategy for Wales*, <https://www.gov.wales/digital-strategy-wales-html>.

¹⁰ Welsh Government (2023) *Wales Resilience Forum*, <https://www.gov.wales/wales-resilience/what-we-do>.

¹¹ CCC (2023) *Progress in adapting to climate change - 2023 Report to Parliament*, <https://www.theccc.org.uk/publication/progress-in-adapting-to-climate-change-2023-report-to-parliament/>.

¹² CCC (2023) *Understanding climate risks to UK infrastructure, Evaluation of the third round of Adaptation Reporting Power*, <https://www.theccc.org.uk/wp-content/uploads/2022/07/Understanding-climate-risks-to-UK-infrastructure-Evaluation-of-the-third-round-of-the-Adaptation-Reporting-Power.pdf>.



Chapter 8

Transport

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Introduction

Table 8.1

Progress summary – Transport

| | Delivery and implementation | Policies and plans | Summary |
|--|-----------------------------|---------------------------------|---|
| Outcome 1: Asset and system level reliability of rail network | Mixed progress | Credible policies and plans | <ul style="list-style-type: none"> Weather events are causing increasing delays across the rail network in Wales. The majority of Core Valley Lines track is in 'good condition' but remains at risk of flooding. Additional indicators are needed for a more robust assessment. Standards and guidance reflect climate resilience requirements and operators have developed robust climate adaptation plans. |
| Outcome 2: Asset and system level reliability of strategic road network | Insufficient progress | Limited policies and plans | <ul style="list-style-type: none"> In 2021-22, 7.3% of the motorway network and 2.5% of the trunk road network required immediate close monitoring, whilst only 40% of critical road structures, such as bridges, are in good or very good condition. Additional indicators are needed for a more robust assessment. Key transport policy strategies include high-level commitments to climate adaptation, but regulatory targets for climate resilience and adaptation measures are not set. |
| Outcome 3: Asset and system level reliability of local roads | Unable to evaluate | Insufficient policies and plans | <ul style="list-style-type: none"> Local road network condition data are not available after 2018/19 to assess progress. Additional indicators are needed for a more robust assessment. There is a lack of credible plans for local roads. |
| Outcome 4: Asset and system level reliability of airport operations | Unable to evaluate | Credible policies and plans | <ul style="list-style-type: none"> Unable to evaluate progress on delivery and implementation due to a lack of indicators. Cardiff Airport has an adaptation plan in place and has commitments to future adaptation actions. |
| Outcome 5: Asset and system level reliability of port operations | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> Unable to evaluate progress on delivery and implementation due to a lack of indicators. Most port policy for adaptation is reserved. In the CCC's UK adaptation progress report (2023), this outcome was 'limited policies and plans'. |
| Outcome 6: Interdependencies identified and managed | Insufficient progress | Insufficient policies and plans | <ul style="list-style-type: none"> Evidence demonstrates improved identification of interdependencies for rail and airports in Wales, but interdependencies are not being consistently addressed in sufficient detail. There is a lack of information for other transport modes. |

Relevant risks from CCRA3: Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures (I1); risks to infrastructure services from river, surface water and groundwater flooding (I2); risks to infrastructure services from coastal flooding and erosion (I3); risks to bridges and pipelines from flooding and erosion (I4); risks to transport networks from slope and embankment failure (I5); risks to subterranean and surface infrastructure from subsidence (I7); risks to transport from high and low temperatures, high winds and lightning (I12).

This chapter covers adaptation to climate change for transport networks in Wales. This includes infrastructure networks for strategic and local roads, rail, ports, and airports. Functioning transport networks are necessary for personal mobility and public services, as well as business supply chains. Weather-related disruption to transport systems can cause significant cascading impacts across society with substantial financial impacts (Box 8.1). Weather conditions can also lead to the safety of transport system users being compromised.

Transportation systems will be affected by a range of climate changes:

- Changes in rainfall intensity and frequency can lead to flooding and earthworks failures across road and rail networks.
- More frequent and intense periods of extreme heat events can cause damage and disruption to all transportation systems. For example, risks of rail buckling and failure of overhead power lines on the railways, and risks of asphalt melting impacting the road network and airports.
- Long-term sea level rise and increased storm surges can affect port operations and damage or disrupt other coastal transport infrastructure.

Exposure of transport networks to these climate hazards is influenced by the age, condition, usage levels, and location of infrastructure. Those networks with more traffic volumes and areas or services supported will be more exposed. The changes in the Welsh population and the expected demands for transportation services (for example vehicle-kilometres per person) will influence the vulnerability of transport networks to climate risks.

Box 8.1

Changes to the climate in Wales affecting transport

Flooding:

- Results from CCRA3 indicate that all rail track assets in Wales will face increased exposure to surface water risk.
- The latest Weather Resilience and Climate Change Adaptation plan for Network Rail's Wales Route reported that flooding was the most significant weather-related cause of delay between 2006/07 and 2018/19, costing a total of £5 million in Schedule 8 payments with an annual average cost of £0.38 million and recording a maximum of £0.68 million.

Heat:

- The number of days per year over 26°C – which currently poses a risk to transport networks – will increase by around seven times under a 4°C scenario.

Source: Jaroszewska, D., Wood, R., and Chapman, L. (2021) *Infrastructure*. In: *The Third UK Climate Change Risk Assessment Technical Report*. [Betts, R.A., Haward, A.B., Pearson, K.V. (eds)] Prepared for the Climate Change Committee, London; Arnell, N.W., Freeman, A., Kay, A.L., Rudd, A.C. and Lowe, J.A. (2021) *Indicators of climate risk in the UK at different levels of warming*. Environmental Research Communications, 3(9), p.095005; Sayers, P.B., Horritt, M., Carr, S., Kay, A., Mauz, J., Lamb R, and Penning-Rowsell E (2020) *Third UK Climate Change Risk Assessment (CCRA3): Future flood risk*. Research undertaken by Sayers and Partners for the Committee on Climate Change. Published by Committee on Climate Change, London; Network Rail (2019) *Route CP6 Weather Resilience and Climate Change Adaptation Plan*.

A number of organisations are responsible for adaptation policy across the Welsh transport system.

- **Rail.** Transport for Wales is responsible for maintaining the rail track that forms part of the Core Valley Lines, running from Cardiff to Aberdare, Merthyr Tydfil, Treherbert, Rhymney and Coryton, as well as lines running to Barry Island, Cardiff Bay, and Bridgend.¹ Network Rail is responsible for maintaining the remainder of rail track in Wales, around 923 miles across Wales and border counties of England.² Infrastructure planning and the funding of Network Rail in Wales remains reserved, unlike in Scotland where this aspect is devolved.³
- **Strategic road network.** The Welsh Government is responsible for maintaining the strategic road network. North and Mid Wales Trunk Road Agent (NMWTRA) is responsible for managing, maintaining and improving the strategic road network in North and Mid Wales on behalf of the Welsh Government. South Wales Trunk Road Agent (SWTRA) is responsible for managing, maintaining and improving the strategic road network in South Wales on behalf of the Welsh Government.
- **Local roads.** Local authorities are responsible for maintaining the local road network.
- **Airports.** Cardiff Airport is a wholly owned subsidiary of the Welsh Government and is the sole major commercial passenger airport in Wales. The Civil Aviation Authority (CAA) regulates all UK airports and monitors how the industry is adapting to climate change.
- **Ports.** Maritime Ports and strategic marine transport matters are predominantly reserved matters.⁴ Ports are largely privately owned and operated. Ports policy is devolved. However, management of ports is carried out under the Harbours Act 1964 in Great Britain.⁵ The one exception is reserved trust ports in Wales (Milford Haven is the only one of these) for which the UK government retains responsibility. Ports around the UK are managed by Statutory Harbour Authorities (SHAs) who are the local legal entities with powers to manage a harbour area.

Any unmitigated extreme weather risk has the potential to result in far reaching consequences in the transport system.

Infrastructure services are increasingly linked and dependent upon one another, for example, where the rail and road network are dependent on the electricity system (for signalling and increasingly as an energy source) and the telecommunications system (also for signalling). This means that any unmitigated extreme weather risk has the potential to result in far reaching consequences in the transport system.

Coverage of adaptation for transport within Prosperity for All: A Climate Conscious Wales (PfACCW) focused on building the knowledge base (Box 8.2).

Box 8.2

Transport within Prosperity for All: A Climate Conscious Wales

Objective: Improve understanding of the risks from climate change to transport infrastructure in Wales.

- The Welsh Government to ensure Wales is comprehensively catered for within research undertaken for transport to enable the development of appropriate support.

- Work with Highways England in setting new standards on climate change for road transport.
- Review of transport sector case studies to share best practice in adapting to transport related climate change risks in Wales.

Indicators from Monitoring and Evaluation framework:

- Qualitative study of impacts from new road standards.
- Review of case studies and approach to sharing best practice on transport related climate risks.

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for All: A Climate Conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress towards well-adapted transport networks

Within the transport sector, successful adaptation aims to ensure reliable Net Zero transport systems, despite climate change (Figure 8.1).

Net Zero transport systems need to be resilient to climate and weather impacts at asset and system level.

The key adaptation outcomes that need to be achieved for transport networks to deliver this aim are:

- **Asset and system level reliability of rail network.** Minimising the impact of severe weather on rail assets and consequently on rail services. Tracks need to be protected from flooding and able to withstand higher future temperatures (as well as remaining resilient to cold weather). Overhead lines, signalling, bridges and earthworks need to be maintained and protected from flooding, storm damage and heat impacts.
- **Asset and system level reliability of the strategic road network.** Motorways and major roads need to be designed and maintained to withstand increased precipitation and higher risk of flooding. Earthworks and geotechnical assets need to be resilient to temperature changes, including deformation and expansion of concrete and changes to ground shrinkage and earth pressures affecting dependent assets such as structures and drainage.
- **Asset and system level reliability of local roads.** Local authority managed roads face similar pressures to strategic roads and account for a significant proportion of the road network and of all traffic. B and C roads and minor surface roads made up 87% of Wales's road network in 2021-22.⁶
- **Asset and system level reliability of airport operations.** The impacts of climate change on UK aviation are expected to be the least significant of all transport modes. However, impacts will still be felt and airport infrastructure, including asphalt and equipment, needs to be resilient to higher temperatures, be protected from flooding and be designed and operated to be resilient to storms and high winds. Reliance on energy and telecommunications, as well as other transport modes, put airports at increasing risk of cascading failures across infrastructure systems.
- **Asset and system level reliability of port operations.** Harbour infrastructure also needs to be resilient to flooding and physical damage. Supporting road and rail networks, crucial to port operations, need to be resilient to a different set of hazards as set out above. Sea level is expected to rise by between 22-28 cm by the 2050s and 43-76 cm by the 2080s, using scenarios for Cardiff compared to a 1981-2000 baseline, depending on global efforts to reduce greenhouse gas emissions.⁷
- **Interdependencies identified and managed.** All transport modes rely on energy, telecommunications and ICT infrastructure to varying degrees. All infrastructure operators need to carry out detailed assessments of their sources of interdependency risks and work across sectors to manage those risks.

All transport infrastructure operators need to identify and manage their risks arising from dependence on other sectors, such as energy, telecommunications and ICT infrastructure.

There are several categories of enabling factors that will be needed if the outcomes identified above are to be implemented at appropriate scales. These include:

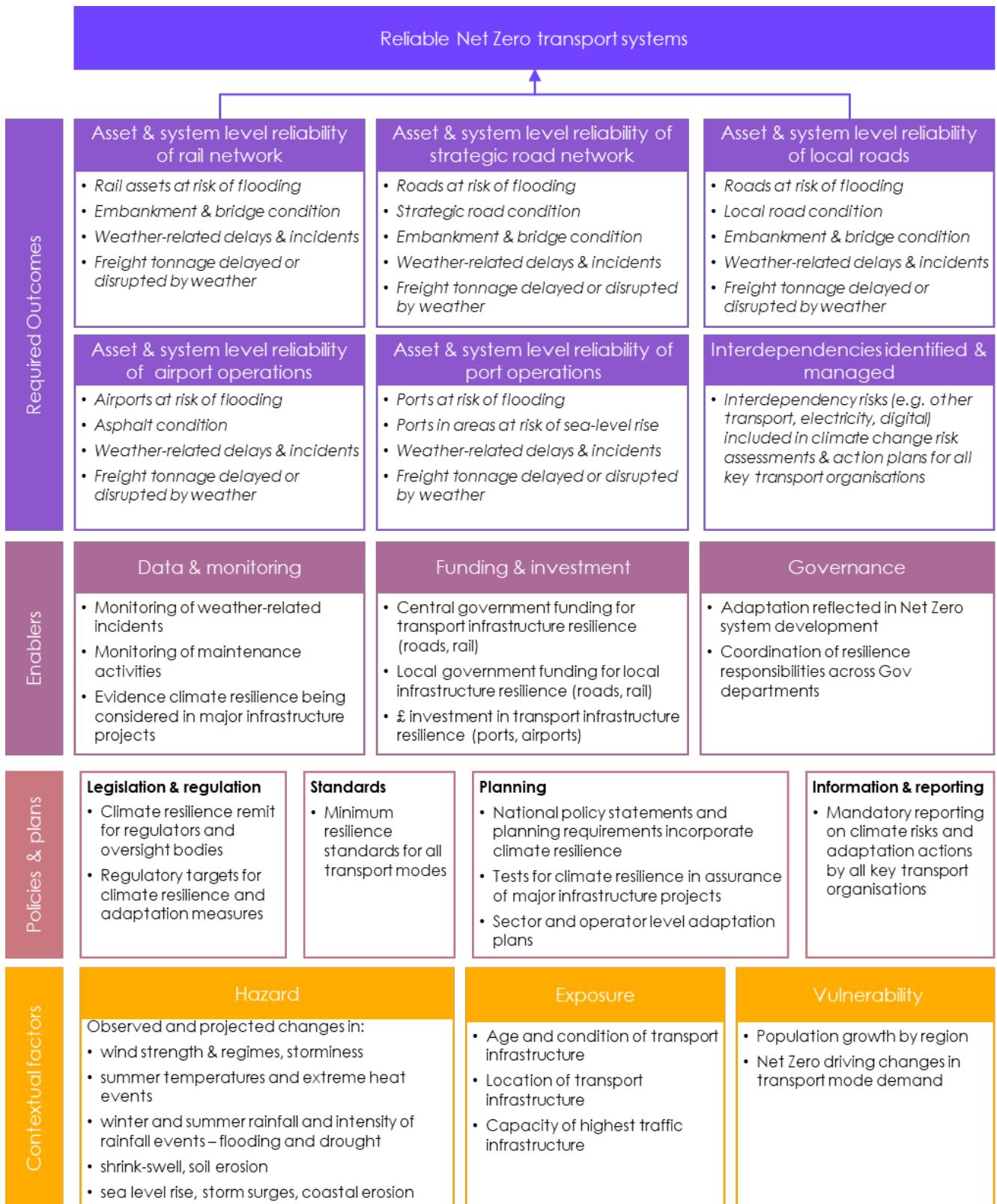
- **Data and monitoring.** Effective monitoring of weather-related incidents and maintenance activities will improve understanding of the impacts of climate change on transport infrastructure and the actions being taken to manage them.
- **Funding and investment.** Delivering the outcomes identified above will require appropriately sized investment that is well-targeted. Sources of investment in the transport system vary across transport modes, including Central and Local Government funding, user charges and private investment. Regulation can facilitate the investment that is needed to ensure the whole transport system is resilient.
- **Governance.** There is a range of organisations that have responsibility for key aspects related to the climate resilience of the transport system and other interdependent infrastructure systems. System development required to deliver Net Zero makes it even more important that resilience remits are well-defined and there is appropriate co-ordination to ensure that the identified outcomes can be delivered, particularly around interdependencies.

There are a range of organisations that have responsibility for key aspects related to the climate resilience of the transport system.

Our monitoring framework highlights policy mechanisms which must be in place to achieve these required outcomes for a well-adapted transport system (Figure 8.1). These fall under the following categories:

- **Legislation and regulation.** National policy must create legislation which enforces sustainable long-term plans for resilient transport networks and provide appropriate frameworks for regulation. Planning must span across regions to ensure suitable national scale planning. Legislation should ensure that funding allocation and investment is appropriate to meet adaptation goals.
- **Standards.** Well-adapted transport networks will require policy to deliver and extend resilience standards, which deliver a transport system compatible with future climate conditions.
- **Planning.** National policy and consenting processes for new major infrastructure should incentivise adaptation actions by transport network operators. All key transport operators need robust climate change risk assessments and adaptation plans, which integrate adaptation into long-term planning and investment decisions.
- **Information and reporting.** Reporting on some aspects of risk and adaptation planning and delivery should be mandatory. This would improve understanding of the national picture of adaptation in transport networks, as well as in other sectors upon which the transport system relies, including energy and telecoms and ICT.

Figure 8.1 Monitoring map for transport



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Asset and system level reliability of rail network

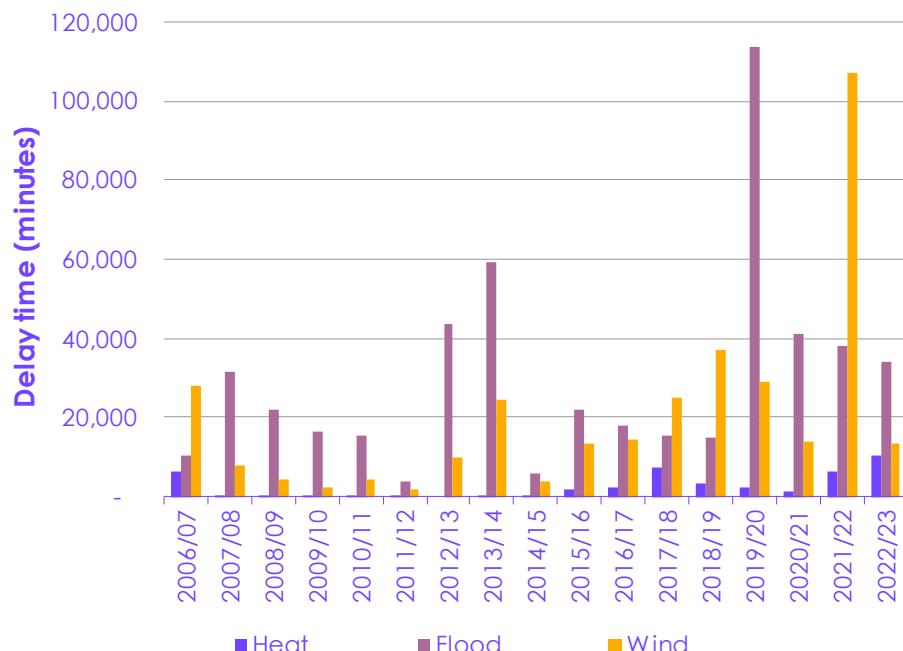
Available indicators for this outcome show **mixed progress** in reducing vulnerability and exposure of the Welsh rail network to climate change.

- **The majority of Core Valley Lines track is in 'good'* condition, but there is a lack of data for remaining rail track in Wales.** Tracks need to be protected from flooding and able to withstand the higher temperatures. 55% of the Core Valley Lines (CVL) track had a residual track life of over 15 years.⁸ CVL rail track condition is monitored on an ongoing and yearly basis across a number of aspects including residual track life. Rail track condition is assessed in 220-yard sections (or the actual track length where it is less than 220 yards).⁹
- **A notable portion of the rail network is at risk of flooding in Wales.** 34% of the rail network was at risk of flooding in 2021.¹⁰ Projections indicate that the railway length in Wales at significant flood risk would increase by 53% by the 2050s under a 2°C global warming scenario with current levels of adaptation.¹¹ The Core Valley Lines network is exposed to flood risks from multiple sources, including an elevated risk of riverine flooding. As urbanisation has increased, the network's vulnerability to surface water has increased due to a reduction in free-draining ground.¹²
- **Weather events are causing increasing delays across the rail network in Wales.** The period 2018/19 to 2022/23 saw total delay time due to heat, flood and wind of 467,320 minutes. This is 278% greater than compared to the period 2008/09 to 2012/13.¹³ Total delay time due to flooding has been decreasing after a spike in 2019/20 (Figure 8.2).¹⁴ Average delays due to heat over the 5-year period from 2018/19 to 2022/23 in Wales have increased by over 3,000% compared to 2008/09 to 2012/13.
 - Specifically for the CVL network, between 2020 and 2022, severe weather caused 253 hours of delays. Heat was the leading cause of service disruption in 2022/23.¹⁵
- **Additional indicators would enable better progress monitoring against this outcome, such as rail embankment condition and bridge scour data.**

Weather events are causing increasing delays across the rail network in Wales.

* TfW consider 'good' to be a residual track life of 15+ years.

Figure 8.2 Total delay time per type of weather-related incident in Wales



Source: Network Rail (unpublished).

(b) Outcome 2: Asset and system level reliability of strategic road network

Indicators for this outcome show **insufficient progress**.

A low proportion of critical road structures, such as bridges, are in good or very good condition.

- **A low proportion of critical road structures, such as bridges, are in good or very good condition.** Only 40% of the critical* elements of structures (based on monetary value) of the Welsh strategic road network are in either 'good' or 'very good' condition in 2021.^{t,16} There is no earlier data to assess progress. Assets need to be resilient to temperature changes, including deformation and expansion of concrete and changes to ground shrinkage and earth pressures affecting dependent assets such as structures and drainage.
- **Sections of major roads require immediate close monitoring.** Roads in better condition should be better able to withstand extreme weather impacts. In 2021-22, 7.3% of the motorway network and 2.5% of the trunk road network required immediate close monitoring, slightly higher than in 2020-21 (Figure 8.3).¹⁷ As of the end of March 2022, results from Deflectograph surveys suggest that the majority of the network was considered to be in good condition and it is estimated that 77% of the motorway and 85% of trunk roads will not be in need of close monitoring for

* 'Critical' are those elements of the structure which have a very high (or critical) importance classification for the particular asset type (e.g. for a bridge this would include the bridge deck). Structures include bridges, retaining walls and culverts.

^t 'Very good' means that asset critical elements have insignificant defects/damage and capacity unaffected. 'Good' means that asset critical elements have minor defects/damage and capacity unlikely to be affected.

at least 20 years.*¹⁸ However, there is no clear KPI set for road condition for Wales.

- **19% of the strategic road network is at risk of flooding.**¹⁹ CCRA3 projections indicate that the length of major roads in Wales at significant flood risk would increase by 54% by the 2050s under a 2°C average global warming scenario, with low population growth and current levels of adaptation.²⁰ Under the same scenario for surface water and fluvial flooding, the estimated increases are 65% and 44%. For coastal flooding, the estimated increase is 27%.

Figure 8.3 Percentage of motorway and trunk roads in Wales requiring close monitoring



Source: Welsh Government (2022) Road lengths and conditions: April 2021 to March 2022.

(c) Outcome 3: Asset and system level reliability of local roads

Indicators for this outcome are limited and we are **unable to evaluate** progress in reducing vulnerability and exposure of local roads to climate change. There is a lack of up-to-date information on local road conditions to assess progress.

There is a lack of recent condition data for the local road network.

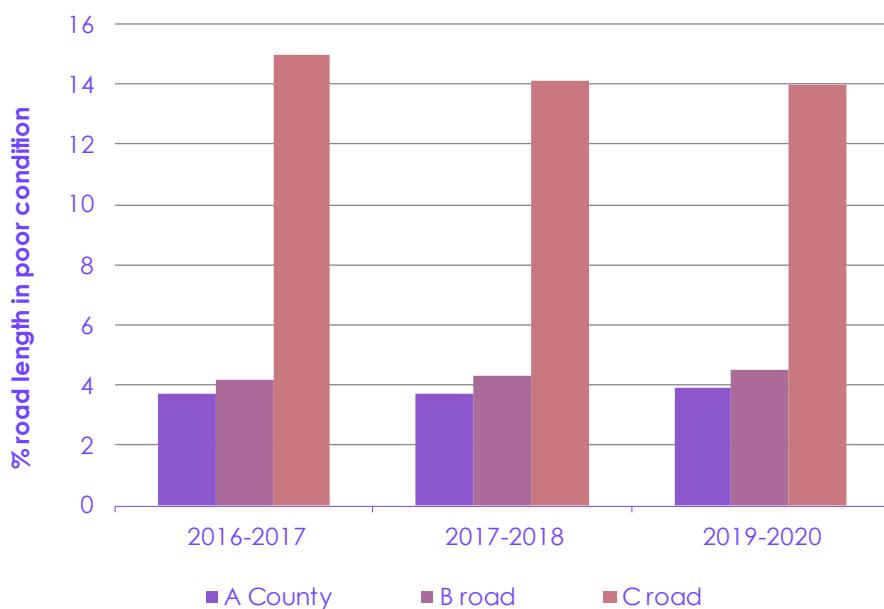
- **Local road network condition data was last made available in 2018/19, so we are unable to assess progress.** Roads in better condition should be better able to withstand extreme weather impacts. The survey to gather information from local authorities on local road network conditions ceased due to the COVID-19 pandemic. At that time, the proportion of local authority A roads in poor condition was 3.9%, B roads was 4.5% and C roads was 14.0%. The level was in line with the previous two years of data (Figure 8.4). The Vale of Glamorgan, Carmarthenshire and Neath Port Talbot had

* The structural condition of a section of road needs close monitoring when it has a negative residual life.

the highest proportion of A country road in poor condition in 2018/19. The collection of local authority road condition should be resumed.

- **37% of the local road network across Wales is at risk of flooding from rivers, sea, surface water and small watercourses.**²¹
- **Additional indicators are needed, to better monitor progress against this outcome.** These include updated local road conditions, embankment and bridge condition, weather-related delays and incidents and freight tonnage delayed or disrupted by weather incidents.

Figure 8.4 Proportion of local road network in Wales in poor condition



Source: StatsWales (2019) Percentage of local authority road network in poor condition by road type and year.

(d) Outcome 4: Asset and system level reliability of airport operations

A lack of available indicator information means that we are **unable to evaluate** progress for this outcome. Cardiff Airport is a wholly owned subsidiary of the Welsh Government, operated at an arm's length as a private limited company. It operates in an independent and commercial manner.

Additional indicators are needed to measure progress on airport climate resilience.

- **A comprehensive climate risk assessment has been conducted to assess the likelihood, severity and residual risk to Cardiff Airport for a range of climate risks.** However, there is a lack of data that covers current impacts to airport operations, although survey information gathered for the Adaptation Reporting Power third round (ARP3) submission notes that staff identified impacts on airport operations due to snow/extreme cold temperatures, heavy rain/flooding, extreme heat and strong winds.²²
- **Most airport operations are privately managed and major policy levers are reserved to Department for Transport and the Civil Aviation Authority.**

- **Additional indicators would enable better progress monitoring against this outcome.** Useful indicators could include quantified flood risks, asphalt condition, weather-related delays and incidents and freight tonnage disrupted by weather.

(e) Outcome 5: Asset and system level reliability of port operations

A lack of available indicator information means that we are **unable to evaluate** progress for this outcome.

There is a lack of available information to assess ports' progress in adaptation to climate change.

- **There is a lack of available information to assess ports' progress in adaptation to climate change.** Some limited and out-of-date information is available for Milford Haven port from past Adaptation Reporting Power reports.
- **Additional indicators would enable better progress monitoring against this outcome.** Useful indicators could include ports at risk of flooding, ports in areas at risk of sea level rise of more than 50 cm, weather related delays and incidents and freight tonnage disrupted by weather.

(f) Outcome 6: Interdependencies identified and managed

Indicators for this outcome show **insufficient progress** across transport modes.

Some transport operators are making progress on interdependencies, but information remains limited.

- **Rail.** Transport for Wales's (TfW) climate resilience plan considers risks to infrastructure networks from cascading failures including power outages, equipment failure and cut-off of rural communities.²³ Network Rail has completed an interdependencies mapping exercise in its ARP3 report and reflected this in the detailed risk assessment. The report recognises that they have more to do to improve understanding of the scale and nature of interdependencies and to identify priorities and what actions to take to address the risks.
- **Strategic roads.** There are no data to assess this outcome for strategic roads.
- **Local roads.** There are no data to assess this outcome for local roads.
- **Airports.** Cardiff Airport have mapped their interacting risks by climate variable and by level of significance. But a quantification of these risks based on climate projections has not been conducted.
- **Ports.** There are no data to assess this outcome for ports. No harbour authorities with operations in Wales were invited to report under ARP3.

(g) Progress on enablers

To achieve these outcomes for well-adapted transport networks, multiple enabling factors must be in place.

- **Funding and investment.**
 - Limited data are available on the current scale of investment for resilient transport networks and the additional investment still needed.

Efforts are underway to align investment with climate-resilient transport systems, but there remain limited data on scale needed.

- Network Rail is now developing estimates of additional investment need for a climate-resilient rail network. Long-term adaptation pathways and investment strategies are expected to be developed for all regions in Great Britain by 2029.²⁴
- Transport programmes' investment decisions are supported by the Welsh Transport Appraisal Guidance (WelTAG), which is currently under consultation to be updated in light of a new transport strategy. There is a proposed requirement to show how the programme or project contributes to social, environmental, economic and cultural well-being in Wales using integrated well-being appraisal.
- The Roads Review examined the circumstances in which it will be appropriate for Welsh Government to invest in road schemes in future, taking into account the Wales Transport Strategy ambitions and priorities, the 2021 Programme for Government commitments and Net Zero Wales.²⁵ The Welsh Government response states that they will consider road investment under four circumstances, one of which is to adapt to the impacts of climate change.²⁶

- **Data and monitoring.**

- The Welsh Government has undertaken several projects to assess scour risks. They have participated in a focus group assisting the British Geological Survey (BGS) with a project to classify the susceptibility of infrastructure assets to river scour. They have applied the associated 'GeoScour' modelling to the trunk road network in Wales, to identify and assess sites with a high susceptibility to scour on the trunk road and motorway network which were then subject to further assessment by river geomorphologists.²⁷
 - Transport for Wales have installed several weather stations to better understand weather patterns across the network.²⁸
 - There is a monitoring framework in place for delivery of the Llwybr Newydd: The Wales Transport Strategy 2021, which includes climate resilience indicators.²⁹
- **Governance.** The National Infrastructure Commission for Wales is in place to provide recommendations to Welsh Government and hold them to account on delivery of infrastructure needs. The work programme is set by Welsh Ministers and includes work packages on flood resilience, existential climate risk and capacity building.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

(a) Outcome 1: Asset and system level reliability of rail network

There are **credible policies and plans** in place to ensure asset and system level reliability of rail network. Standards and guidance reflect climate resilience requirements and operators have developed robust climate adaptation plans.

Climate resilience is established as a key deliverable in Transport for Wales's remit from the Welsh Government.

- **Climate resilience is established as a key deliverable in Transport for Wales's remit from the Welsh Government.** TfW have developed a climate adaptation and resilience action plan in May 2023 that includes embedding the requirement for climate change risk assessments into all TfW major projects (such as North Wales Metro) and existing policies, and to develop a Climate Adaptation and Resilience Delivery Plan for the CVL network, including drainage and earthworks.³⁰ It is too early to tell the effective delivery of this plan.
- **Network Rail have a range of standards, minimum requirements and guidance, including on environment, drainage and weather management:**
 - **Environment and Social Minimum Requirements.**^{*} It is mandatory for all construction and design works carried out by Network Rail and its contractors to carry out a weather resilience and climate change risk assessment.
 - **Drainage Standard.**[†] Requires designs to include climate change uplifts in their design life and consider vulnerability of the assets. The uplifts used are in line with Defra recommendations at the time and will be revised as part of drainage and water management strategies.
 - **Design For Reliability Standard.**[‡] Includes a reference to consider future climate changes in product development and design, accounting for expected climate changes during the product's operational lifespan.
 - **Operations weather management standards and processes.** Reviewed on a rolling basis and in response to serious events, with KPIs developed for managing seasonality.
- **Network Rail has a specific climate change adaptation plan that covers the Wales route.** Route Weather Resilience and Climate Change Adaptation (WRCCA) plans for the Wales route contain actions which prepare for a range of climate hazards including flooding, landslips and wind.³¹ Adaptation pathways are being developed for the five Network Rail regions by the end of Control Period 7 (2029), which will include detailed plans for the entire network, highlighting areas with the highest level of risk

* ESR standard (NR/L2/ENV/015).

† NR/L2/CIV/005/09 Module 9 - Drainage design.

‡ NR/L2/RSE/0005.

or a need for transformational change. Network Rail has launched a new extreme weather resilience task force in response to the impacts of the summer 2022 heatwave on the rail network. Further examples include a wind-risk management scheme along the Wales route which completed a targeted removal of 20% of high-risk vegetation in 2020 with a 2024 target of 100%.³²

- **Network Rail has reported its climate change risk assessment and progress in adaptation plans in all three rounds of the adaptation reporting power (ARP).** In ARP3, the report includes a detailed risk assessment over appropriate timescales (present day, 2050s and 2080s) based on a medium-high emissions scenario under UKCP18. This is accompanied by an adaptation action plan, though actions are not mapped to specific risks. TfW were not requested to report under ARP3.
- **The Office of Rail and Road does not have a legislative remit for climate resilience.** There is no reference to resilience or climate change in the duties of the ORR for the regulation of the rail network. Duties are typically defined around economic regulation, performance, efficiency, safety and maintenance. However, performance measures for Network Rail include measures related to climate resilience.
- **The Infrastructure and Projects Authority (IPA) has added tests for climate resilience for major infrastructure projects.** The IPA's assurance processes for infrastructure projects on the Government's Major Projects Portfolio now include specific tests for climate resilience.

(b) Outcome 2: Asset and system level reliability of strategic road network

There are **limited policies and plans** in place to ensure asset and system level reliability of the strategic road network.

High-level road policies include consideration of climate risk to roads, but currently lack specifics on actions.

- **Key road transport policy strategies include high-level commitments to climate adaptation, but regulatory targets for climate resilience and adaptation measures are not set.** The recent Roads Review establishes climate adaptation as one of only four possible cases for investment.³³ This is requiring all schemes to proactively demonstrate how they will reduce carbon emissions, support modal shift and adapt to the impacts of climate change if they are to be approved. The National Transport Strategy makes a commitment to 'adapt existing infrastructure to climate change by addressing issues such as flooding'.³⁴ The National Transport Delivery plan places an emphasis on responding to the climate and nature emergencies. It states a priority of managing and upgrading existing transport infrastructure, including to adapt it to a changing climate and to 'work with Natural Resources Wales to manage the impact of climate change on road infrastructure by improving surface water drainage, managing flood risks and ensuring that new developments do not create harmful surface water discharge'.³⁵
- **A climate plan that covers mitigation and adaptation for the strategic road network (SRN) is currently under early development, but it is too early to assess the effective incorporation of adaptation in this publication.** This will be developed along with an asset management strategy which will outline how the SRN will be operated and maintained in a safe, sustainable, secure and resilient way.

There are some promising upcoming actions to encourage biodiversity along the strategic road network.

- **There are some promising upcoming actions to encourage biodiversity along the strategic road network.** The Welsh Strategic Road Network Nature Recovery Action plan is upcoming and will develop the Llwybr Newydd: the Wales Transport Strategy commitment to maintain and enhance biodiversity and increase ecosystem resilience through transport operations and infrastructure projects, for example by encouraging nature-based solutions to manage flooding. The Strategic Road Network trunk road biodiversity plan is in place across their 3,000 ha soft estate.³⁶ A Green Corridors Initiative is in place to encourage more biodiversity to manage climate change on roads along the three routes that make up the Wales Way and routes into and around major towns and cities.³⁷
- **Highway standards and guidance reflect climate resilience requirements.** The Highway Standards which apply to the Welsh motorway and trunk road network are contained in the Design Manual for Roads and Bridges (DMRB) and reflect climate resilience requirements. Standard LA114 sets out the requirements for assessing and reporting the effects of climate on highways and requirements for environmental assessments in relation to vulnerability to climate change.³⁸ Standards for drainage require flood risk assessments which apply the latest climate change allowances in accordance with relevant national legislation requirements.^{39,40} The DMRB is a set of national standards applicable throughout the UK, produced by Highways England in conjunction with the governments of Wales, Scotland and Northern Ireland.
- **The Trunk Road Maintenance Manual contains a requirement for service providers to prepare an Adverse Weather Plan.** The day-to-day routine and cyclic maintenance work is carried out by the trunk road agents in accordance with the Trunk Road Maintenance Manual which ensures the network is maintained safely and meets legal obligations.⁴¹

(c) Outcome 3: Asset and system level reliability of local roads

There are **insufficient policies and plans** in place to ensure asset and system level reliability of local roads.

- **A Code of Practice asks authorities to take account of climate change, although it is unclear how widely this is adhered to.** The Code of Practice for Well-Managed Highway Infrastructure states that the effects of extreme weather events on highway infrastructure assets should be risk assessed and ways to mitigate the impacts of the highest risks identified.⁴² There is limited information to understand the extent to which this is being applied to the local road network.
- **57% of local authorities have incorporated adaptation into their climate action plans.** However, this is primarily confined to flood-related actions or initial work through Public Service Boards, which are responsible for resilience leadership.⁴³ Anecdotal evidence from a recent local authority engagement highlights how recent summer heatwaves in Denbighshire brought attention to the issue of road surfaces reaching melting point and becoming too hot for maintenance work.⁴⁴ See Chapter 12 (Community preparedness and response) for more information on local authority adaptation planning.

There is limited information to understand at a national scale how local authorities are adapting local roads to climate change.

(d) Outcome 4: Asset and system level reliability of airport operations

There are **credible policies and plans** in place to ensure asset and system level reliability of airport operations. Whilst airport policy is reserved, we have scored this outcome because Cardiff airport is owned by Welsh Government and is the only major airport in Wales.

- **Cardiff Airport has undertaken a number of measures to prepare for climate change.** Based on its recent ARP3 submission, it factors climate into long-term decisions, has an adaptation action register and a comprehensive risk management structure, and has conducted case study assessments to understand impacts of extreme weather events on airport operations.⁴⁵ Specific adaptation actions are also committed to, such as resurfacing of the runway and taxiways planned for completion by 2025, factoring in projected temperature increases to new fuelling projects and developing and implementing a surface water action plan.⁴⁶

(e) Outcome 5: Asset and system level reliability of port operations

We have provided an assessment for adaptation policies and plans for ports below, but not formally scored them. Policy for Freeports and reserve trust major ports is reserved to UK Government, and other policy relating to management of ports is carried out under the Harbours Act 1964 in Great Britain.⁴⁷

Resilience standards for ports are left to individual operators and there is limited information available on the extent of planning for climate change impacts.

- **Resilience standards for ports are left to individual operators.** Also, there is limited information available on the extent of planning for climate change impacts.
- **The major port of Milford Haven was not requested to report in the latest round of ARP3.** Maritime Ports and maritime transport are predominantly reserved matters. Milford Heaven is the only reserved Trust Port in Wales. The Committee has recommended since 2016 that reporting under the ARP should be mandatory, to ensure all key port operators are completing climate change risk assessments and adaptation plans. Five Welsh ports are included within British Ports Group submission to ARP3, but there is no breakdown of individual ports and the submission only partially represented a proportionate, risk-based approach to climate risk management and reporting.⁴⁸
- **Upcoming freeports planned for development in Wales should adhere to the Infrastructure and Projects Authority's climate resilience tests.** The Celtic Freeport in Milford Haven and Port Talbot and Anglesey Freeport on Ynys Môn have been chosen as Wales's first freeports.⁴⁹ Freeports are part of the Government's Major Projects Portfolio (GMPP).⁵⁰ The Infrastructure and Projects Authority (IPA) has added tests for climate resilience for major infrastructure projects. The IPA's assurance processes for infrastructure projects on the GMPP now includes specific tests for climate resilience. This includes requiring projects to demonstrate compliance with the Green Book Supplementary Guidance on climate change. Application of the tests is not yet being monitored by the IPA.
- **Harbour works and landside development is devolved to the Welsh Government.** Planning considerations are dealt with through the local authority which requires an environmental impact study. The delayed

revision to Technical Advice Note 15 regarding flood risk and development will also influence harbourside developments. See Chapter 9 (Towns and Cities) for further information on planning guidance.

- **Shoreline management plans are in place along the full coastline of Wales and encompass ports and harbour areas.** The plans outline key actions to manage the coast, consider other existing planning initiatives and legislative requirements and are intended to inform wider strategic planning. However, they are non-statutory, making it challenging to effectively monitor their implementation or ensure reliable funding. See Chapter 9 (Towns and Cities) for more information on shoreline management in Wales.

(f) Outcome 6: Interdependencies identified and managed

There are **insufficient policies and plans** in place to ensure interdependencies are managed.

- **Regulators in the transport sector and other infrastructure sectors have inconsistent climate remits.** Together with minimum climate resilience standards, consistent remits of regulators would enable more cross-sector collaboration on managing interdependency risks.
- **There are some groups in place that could facilitate identification, research and dialogue on management of interdependencies across Wales.** The National Infrastructure Commission for Wales (NICW) has a remit that covers adaptation. The NICW was created to inform the Welsh Government's approach to future policy decisions and advise on longer-term objectives for infrastructure as well as focus on responding to the challenge of adaptation to a changing climate.⁵¹ TfW has put forward a suggested action to facilitate the coordination of a cross-discipline Climate Change Adaptation Working Group for Welsh Infrastructure Owners to support the development of management for cascading failures.⁵²
- **ARP3 submissions cover very limited transport companies with operations in Wales.** For example, Network Rail identify and quantify climate risk interdependencies. See Chapter 1 for consideration of use of Welsh adaptation reporting powers.

There are some groups in place that could facilitate identification, research and dialogue on management of interdependencies across Wales.

(g) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for transport (Table 8.2). Primary responsibilities are assigned to ministerial portfolios, unless stated otherwise.

Table 8.2
Recommendations

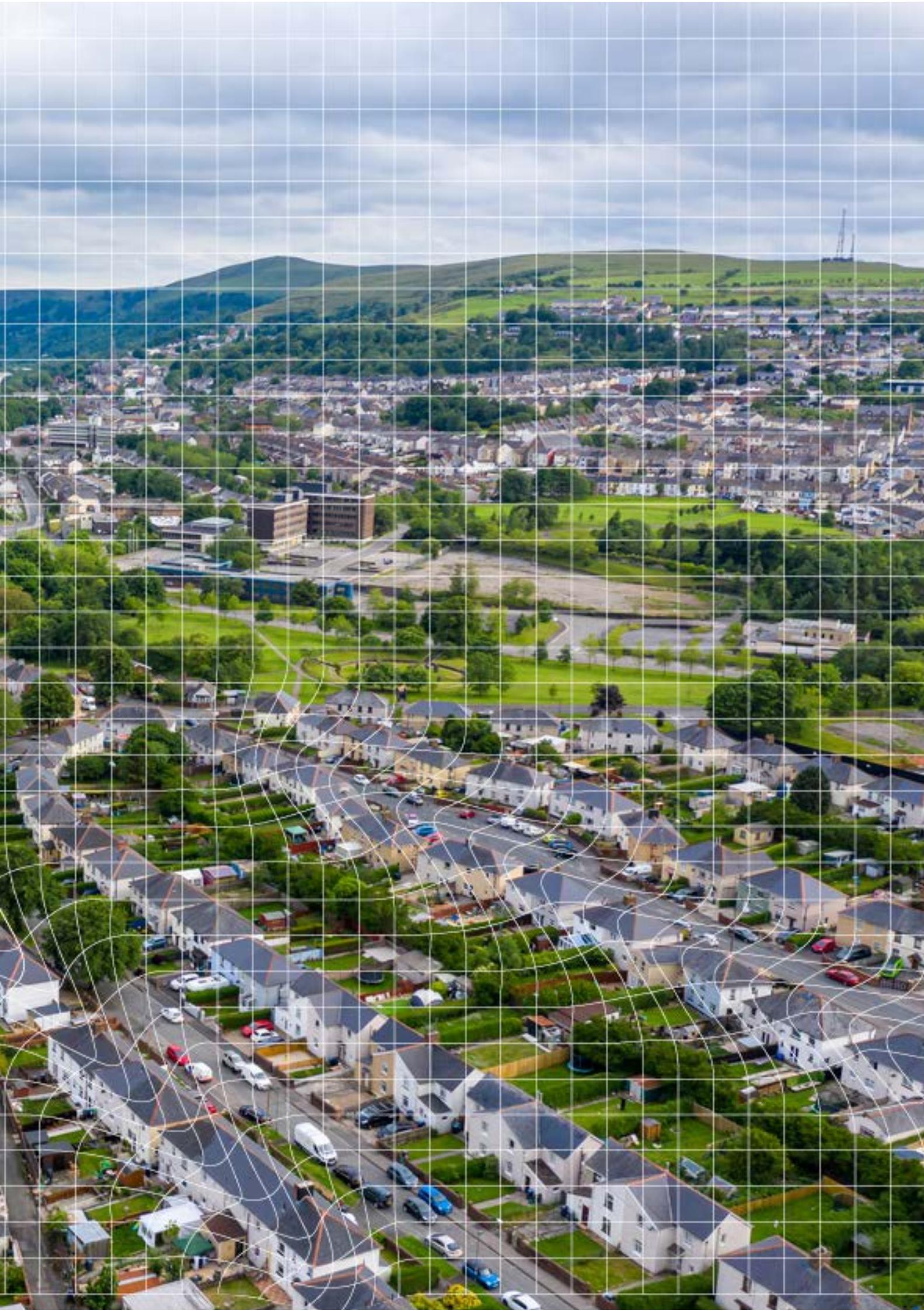
| Primary responsibility | Recommendation | Timing |
|------------------------|---|-------------|
| Climate Change | Road, rail, airport and port operators should conduct risk assessments that identify current and future climate change risks to services, based on UKCP18 projections, and create adaptation action plans that address the high-risk areas that are identified in the risk assessment. | Ongoing |
| Climate Change | Oversee that road, rail, airport and port operators conduct regular monitoring of existing infrastructure and improve maintenance practices. For new infrastructure, climate change adaptation and resilience should be embedded into planning standards and design to avoid costs of retrofitting in future. | Ongoing |
| Climate Change | Engage with UK Government to designate transport sector regulators with consistent remits for climate resilience. | 2030 latest |
| Climate Change | Require mandatory reporting of climate risks and adaptation progress by all key transport operators, including ports and airports. | 2025 |

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Chapter 9

Towns and cities

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Introduction

Table 9.1

Progress summary – Towns and cities

| | Delivery and implementation | Policies and plans | Summary |
|---|-----------------------------|---------------------------------|--|
| Outcome 1: Towns and cities are prepared for and resilient to river and coastal flooding | Mixed progress | Credible policies and plans | <ul style="list-style-type: none"> Flood risk management activities are being delivered in Wales, but evidence suggests that positive trends in delivery and maintenance are slowing down. Current flood risk management policy and funding represent significant progress in adaptation planning, although it is mostly too early to assess their impact. |
| Outcome 2: Towns and cities are prepared for and resilient to surface water and groundwater flooding | Unable to evaluate | Partial policies and plans | <ul style="list-style-type: none"> There are no indicators to assess adaptation in urban water and drainage management, including on sustainable drainage Systems. Policies to manage urban drainage are partially in place through Schedule 3 and improved regulation of water companies. Plans are not currently accompanied by sufficient guidance or monitoring. |
| Outcome 3: Long-term and sustainable coastal erosion management plans | Mixed progress | Partial policies and plans | <ul style="list-style-type: none"> Coastal change is being managed through actions in long-term plans and increased investment, but delivery is variable and there are monitoring data gaps. Plans for erosion management exist but are non-statutory and are not adaptation focused, with gaps in community engagement. |
| Outcome 4: Urban heat risks to towns and cities are managed | Unable to evaluate | Insufficient policies and plans | <ul style="list-style-type: none"> Trends in urban trees are reported but no other monitoring of the delivery of cooling measures, including green space and active cooling is available, resulting in insufficient evidence to evaluate. There are no overarching policies or plans for managing urban heat risk in national-scale policy, with initiatives currently fragmented. |
| Outcome 5: A planning system which prioritises future climate resilience | Insufficient progress | Insufficient policies and plans | <ul style="list-style-type: none"> New developments continue to be built in areas at risk of flooding, although data have not been collected in recent years. Data for monitoring climate-resilient planning overall are sparse. Climate resilience is not embedded nor sufficiently enforceable within existing planning policy in Wales. |

Relevant risks from CCRA3:

Risks to health and wellbeing from high temperatures (H1); Risks to people, communities and buildings from flooding (H3); Risks to coastal communities from sea level rise (H4); aspects of risks to infrastructure services from river, surface water and groundwater flooding (I2) and risks to infrastructure services from coastal flooding and erosion (I3) are also covered less explicitly in this chapter.

Around 2.8 million people in Wales lived in built-up areas in 2019, close to 90% of the country's population.¹ Approximately 350,000 of these people live in larger* cities.² Between 2011 and 2019, the population living in towns and cities grew by around 3.4% – faster than the overall population growth in Wales during the period (1.7%).^{2,3}

Towns and cities represent areas where there are more people, buildings, infrastructure, and businesses exposed to the risks from changes in the UK's climate over the coming decades (Box 9.1):

The risks of heatwaves and flooding are expected to increase in towns and cities in Wales in the future.

Over half of Wales's population lives in coastal areas, including in major cities, which are at risk of impacts of sea level rise.

- **Heatwaves.** Urban land surfaces, such as pavements and buildings, absorb and retain heat. Heat is also generated from traffic and buildings. This means that towns and cities are usually warmer – particularly at night – than surrounding rural areas and experience increased risk, and potential harmful impacts, of overheating during hot periods.
- **River and surface water flooding.** Increased flood risk is expected as high intensity rainfall events become more common, as predicted under future climate scenarios (Box 9.1). Additionally, even in the absence of flooding induced by climate change, there are more people and buildings at risk of flooding in towns and cities due to the development of land on floodplains and the use of more impermeable surfaces (e.g. roads and paving).
- **Sea level rise.** Sea level rise means that coastal towns and settlements are at higher risk of coastal flooding during storms or high tides. Over 60% of Wales's population lives in coastal areas. Many of the nation's major urban areas, including Cardiff, lie on the coast.⁴ The sea level around Cardiff is predicted to rise by up to 0.8 m under medium[†] emission scenarios by 2100.⁵ Coastal erosion rates are also expected to increase with sea level rise, as deeper water at the shoreline results in higher waves with more energy and more damaging storms.

Box 9.1

Future climate change and contextual factors in towns and cities in Wales

The present-day expected annual damages from flooding of residential properties in Wales are around £94.5 million. This is expected to increase by between 17- 49% by 2080 under a 2°C warming scenario, with current levels of adaptation.⁶ Evidence currently suggests that warming air will influence rainfall patterns and therefore flooding hazard intensity, particularly the intensity and timing of short-duration precipitation.

Wales has already seen significant damages from climate events. February 2020 was the wettest February on record in Wales, with storm events affecting 3,130 properties (of which 2,530 were households), resulting in around £81 million flood damages.⁷

Contextual factors may influence the level of risk and the most suitable adaptation in different towns and cities. The magnitude, frequency and sequencing of events may affect the response capacity, as observed in February 2020. Impacts may also be affected by interactions between climate risks, such as heavy rainfall combined with high tides, or waterlogged or drought-hardened ground.

Research for the Third Climate Change Risk Assessment (CCRA3) indicates that the number of residential properties at significant risk of surface water flooding in Wales will increase by 43% into the 2050s under a 2°C warming and high population scenario, with current levels of adaptation. Under a low population scenario, the increase in properties at risk is lower, at 20% for surface water and 9% fluvial. This is due to estimated decreases in the population living in areas prone to river flooding.⁸

* Those with populations greater than 225,000 people.

† 95th percentile at RCP 4.6.

As well as population change, demographic and socio-economic factors may influence the resilience of people and buildings in towns and cities. For example, the coastal population in Wales grew by 10% between 2001 and 2019, with people aged 65 years and over making up around 21% of the residents of coastal towns in 2019.² This implies increasing exposure to coastal climate hazards for a potentially vulnerable group.

Adaptation in towns and cities can be driven by devolved policies for spatial planning, health and flood risk management.

Spatial planning, public health and flood and coastal erosion risk management are the key areas of policy which can influence adaptation to climate change in the urban and rural built environment. All are devolved, although the Severn and Dee catchments extend across England and Wales.

The direction, objectives and funding in these policy areas are driven by the Welsh Government. Others, including Natural Resources Wales (NRW), local authorities and risk management authorities also have a key role in delivery. The distribution of climate risks, harmful impacts and the most suitable adaptation interventions will be different in different places, requiring collaboration across a range of actors (Box 9.2).

Local government and local actors strongly influence adaptation in towns and cities.

Box 9.2

Key actors for climate adaptation in towns and cities in Wales

- **Local government bodies**, particularly **Planning Authorities**, are key actors for local planning development. There are 25 planning authorities in Wales (22 local authorities and three national parks authorities) who are required to produce local development plans. These plans set the framework for the development of the land within the authorities.
- Local authorities also have a role as **Lead Local Flood Authorities** and are responsible for managing risk of flooding from ordinary watercourses, surface water and groundwater. Coastal local authorities are also authorised to carry out coastal protection work as a **coastal erosion risk management authority**.
- **Natural Resources Wales** manages the risk of flooding from main rivers, their reservoirs, and the sea, including defence maintenance. They also carry out coastal protection works as a coastal erosion risk management authority.
- **Planners and developers** influence the design and location of new developments.
- **Water and sewerage companies** manage the risk of flooding to water supply and sewerage facilities, and the flood risks arising from any failure of their infrastructure. There are two main water companies in Wales (see Chapter 5).
- **Adaptation planning by other infrastructure providers** (such as power, telecoms, transport and highways, see Chapters 6-8) also contributes to the overall resilience of the system through their capability to maintain key services and enable effective response.

Adaptation in towns and cities must align with other policy goals for reducing emissions, housebuilding and creating safe places.

There are several other policy goals for towns and cities which may have co-benefits or trade-offs with climate change adaptation. These include:

- Meeting housing and infrastructure demands
- Reducing greenhouse gas emissions towards Net Zero
- Making urban environments safer and more pleasant places to live
- Aligning with Wales's policy framework (Box 9.3)

Creating resilient towns and cities requires a cross-cutting approach, which includes nature, communities and infrastructure.

Some of the key risks to towns and cities, such as flooding and overheating, overlap with risks to thematic areas covered in other chapters in this report.* Adapting to these risks therefore requires a cross-cutting approach, with key interactions including:

- **Energy, telecoms and transport infrastructure.** Infrastructure systems should be built in ways which increase resilience in nearby settlements. Vulnerable infrastructure can create risks to towns and cities; for example, landslides and slope failure in legacy coal industry infrastructure have been identified as a particular risk in Wales (Box 9.6).
- **Water supply.** Well-adapted drainage and sewer infrastructure can increase resilience to flooding, while poorly maintained drainage systems can exacerbate impacts.
- **Buildings.** Adaptation of individual buildings can contribute to overall resilience in well-adapted towns and cities. Buildings, and their contents and occupants, will be impacted by urban heat and flooding hazards.
- **Nature.** Risks to urban and rural nature will also have knock-on impacts for built-up areas. Nature can help to build resilience in towns and cities, for example through nature-based solutions.
- **Community preparedness and response.** Community-level preparedness and ability to respond contributes to overall resilience of the people who live in towns and cities.

Well-adapted towns and cities will contribute to Wales's 'Prosperity for All' goals.

Box 9.3

Towns and cities in Prosperity for All: A Climate Conscious Wales

Key outcomes related to well-adapted towns and cities are included in Wales's **Prosperity for All**.⁹

- '**Protecting people, communities, buildings and infrastructure from flooding'**. Achieved through implementing the National Strategy for Flood and Coastal Erosion Risk Management.
- '**Tackling land management practices that increase flood risk**'. The Welsh Government committed to continue to work with stakeholders to promote catchment-based and sustainable land practice.
- '**Planning Policy for Wales & National Development Framework**'. This is a cross-cutting priority which included actions to improve accessible green space, prevent housebuilding in vulnerable areas, restore Wales's uplands and develop guidance.

There are several indicators within the monitoring framework that may be useful for measuring progress towards well-adapted towns and cities:

- AN1: Number of schemes enabling nature-based solutions
- AN5: Number of NFM and/or hybrid schemes via the FCERM grant funding where the primary scheme objective is to reduce flood risk to properties
- MC1: Documentary review of climate risk approach to SMP reports; Proportion of policies from SMPs implemented; Number of habitat creation projects; Proportion of coastal schemes with NbS; Number of relevant plans and policies that include cultural heritage considerations
- HP3: Number of GI projects implemented with clear contribution to climate adaptation; Number of SuDS approvals recorded by SABs

* This chapter excludes risks and policies related to large-scale infrastructure, individual buildings and urban habitats in towns and cities.

1. Monitoring progress towards well-adapted towns and cities

Well-adapted towns and cities are places which are adequately equipped for climate and weather extremes, such as flood events and high temperatures. They should be designed in ways which minimise the negative impacts of future climate hazards.

Well-adapted towns and cities are designed in ways which minimise the impacts of climate risks.

In this chapter we propose a monitoring map of the key outcomes, enablers and policy actions that are needed to ensure that fewer buildings, people and activities in towns and cities are at risk from the harmful impacts of climate change (Figure 9.1). This can be achieved through good planning, design, and preparedness.

The key adaptation outcomes that are required are:

- **River and coastal flood risks to people, land and buildings are minimised.** New flood defences are likely to be required; and both existing and new flood defences need to be well-maintained to continue functioning well. There is also a set of broader actions required to increase resilience and the ability to recover quickly, such as improved risk mapping, flood warnings and a catchment-based approach. A combination of upstream (rural) and downstream (urban) interventions allows for better management of overall risk.
- **Surface water and groundwater flood risks to people, land and buildings are minimised.** This requires effective management and mapping of water flows above and below ground in urban areas, achieved through well-maintained drainage infrastructure, including sewers, drains and sustainable nature-based options. Managing the extent of impermeable surfaces and delivering appropriate property level protection are also key to managing surface water flood risk. Groundwater flood risks can be managed through drainage and pumping, as well as property level protection measures.
- **Areas at risk of coastal erosion are supported in a sustainable coastal transition.** Some coastal areas will need to be defended by structures. In some areas, coastal defence may not be a sustainable option, and communities should be supported to relocate. The whole coastline should be considered as connected using a combination of approaches, including nature-based solutions.
- **Urban heat island risks are managed.** Urban heat island effects can be minimised through careful urban design. Policies which encourage passive cooling can help to reduce urban outdoor temperatures. These include shading (e.g. from trees), maximising green and blue spaces and reducing surfaces that absorb heat by creating green or reflective roofs. Innovative urban design can also increase air flow and breeze. In high density areas, the management of exhaust heat from buildings and traffic, as well as active cooling, may also be required.¹⁰
- **Climate resilience is fully integrated into, and enforced by, the planning system.** Sufficient legislation, regulation and enforcement is required to ensure that new developments are built in locations and designed in a way that reduces vulnerability to flooding, coastal erosion and urban

Places should be prepared for future flooding from rivers, the sea and rainfall events, as well as coastal erosion.

Urban heat impacts should be managed by planning policy and cooling interventions.

overheating now and in the future. Policies should enforce and support sustainable planning decisions in new developments and adaptation retrofitting in existing developments.

Funding from central government and the private sector is required to build-in and maintain adaptation measures.

Enabling factors that need to be in place to deliver these outcomes are:

- **Funding.** All the below require significant and long-term investment – both well targeted public capital, including local authority spending and additional support from the private sector.
 - Building and maintaining flood defences and green infrastructure.
 - Planning decisions to allow for a thorough consultation and assessment process.
 - Monitoring and research, warning systems and community engagement.
- **Governance.** A proactive planning system which considers future climate risks needs to be supported by joined-up risk management plans, which have clear responsibilities for decision makers and stakeholders. This allows for collaboration across catchments and between urban and rural regions and promotes the sharing of data necessary for effective adaptation. Ambition and resource in local authorities and risk management authorities are key enablers for this.
- **Engagement and education.** Climate-resilient planning and construction requires workers with technical and practical skills to support activities such as modelling, design and installation. The public should be well-informed about future climate risks to enable household and community-level decisions for preparedness and response actions.
- **Research.** There are particular gaps in our understanding of groundwater flood risk and risk mapping which links to vulnerability. Further research will help to ensure that adaptation funding is allocated to locations and projects based on socio-economic factors in addition to where benefits are the highest.
- **Data and monitoring.** Standardised and consistent risk-mapping and monitoring are required to assess national-level risk. Good practices of data sharing across sectors, regions and authorities are key to enabling climate resilient planning. Monitoring changes in risk and the status of adaptation will enable better targeting of future actions.

Adaptation actions must be accompanied by monitoring and evaluation.

Our monitoring framework highlights policy and planning milestones which must be in place to achieve these required outcomes for well-adapted towns and cities. These fall under the following categories:

- **Legislation and regulation.** National policy must create legislation which enforces sustainable long-term plans for flood risk management, coastal erosion risk management and spatial planning.
 - Legislation should include mandatory, place-based and adaptable resilience targets (such as green infrastructure installations or delivery of shoreline management projects) and provide appropriate frameworks for regulation.

- However, licensing and regulation should be pragmatic. Small-scale natural flood management or sustainable drainage systems (SuDS) should not be subject to the same evidence standards as hard engineered construction projects. Portfolio approaches, where multiple small interventions are considered together, should be enabled.

Policy should create resilience standards which promote place-based adaptation.

- Legislation should also ensure that funding allocation is appropriate to meet adaptation goals. This requires funding policy to value the capacity for adaptation in plans – promoting a wider focus on flexibility and whole-system resilience over a greater number or height of built interventions.

- **Standards.** Well-adapted towns and cities require policy to create resilience standards which support planning fit for future climate conditions. A nationally consistent approach to setting resilience standards should promote place-based resilience by enhancing plans for protection, response, and recovery from climate impacts.

- This includes standards for buildings in new developments, as well as quality standards for green infrastructure and nature-based solutions.
- Quality and maintenance standards are also required for flood and coastal defence infrastructure.
- Monitoring of risk and adaptation actions should also be of consistent standard. This information can then inform future policies and plans.

Policies should leverage private investment and incentivise adaptation actions in towns and cities.

- **Financial instruments.** Policies should seek to financially incentivise adaptation actions in towns and cities by actors, including developers, utilities companies and individual home or business owners. These policies should consider wider socio-economic vulnerability.

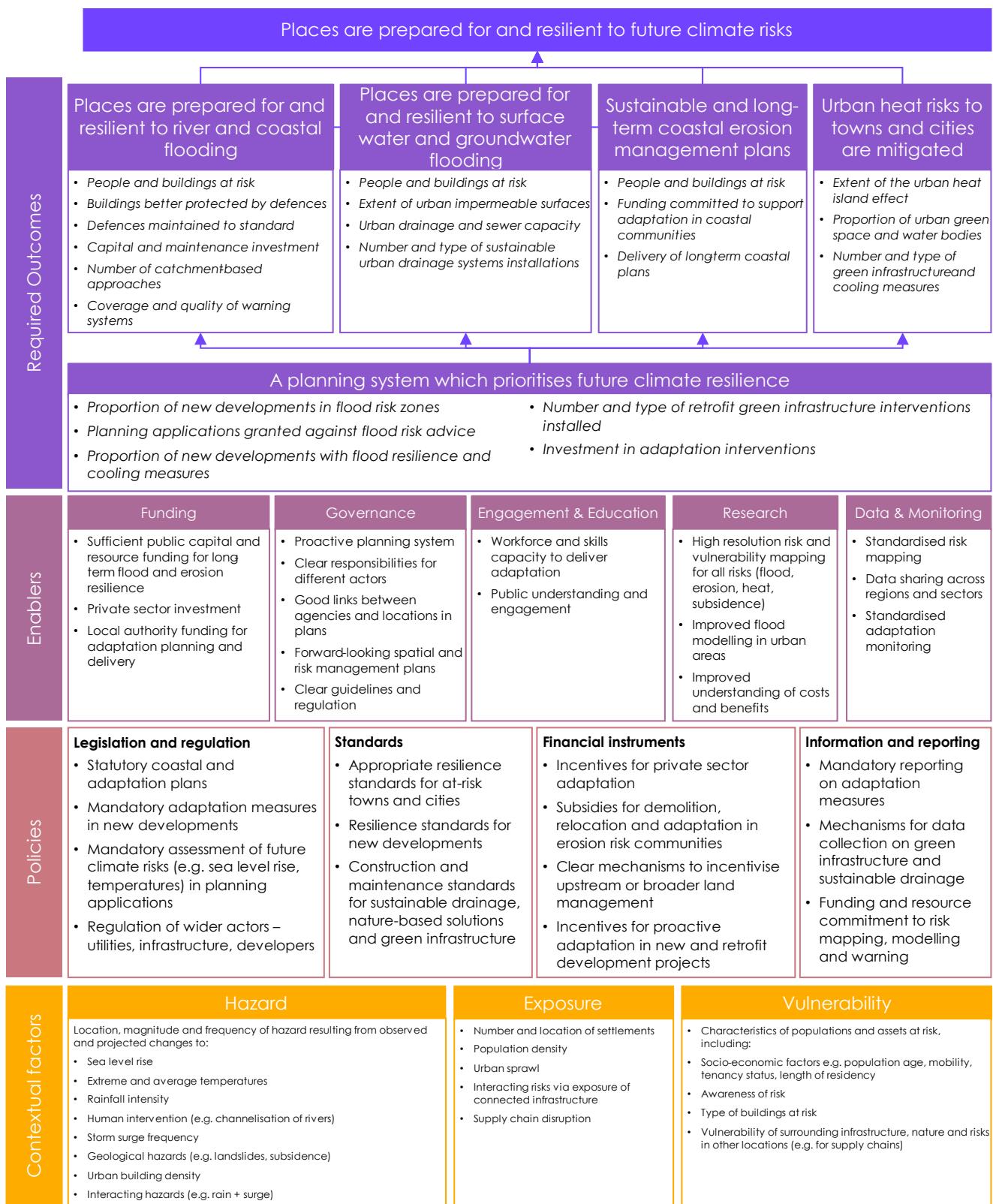
- Good practice for wider land management not directly within built-up areas at risk should also be supported.
- Policies and plans must incentivise and leverage private finance for adaptation.

- **Information and reporting.** National policy must ensure that there are clear responsibilities for key actors (Box 9.2) to create joined-up risk management and consistent adaptation reporting. This will improve understanding of the national picture of adaptation in towns and cities, resulting in improved future modelling and risk assessment, to be used for funding prioritisation and community engagement. Policy should ensure that people who live in towns and cities are able to access risk information.

Policies must include mechanisms for information and reporting.

There are other factors which might be outside of policy control which influence the level of climate change risk to towns and cities. These include changes to the vulnerability of the population, such as age, as well as changes in the hazard, such as more frequent and more intense rainfall (Box 9.1).

Figure 9.1 Monitoring map for towns and cities



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents the available evidence on progress towards the delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Towns and cities are prepared for and resilient to river and coastal flooding

Indicators show mixed progress in creating towns and cities resilient to flooding from rivers and the sea in Wales.

Indicators show **mixed progress** in reducing vulnerability and exposure of towns and cities to river and coastal flood risk. There are some positive trends in the number of homes protected by government schemes, but the risk of flooding is increasing and we lack data to evaluate catchment-scale management.

- **The risk of flooding to the built environment from rivers and the sea in Wales is increasing.** In December 2021, the updated national-scale Flood Risk Assessment for Wales (FRAW) found that approximately 164,000 properties in Wales are at risk of flooding from rivers, the sea or both.¹¹ This is a 5% increase on estimates from 2019 and a 2% increase since April 2021 – although some of this change may be attributed to improvements to the methodology.^{12,13} Around 140,000 of the properties at risk are residential, equating to approximately 11% of Wales's total housing stock.¹⁴
- **More residential properties are at risk from river flooding than tidal flooding (in total), but the dominant source for high-risk properties is tidal flooding.** The most recent flood risk assessment data show approximately 78,000 residential properties (12,000 non-residential) at risk of river (fluvial) flooding and 62,000 (9,000 non-residential) at risk of tidal flooding. Of these at-risk residential properties, 22,000 and 42,000 have a 1 in 30 or greater chance of flooding each year (they are at 'high risk') from rivers and the sea respectively (Figure 9.2).^{*} Some properties will be impacted by flooding from multiple sources. Around 3,000 'key services', including education, health, transport, utilities and emergency services, are also found to be at high risk from flooding from rivers and the sea.¹¹
- **The total number of properties within areas protected by flood defences in Wales is increasing.** In 2019, 112,600 properties were classified as benefitting from the national network flood defence infrastructure.¹⁵ This dataset has not been updated since 2019, but additional data from Natural Resources Wales (NRW) shows a further 995 properties have benefitted from increased protection as a result of their capital investment schemes.[†] Around 73% more properties have benefited from a sustained level of protection from schemes in 2022/23 than in 2021/22 (Figure 9.3).¹⁶ The number of properties protected by schemes not managed by NRW is unknown.

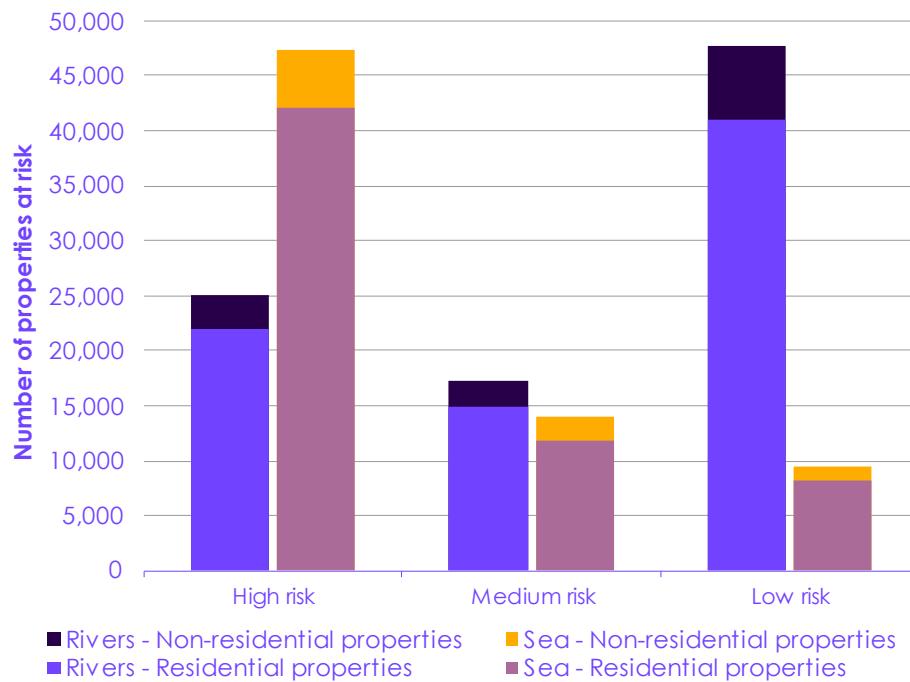
Around 64,000 properties in Wales are considered at high risk of flooding from rivers and the sea.

The number of protected by capital flood defence schemes shows an increasing trend.

* Properties are classed as high risk of flooding if every year, the chance of flooding is greater than 1 in 30 (3.3%). Properties are classed as medium risk if every year, there is a chance of flooding between 1 in 100 and 1 in 30 (1% to 3.3%) of rivers flooding and between 1 in 200 and 1 in 30 (0.5% to 3.3%) of flooding from the sea. Properties are classed as low risk if they lie in areas which, for every year, have a chance of flooding of between 1 in 1000 and 1 in 100 (0.1% to 1%) for rivers or between 1 in 1000 and 1 in 200 (0.1% to 0.5%) from the sea.

† There are no data reported for 2019/20 period.

Figure 9.2 Number of properties at low, high and medium risk of flooding from rivers and the sea



Source: Natural Resources Wales (2023) Flood Risk Management Plan for Wales: National Overview.

Notes: Data is correct as of December 2021. Risk bands are categorised based on annual probability of flooding: 'High' – greater than 1 in 30 (3.3%); 'Medium' - between 1 in 100 and 1 in 30 (1% to 3.3%) for rivers and between 1 in 200 and 1 in 30 (0.5% to 3.3%) for sea; 'Low' - between 1 in 1000 and 1 in 100 (0.1% to 1%) for rivers or between 1 in 1000 and 1 in 200 (0.1% to 0.5%) for sea.

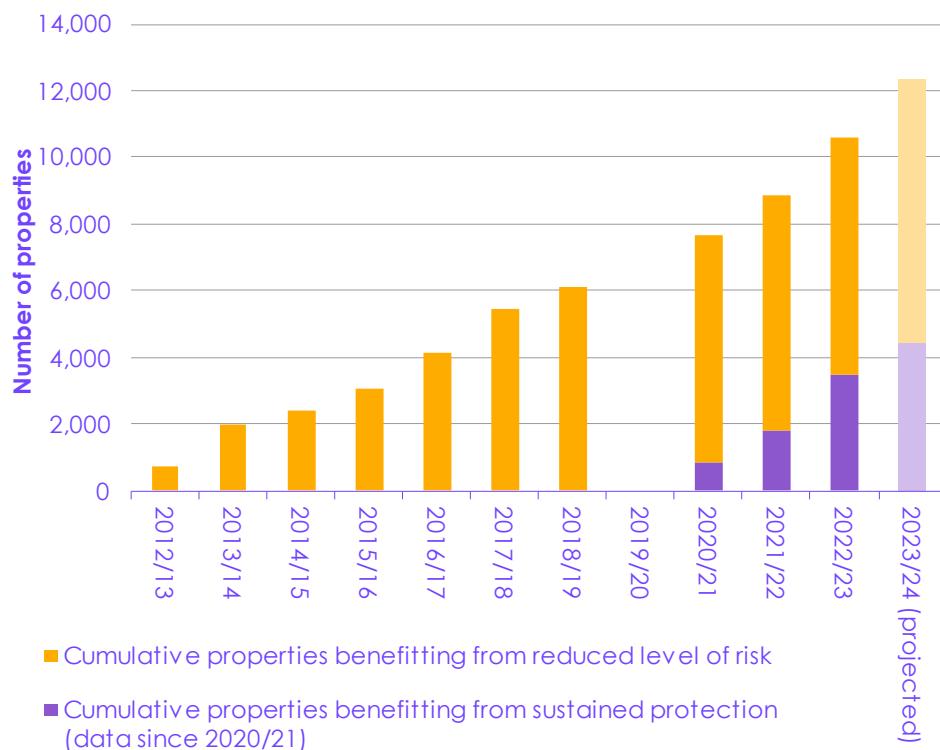
Flood defence assets maintained by Natural Resources Wales are mostly in good condition.

- Flood defence assets maintained by Natural Resources Wales have consistently been at or above their required condition.** In 2021/22, 98.1% of NRW's flood defence assets in high flood risk systems were found to be at or above their required condition. This is an increasing trend from 2020/21 (97.5%) and 2018/19 (97.7%).^{15,17,18} In 2021/22, £7.3 million (33%) of NRW's revenue settlement from Welsh Government was spent on managing flood risk assets.* This is consistent with the previous year when the 2020 National Strategy was announced.¹⁸
- More natural flood management schemes are being delivered across Wales.** At the time of writing, there are 11 NFM schemes under construction as part of the NFM Programme, which provides 100% grant funding to local authorities and NRW to undertake NFM. When completed, these schemes are estimated to protect 280 homes. £1.5 million of an estimated £2.6 million cost was allocated to these schemes in 2022/23.¹⁹
- There is a lack of evidence on delivery of upstream land management.** There are no monitoring data available to assess the delivery of upstream NFM and interventions which may slow or store flood water. Catchment approaches are identified as a priority in NRW's draft Flood Risk Management Plan, which was under consultation until May 2023.

Monitoring and evaluation data for upstream land management is lacking, creating a data gap.

* Revenue funding supports routine operational activities and services. Capital funding is used to deliver project work. NRW is funded directly by Welsh Government in the form of Flood Defence Grant in Aid funding.

Figure 9.3 Cumulative number of properties better protected from flooding through Natural Resources Wales capital investment schemes



Source: Natural Resources Wales (2023) Unpublished data provided on request.

Notes: There are no data for properties benefitting from sustained protection before 2020/21. There were no data collected or reported in 2019/20. Projections are estimates and subject to change. In 2023/24, NRW received funding from the Welsh Government for schemes in construction which will potentially protect over 3,400 homes. It is unknown when these will be completed, but NRW are projecting over 1,000 homes better protected by 2024. The overall government target (across all risk management authority's capital schemes) is 45,000 properties better protected by the end of this government term.

- **Natural Resources Wales has improved its capacity to manage reservoir flooding.** As of March 2022, NRW had identified 395 large, raised reservoirs in Wales, 19 more than last year. 248 of these are considered high-risk – where failure of the dam could endanger life. NRW recorded incidents at five incidents reservoirs in 2021/22, where emergency and remedial action was required. At the end of 2022, NRW had safety enforcement notices in place at three reservoirs, consistent with previous years.¹⁷ This represents increasing regulation of reservoirs in Wales since the Amendment to Reservoirs Act came into force in 2016.
- **The number of properties registered for flood warnings declined last year, following steady increases in uptake since 2017.** The number of properties signed up to receive flood warnings (via NRW's Flood Warning Service and the national Extended Direct Warning Services)* declined by 18,800 (14%) in 2022 in comparison to March 2021.¹⁷
- Further data are required to fully assess the progress in adapting to flooding from rivers and the sea in Wales. Data are needed on the location of flood

There has been a recent decline in uptake of flood warnings.

* The Extended Direct Warning Service is an opt-out service, where phone companies provide NRW with numbers for unregistered properties at flood risk.

defence assets in relation to the highest risk populations and evidence for the delivery of catchment-based approaches.

(b) Outcome 2: Towns and cities are prepared for and resilient to surface water and groundwater flooding

There are few indicators to evaluate the delivery of adaptation to surface water flood risk, despite it being the dominant source of flooding in Wales.

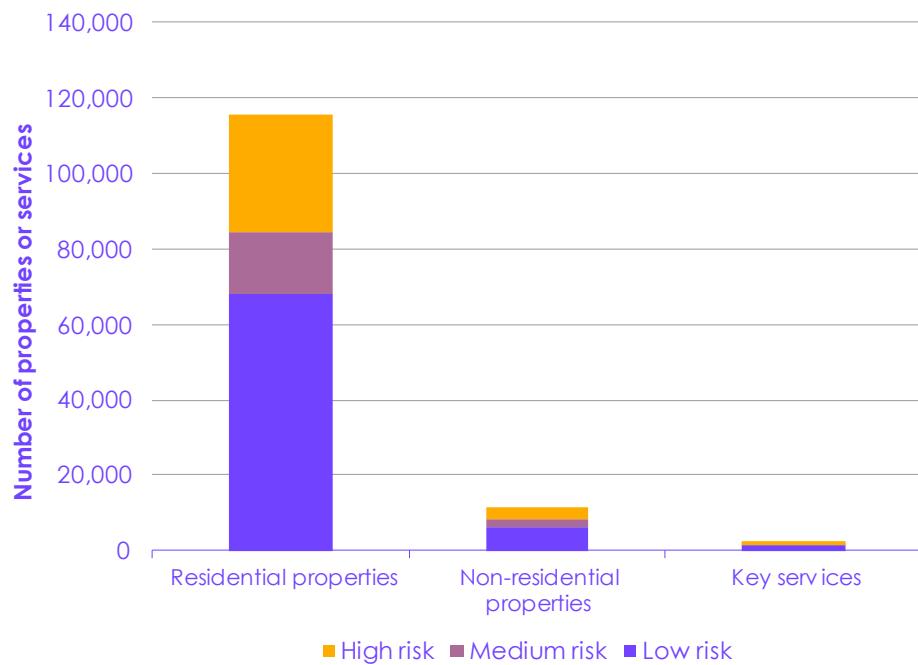
There are few indicators to evaluate progress towards adapting to surface water and groundwater flooding in Wales. There are no data on the delivery of new and retrofit SuDS and the extent of impermeable surfaces in urban areas. We are therefore **unable to evaluate** progress towards this outcome.

- **More properties in Wales are exposed to flooding from surface water than flooding from other sources.** A total of 115,700 residential and 11,700 non-residential properties are at risk of surface water flooding in Wales based on the most recent (2021) FRAW data (Figure 9.4). Around 2,500 key services are also at risk.¹⁷ Of residential properties at risk, 27% are considered at 'high' risk and 59% at 'low risk'.^{*} Properties at risk of flooding from surface water therefore make up around 53% of the total at risk of all sources of flooding. There is currently no timeseries for these data to assess change over time.
- **The extent of impermeable surfaces in urban areas in Wales is unknown.** Impermeable land surface can be a proxy for indicating how well adapted urban areas are to surface water flood risk. Increases in planned and unplanned impermeable surfaces through paving over gardens or verges reduces infiltration rates and contributes to greater surface water run-off. A NRW study in Cardiff showed that the impermeable area had increased by 20% between 1984 and 2009 due to extensions, conservatories and paving of gardens.²⁰
- **The number and character of sustainable drainage systems (SuDS) installed in urban areas is not currently monitored at the national scale.** There is no centralised database of SuDS installations (both new and retrofit), although some records should be kept by local government SuDS approval bodies. Data, including the location, type, maintenance condition and level of protection would be useful for monitoring progress in implementation and building evidence about what works. There are some localised examples of good practice, such as the £3 million Greener Grangetown scheme in Cardiff, which installed SuDS (rain gardens, permeable paving and drainage infrastructure) at a 12 ha site covering 12 streets and 550 properties to remove 4.4 ha of surface water from the combined sewer.²¹
- **The storage capacity of urban drainage systems is not routinely monitored.** Water and sewerage companies in Wales are producing Drainage and Wastewater Management Plans (DWMPs), which must assess capacity, pressures and risks to their networks. The plans are being produced on a non-statutory basis for 2023. Within the process of creating the draft DWMPs, water and sewerage companies looked at indicators of capacity. There is no national-scale database of these indicators or the indicative capacity.
- **Water companies record the number of external and internal areas flooded from sewers.** In 2021/22, there were 46 flood events per 10,000 connections to sewers maintained by Wales's two water companies (Dŵr Cymru Welsh Water and Hafren Dyfrdwy). This is an increase from 37 per 10,000 the

* For surface water, 'High risk' means that every year, there is a 1 in 30 (3.3%) chance of flooding in the area. 'Low risk' means that every year, there is a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) in the area.

previous year. The number of properties flooded internally per 10,000 sewer connections in this time decreased from 4.9 to 3.7.²²

Figure 9.4 Number of properties at risk of surface water flooding in Wales (as of April 2021)



Source: Natural Resources Wales (2022) Flood risk management annual report 2021-2022.

Notes: For surface water flooding: 'High' risk means that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%), 'Medium' risk means that each year, an area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%), 'Low' risk means that each year, an area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%).

More data is required to understand groundwater flood risk in Wales.

- **There are no data for the number of buildings at risk of groundwater flooding at the national scale.** Groundwater flooding occurs when water within the ground (in rock or soil) rises above ground level, due to long-term and short-term rainfall and water abstraction. Data on groundwater are held at local authority level and there is a lack of monitoring of the overall incidence of groundwater flooding and its impacts, as well as research to help us understand adaptation options.

(c) Outcome 3: Long-term and sustainable coastal erosion management plans

Some indicators for adapting to coastal change show positive trends, such as funding and number of projects.

Overall, the available indicators demonstrate **mixed progress** in delivering adaptation to coastal change – while more funding has been invested and shoreline management policies are being implemented, there are sparse data for evaluating long-term adaptation to coastal change.

- **The number of homes at risk of coastal erosion in Wales is small but likely to increase with future climate change.** The Welsh Government has identified around 400 properties at current risk of coastal erosion.²³ Predictions suggest that 2,100 properties are likely to be at risk in the next 100 years if defences are not maintained.²⁴

- **There are four shoreline management plans that cover the coastline of Wales but delivery of actions has been inconsistent.** Two of these are cross-border with England. It is positive that the whole coastline is covered by SMPs. By 2100, current projections suggest 95 coastal areas in Wales will need to move from a defending policy ('hold the line') to 'no active intervention' or 'managed realignment' policy, with around 40 of these areas requiring relocation.²³ However, the presence of SMPs will not necessarily indicate progress in adapting to coastal change, which requires a suite of long-term resilience actions, often beyond defence or realignment. The January 2021 progress report of Wales's Shoreline Management Plan (SMP) Action Plans reported that only 140 SMP actions out of 928 had been classified as complete, although some of these are ongoing actions. A further 283 actions have been challenged and 158 actions placed on hold.¹⁸ There are multiple contextual factors, such as political pressures and land ownership, which may influence the delivery and adaptation capacity of SMPs.

Delivery of actions in shoreline management plans has been inconsistent.

- **There are multiple projects in construction phase in Wales which focus on addressing coastal risk, facilitated by more central government investment.** There are 14 Coastal Risk Management Programme projects in construction phase, which were granted a combined total of £7.5 million funding for 2022/23 and are expected to protect 16,900 properties. The cost of delivering these projects is estimated at around £217 million in total.²⁵ A further 16 projects, which would protect approximately 22,000 properties, are in detailed design and outline business case phases. These were granted £2.1 million in funding last year.²⁶ This represents a considerable increase in investment in coastal schemes from 2016-2019, when the Welsh Government invested around £4.7 million in total for the Coastal Risk Management Programme.¹⁵
- **Natural Resources Wales is restoring and recreating coastal habitat as part of the National Habitat Creation Programme.*** Around 18 ha of salt marsh have been created through the programme since 2016 at Cwm Ivy Marsh and Morfa Ffriog. NRW are currently developing projects at further sites across Wales.¹⁷ Further data are required to assess whether habitat is being created in the right places and appropriately managed.

Further data are required to monitor the level of government support for adaptation in coastal communities.

- **There are no available data on the financial support provided to local authorities at imminent risk of losses due to coastal erosion.** We lack quantitative data to monitor the support provided to local authorities for adapting to coastal change in Wales. Furthermore, there are no available data on the number of properties and land lost to coastal erosion and therefore no consistent national picture of the adaptation gap. This data would provide useful context for national-scale risk assessment and targeting funding.

(d) Outcome 4: Urban heat risks to towns and cities are managed

We are **unable to evaluate** indicators for this outcome on reducing the vulnerability and exposure of people and buildings to urban heat risk. Urban canopy cover is decreasing, and we lack other data on urban cooling initiatives and green infrastructure.

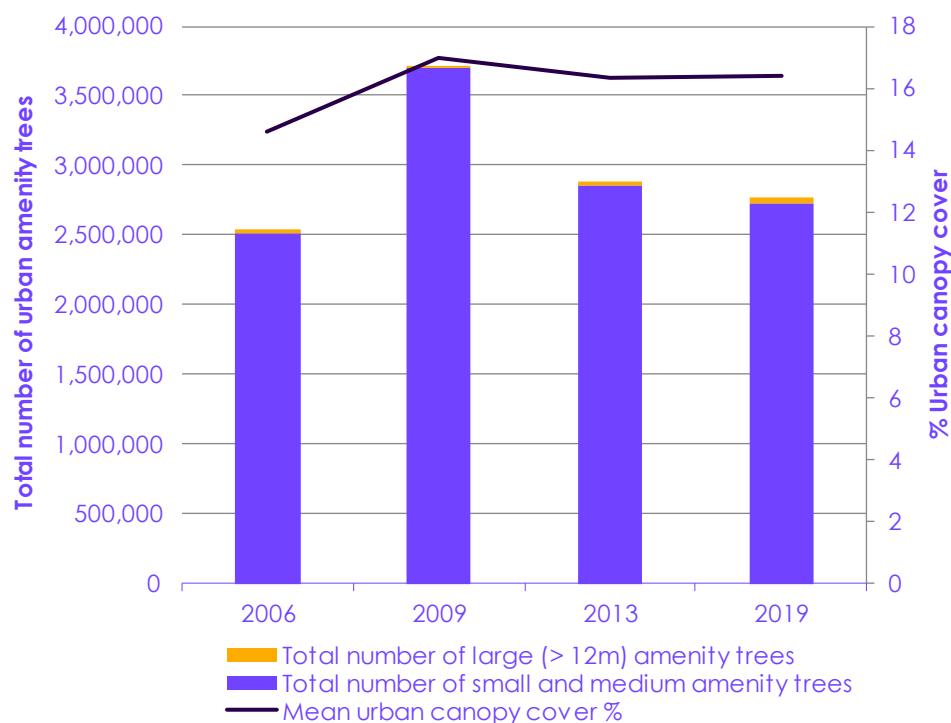
* This programme creates and restores coastal habitat to compensate for habitat area lost due to coastal erosion or pressures on the coastline elsewhere.

Delivery and monitoring of adaptation measures to manage urban heat are patchy.

- **Cities in Wales will be more at risk from higher temperatures in the future.** In Cardiff, the average summer air temperature is estimated to increase by up to 3.7°C by the 2050s.²⁷ Recent modelling found projected annual average outdoor temperatures for 2030 in the city were up to around 2°C higher than in more rural towns, such as Narbeth and Llangefni.²⁸
- **Urban areas in Wales are growing at an increasing rate.** Urban area in Wales was approximately 90,500 ha in 2019, around 4.4% of the total area.²⁹ This has increased in comparison to 86,300 ha measured in 2013.³⁰ Analysis of historical maps suggest around 46,700 ha of Wales's land use was considered urban in 1930, indicating an acceleration in the rate of urban expansion.³¹

Urban areas in Wales are growing and are likely to be at risk of high temperatures in the future.

Figure 9.5 Number of urban non-woodland trees and percentage total urban canopy cover in towns and cities in Wales



Source: Dowding & Hodges (2020) Tree cover in Wales's Towns and Cities: update 2020; NRW (2016) Tree cover in Wales's Towns and Cities.

Notes: 'Amenity' trees are non-woodland trees, growing along streets, gardens, car parks and other urban public and private spaces. Large amenity trees are those with a crown diameter greater than 12 metres.

Recent data suggests an increase in large trees in towns and cities, but overall tree cover and green space in show decreasing trends.

- **Urban canopy cover in Wales is decreasing but trends in the number of large trees in towns and cities suggest improvement.** Mean urban tree cover in Wales was measured at 16% in 2019, a one percentage point decline since 2009. These data come from a national-scale assessment of urban trees which was carried out by NRW in 2006, 2009, 2013 and 2019. Urban woodlands were found to represent around 35% of urban canopy cover in Wales, with the rest made up by 'amenity' trees in streets, gardens and parks.³⁰ Between 2013 and 2019, canopy cover declined in 41% of towns and cities in Wales. However, the number of large trees over 12 m crown diameter increased by 12,400, improving on losses of 7,000 between 2006-2013 – although, this may also reflect an ageing and more mature tree population, with fewer young trees being planted (Figure 9.5).³²

Further monitoring is required to understand delivery of other active and passive cooling measures in towns and cities.

- **Urban green and blue spaces are not being monitored at a national scale in Wales but there are data to provide a baseline.** In 2019, the Office of National Statistics estimated that the proportion of natural land cover in urban areas in Wales was around 30.2%, with blue space making up an additional 1.1% of the urban area. Private residential gardens made up 28% of urban green space in Wales.³³ Continued data collection is required to further understand trends over time. In Cardiff, there is approximately 3,290 ha of natural land cover and 240 ha of blue space out of a total 11,600 ha of urban area. The average annual cooling effect of this green and blue space between 2013 and 2018 was estimated at -0.7°C, equating to an asset value (stock) of around £576 million in 2021 (2021 prices).³³
- **There are a lack of nationally consistent datasets on other green infrastructure, such as green roofs, and wider urban heat management.** There are not enough data to evaluate progress in increasing green space and installations of new and retrofit installations of other green infrastructure, such as green roofs. There are no data which track change over time. An improved green infrastructure asset registry, which includes data on green infrastructure type and metrics of quality (such as biodiversity and density), would allow improved future assessment. Data on management of heat from traffic and other sources are also not consistently collected.

(e) Outcome 5: A planning system which prioritises future climate resilience

Indicators show **insufficient progress** in reducing the vulnerability and exposure of towns and cities through the spatial planning system. Monitoring for development in flood risk zones is lacking and available data show concerning trends. There are limited data to evaluate the delivery of green design in planning.

Available indicators show concerning trends in the location and adaptation potential of new built development.

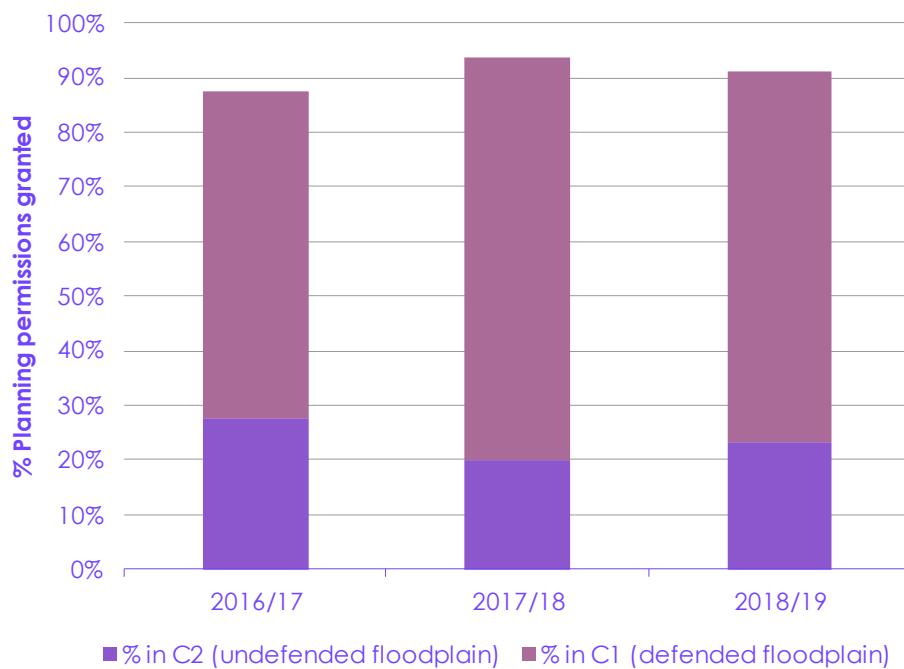
- **The proportion of planning permissions granted for new developments in flood risk zones was decreasing, but there are no recent data.** The number of residential dwellings approved in flood risk zones was 47% lower in 2018/19 than 2017/18, when 1221 residential dwellings (93% of applications for development in flood risk areas), were granted planning permission in flood risk areas. There are no comparable data available from after 2019 due to Covid-19 and resource constraints. In 2018/19, 91% of development applications in flood risk areas were granted permission, 26% of which were in zone C2.³⁴ Zone C2 is undefended floodplain with a greater than 0.1% annual chance of flooding.* Current trends in development are unknown; while the available data shows a decrease in development in the floodplain, results continue to show concerning decisions by local planning authorities (Figure 9.6). In 2021/22, NRW provided 2,350 responses to planning applications where flood risk is a constraint, 55% of which were in zone C2.¹⁷

* Zone C represents areas which have a greater than 0.1% annual probability of river, tidal or coastal flooding or areas which have recorded floods in the past. It is based on the Environment Agency's extreme flood outline. Zone C1 indicates areas within Zone C which are developed and served by significant infrastructure, including defences. Zone C2 indicates areas without flood defence infrastructure, where development should be avoided.

Planning permission continues to be granted in undefended areas of flood plain, although there is a gap in recent data.



Figure 9.6 Percentage of planning permissions granted for residential development applications in the floodplain, split by defended and undefended area



Source: Welsh Government (2019) *All Wales Planning Annual Performance Report 2018-19*; NRW (2019) *Flood and Coastal Erosion Risk Management in Wales, 2016-2019*.

Notes: There are no available data after 2018/19. Graph shows the number of permissions granted out of applications for development in the floodplain (not all applications). Zone C is floodplain area with a greater than 0.1% chance of flooding in any year. C1 area is the area within zone C which is protected by defences. C2 areas have no defences.

- **Urban and rural green infrastructure is included across all of Natural Resources Wales's Area Statements.** Area Statements should be used as guidance for developing local plans.* The [North East Wales Area Statement](#) includes 'Develop and improve urban and rural green infrastructure' as a key theme. The other five terrestrial Area Statements include references to green infrastructure and urban and rural green space.
- **Natural Resources Wales have carried out some mapping on the opportunity for green infrastructure.** The maps show accessible urban greenspace and indicate 'demand' for green infrastructure interventions based on population density and the Welsh index of multiple deprivation for pluvial flood risk, air pollution and noise pollution. The maps show pockets of high demand in urban areas across the country, with parts of Cardiff, Wrexham and Rhondda Cynon Taf scoring highly.³⁵
- **There are no centralised or national-scale datasets on the number of new developments built with flood resilience and cooling measures.** While individual local authorities (or developers) may track their investment in

Green infrastructure is included in guidance for planning but evidence for delivery is lacking.

* Area Statements are developed by NRW in response to the Natural Resources Policy. They cover seven areas of the country (including the marine environment) and outline challenges for natural resource management in that region.

blue-green infrastructure for new developments and retrofits, there is no centralised information to evaluate progress at the national scale.

Further monitoring and evaluation are required to track progress.

- **There are no centralised or national-scale datasets for tracking planning and installation of retrofit green infrastructure.** More than 90% of today's housing stock in Wales is predicted to remain in use by 2050 due to low rates of new and replacement housing.³⁶ This means that retrofit is key for climate change adaptation in Welsh towns and cities.

(c) Progress on enablers

We have identified key enabling factors that should be in place to ensure that policies deliver well-adapted towns and cities. Trends in some of these enablers can be monitored:

- **Welsh government funding and investment for flood and coastal risk management has been increasing.** The Welsh Government has increased investment for FCERM since the implementation of the National FCERM Strategy in 2020, with the budget showing a 48.7% real terms increase in funding on flood risk management by 2024/25 from 2021/22.³⁷ The Welsh Government has allocated £25.8 million in capital funding to risk management authorities as part of the flood and coastal erosion risk management programmes and £23 million as core funding to NRW for 2023/24.³⁸ This is an increase from the total £43.3 million (£19.8 million for local authorities and £24 million for NRW) allocated in 2022/23.³⁹ Funding is also available for local authorities to carry out smaller works under the 'Small Scale Works Grant'.
- **Revenue funding from Welsh Government to local authorities and NRW has also increased.** In the 2022/23 FCERM programme, the Welsh Government committed to increase revenue funding by £24 million over the next three years, enabling a doubling of local authority funding (to £225,000 per local authority) and an increase in NRW's revenue budget by £1.5 million.⁴⁰
- **Water companies are investing in flood risk management.** Some flood risk management – particularly for surface water flooding – must be carried out by water companies who own and maintain drainage infrastructure. 'RainScape' is a programme of water flow management implemented by Dŵr Cymru Welsh Water. Between 2012 and 2020, the company invested £115 million in Llanelli and Gowerton in kerb drainage, pipework, planting and storage basins, removing 41 properties from the flood risk register and 1.5 million m³ of rainwater from the sewer network each year.⁴¹
- **Natural Resources Wales has increased their investment in monitoring flood risk.** NRW invested two percentage points more of their capital funding in mapping and modelling in 2022/21 than 2021/22 (an absolute increase of £470,000). Resource spending on hydrometry and telemetry also increased by £371,000 in this period, although there was a slight decrease (by £79,000) in resource spending on analysing flood risk.¹⁷
- **Governance structures for flood risk management in Wales do not clearly clarify roles and responsibilities.** Recent research from the Flood and Coastal Erosion Committee (Box 9.4) highlighted that governance and ambiguity across risk management authorities remains a barrier to delivering adaptation to flood risk in Wales. FCERM in Wales is governed through a mixture of legislation and policy frameworks.⁴²

Trends in funding show increases in public and private investment for managing flood risk.

Recent research highlights a lack of clarity in roles and responsibilities for different actors in managing flood risk.

- **The majority of people in Wales believe climate change is already having an impact, but the overall population is less worried about future climate risk than the rest of Great Britain.** As of October 2022, 63% of people in Wales are worried about climate change. This is comparatively lower than in England (75%) and Scotland (72%).⁴³ Further survey evidence from September 2022* found that 61% of people in Wales believe climate change is already having an impact, with 72% highlighting extreme weather and flooding as risks already occurring.⁴⁴ However around 21% believe that climate change will only impact future generations.

The public are increasingly engaging with flood risk but there remain gaps to increase awareness.

Natural Resources Wales estimate they will require more skilled workers to keep pace with future risk management.

- **More people are concerned about flooding in their local area in Wales.** In 2020/21, 45% of respondents to the national survey were very or fairly concerned about flooding in their local area, compared to 28% in 2018/19.[†] 20% of respondents in 2018/19 had investigated the risk of their home flooding, a slight increase from 18% two years prior.⁴⁵ More people are checking NRW's website for advice on how to prepare for flooding. In 2022, their relevant webpages had around 8,000 combined views. This is double the number from 2021, with increases associated with Storms Eunice and Franklin in February 2022.¹⁷ However, 41% of people in Wales would contact their local council about flooding rather than NRW or the Environment Agency (both 18% of respondents).⁴⁴
- **Skilled workers will be required to keep up with the requirement for risk management activities, as well as resilient construction and design.** NRW monitors the number of full-time equivalent staff working directly in flood risk management, showing consistent levels in the past two years of around 350. NRW estimate that they will require 60-70 staff over the current baseline to sustain their overall response service‡ at levels described by actions and improvements in their review of the 2020 February floods.⁴⁶
- **Community engagement in flood planning is increasing.** There were 513 Community Flood Volunteers as of March 2022, an increase from 409 in 2021. Subscriptions to the quarterly newsletter produced by NRW to support volunteers have increased from 791 for the first issue to 2,969 in March 2022 – an increase of 824 since the previous year.¹⁷

* From a survey of 2,269 residents of Wales aged 16 and over (face-to-face, telephone and online).

† The National Survey for Wales involves face-to-face and telephone interviews with around 12,000 randomly selected adults in Wales. Sample size for flood risk questions was in the range of 5,000-8,000.

‡ This covers permanent staff to undertake and sustain new improvement work related to flood forecasting and warning, asset management and planning, flood risk mapping and modelling, asset maintenance and operational incident response, hydrometry and telemetry work, plus support work in areas such as ICT and finance.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

(a) Outcome 1: Towns and cities are prepared for and resilient to risk of flooding from rivers and the sea

Policies and plans to prepare towns and cities for river and sea flooding are in place.

There are **credible policies and plans** in place to ensure that towns and cities are protected from the harmful impact of river and coastal flooding. However, while key policy milestones are in place, some gaps remain, including for catchment-based management and setting clear targets for flood risk resilience.

- **Key aspects of legislation are in place through the National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in Wales.** The 2020 strategy and subsequent guarantee of investment are policy milestones for a resilience-based approach to flood risk management. The strategy replaced the previous 2011 National Strategy and has been accompanied by improved flood risk mapping. Clear, place-based targets for risk reduction through FCERM schemes would help to ensure the strategy delivers on the ground. Furthermore, plans still fall short in clarifying roles and responsibilities for different actors set out in legislation. The Welsh Government's Flood and Coastal Erosion Committee (FCEC) is a valuable governance group to support policy development (Box 9.4). The Committee's 2022 review of FCERM legislation included proposals to Welsh Ministers, with the Law Commission also considering a review of statutory responsibilities in England and Wales.³⁷
- **The Welsh Government has committed to record levels of funding for the FCERM programme for 2023/24.** Funding committed for 2023/24 totals £75 million, with £25.8 million allocated for the FCERM programme and £23 million for NRW's core funding programmes, as well as £3.7 million for local authorities to carry out small schemes.³⁸ This is a considerable increase in the funding for NRW than in previous years. The Welsh Government published a memorandum relating to FCERM capital grants for local authorities and NRW in April 2023. This clarifies the guidance and procedure for grant eligibility and allocation. While funding prioritisation considers wider benefits and cost-benefit ratios, the standard of protection does not always map on to the areas of highest risk or vulnerability. Funding is available for local authorities to carry out smaller works under the 'Small Scale Works Grant'.
- **A National Asset Database has been developed to provide an overview of asset location and ownership in Wales.** This brings together key Lead Local Flood Authority (LLFA) asset data to NRW alongside NRW's asset data into a public facing map to support better decision making by others. The Welsh Government's FCEC (Box 9.4) put forward a proposal in September 2022 to create a national register of significant FCERM assets not in control of RMAs, but this has not yet been taken forward.⁴¹ Risk management authorities in Wales currently lack powers to enforce maintenance of both public and private flood risk assets to required standards due to complexities in ownership and incompatibility across floods legislation and other legislation, such as highways and agriculture. NRW are also developing a risk-based

Welsh Government's 2020 National Strategy for FCERM is supported by record levels of capital and maintenance funding.

revenue allocation model to allocate asset maintenance revenue funding. Further support and work is needed to add information about assets not owned by Lead Local Flood Authorities or NRW.

A national flood and coastal defence asset database has been developed.

- **Natural Resources Wales's draft Flood Risk Management Plan is under consultation.** This plan shows promising ambition across the national and local scales for managing defence assets and reservoirs, improving forecasting and monitoring, flood risk advice, strategic planning, and community engagement.
- **There are no policies to support upland catchment management by private landowners.** Welsh Ministers have committed to delivering nature-based flood management in all river catchments. Between 2020 and 2022, the NFM fund offered 100% funding to risk management authorities for NFM projects. This programme has been continued via the Natural Flood Management accelerator programme, launched in 2023. However, there remains a lack of policy to support private landowners in upland land management, because policy for land management by farmers, land managers and the rural sector is piecemeal for the next two years during the transition to the Sustainable Farming Scheme (SFS) (see also Chapter 3, Working Land and Seas).
- **Guidance for flood and coastal erosion risk management authorities in Wales has been updated with more recent climate change projections for sea level but not river flows.** Guidance updates sea level rise climate change allowances to reflect the higher central and upper end allowances based on UKCP18 climate projections. Peak river flows, extreme rainfall and storm surge data remain based on UKCP09 climate projections and are expected to be updated later in 2023.

Box 9.4

The Welsh Flood and Coastal Erosion Committee (FCEC)

The Environment Act (Wales) 2016 gave Welsh Ministers the power to abolish the Flood Risk Management Wales Committee and establish a new Flood and Coastal Erosion Committee (FCEC) in July 2017. The committee's role is to facilitate communication between the flood and coastal erosion risk management sector and Welsh Ministers. The Committee has links across relevant actors (see Box 9.2) and includes members from Lead Local Flood Authorities, academic institutions, water, agriculture, hydrology and consultancy. The Committee has reported annually to Welsh Government since 2020 and has its own work programme linked to the National Flood and Coastal Erosion Risk Management (FCERM) Strategy. There are two Sub-Committees which focus on resources and policy and legislation. In May 2022, the Resources Sub-Committee finalised a review of resources, where it made 20 proposals, and in September 2022, the Policy and Legislation Sub-Committee published a report which made 10 proposals. The formal Ministerial responses to these proposals are being considered.

- **Policies and plans show progress in ambition to improve information about flood risk preparedness.** A new digital service to provide flood risk and warning information was introduced in Wales in 2020. NRW has endorsed a Flood Warning Service Review and will take forward its recommendations alongside those made after the February 2020 floods review. There have been improvements in NRW's hydrometric networks, new models and forecast locations, increasing the coverage of warning systems.

The Flood and Coastal Erosion Committee was established in 2017 and advises the Welsh Government on flood risk management.

- **The National Infrastructure Commission for Wales and the Flood and Coastal Erosion Committee can provide advice to the Welsh Government.** The Welsh Government sets the programme for work for the National Infrastructure Commission for Wales (NICW), which is currently running a floods management project. This project will make recommendations on vision, strategic flood response, workforce and funding and land use planning.⁴⁷ The FCEC also reports annually to the government specifically on FCERM management (Box 9.4).

(b) Outcome 2: Towns and cities are prepared for and resilient to surface water and groundwater flooding

This outcome is scored as having **partial policies and plans** in place to prepare towns and cities for surface water and groundwater risks. Some key policies are in place but there remain some significant policy gaps in managing urban water flows and impermeable surface area.

Legislation in Wales means that new developments must include sustainable drainage systems.

- **Sustainable drainage systems are mandatory in new developments.** In January 2019, the Welsh Government implemented Schedule 3 of the Flood and Water Management Act 2010. This places a statutory requirement for SuDS in new developments over 100 m² and provides a set of statutory standards for design, construction and operation and maintenance. The Welsh Government are undertaking a post implementation review of Schedule 3. Commissioned research was carried out in autumn 2022 but outcomes of the review are not yet available.
- **SuDS approval bodies operate within individual local authorities but there is no nationally consistent adoption process or centralised monitoring.** Each of the 22 local authorities in Wales has a SuDS approving body (SAB) function. Each SAB must develop their own legal adoption and maintenance funding frameworks, with limited guidance. This has resulted in inconsistencies in adoption, regulation, and monitoring. Furthermore, there is no national dataset on the location and character of SuDS adopted.
- **Current policy does not support risk management authorities to retrofit sustainable drainage systems or maintain historical drainage infrastructure.** Lead Local Flood Authorities (and SABs) lack powers and funding to manage and adapt existing and retrofit infrastructure. There is no legislation and policy framework to support drainage retrofit and maintenance as part of other improvements, such as highways maintenance. Current legislation and policy frameworks do not provide clarity on the responsibility for maintenance of some culverts and watercourses.

Current policy does not clearly support retrofit or maintenance of drainage infrastructure and impermeable surfaces.

- **There are no policy mechanisms for addressing increases in impermeable surfaces in towns and cities.** This is particularly the case for unplanned impermeable surfaces which may come from paving, driveways, and highways in urban areas in the future.
- **There is some funding for local authorities and small schemes but options for financing surface water flood risk management are still lacking.** NRW launched a new small-scale retrofit SuDS grant in June 2023, funded by the Welsh Government Capital Fund. £450,000 is available in the first funding round to support feasibility studies for projects between £25,000-£40,000, with future competitive grants to support schemes.⁴⁸ However, there remain limited incentives and business models for private sector, water companies and homeowners to install sustainable drainage systems or interventions to

There are policy gaps in leveraging funding for sustainable drainage in towns and cities.

reduce surface water run-off. For many risk management authorities, small-scale projects are also currently subject to fees and complex applications which may be disproportionate to the size of development. Furthermore, there is currently no clear pathway for securing funding for long-term operation and management. Water company investment, such as Dŵr Cymru Welsh Water's 'RainScape' approach should be encouraged, and barriers to public funding for small-scale projects investigated.

Water companies are producing plans for managing drainage and wastewater.

- **The creation of draft Drainage and Wastewater Management Plans (DWMPs) will support better management of water flows.** Water companies in Wales are producing DWMPs. Plans are currently being produced on a non-statutory basis, but the Welsh Government intends to put the next round of DWMPs (in 2027) onto a statutory basis. The Welsh Government requires water companies to demonstrate how DWMPs align with the Well-being of Future Generations Act 2015 and the Environment (Wales) Act 2016. These plans could present an opportunity to promote engagement between water companies and other risk management authorities, encouraging collaboration, clear roles, and data sharing. However, there are no specific targets for risk reduction from surface water flooding.
- **Improvements to surface water mapping and modelling represent good progress in risk preparedness.** Monitoring data at local scales is important for understanding surface water flooding. Local authorities had the chance to incorporate local modelling into NRW's updated flood map for planning. However, national policy on understanding and managing surface water flooding, and commitment to awareness raising, lags behind river and sea flooding. Planned improvements to warning systems for surface water flood events must be delivered to improve household awareness and preparedness.
- **Proposed policies to manage the risk of surface water flooding to legacy coal industry infrastructure are in development (Box 9.5).** Coal tips are engineered structures comprising drainage systems with a specified design life. Tips have been assigned a rating to reflect the frequency of inspections required to monitor water and ground movement, which can be caused by surface water flooding. The Welsh Government is developing new policies to manage tip safety and new legislation is due to be introduced, subject to Ministerial agreement.

Box 9.5

Flood risk to legacy coal industry infrastructure

- Landslides on coal tips are a known hazard in Wales. A major slope failure occurred at Llanwonno tip near Tylorstown in South Wales after heavy rain during Storm Dennis in February 2020.
- In response to the Tylorstown landslide, the First Minister of Wales established a Coal Tip Safety Taskforce.
- This programme of work has identified nearly 350 sites at higher potential risk with more than 90% in the South Wales Valleys. Welsh Government has commissioned the Coal Authority to undertake regular inspections of all higher-rated tips.
- The Welsh Government has provided £44.4 million in capital funding for coal tip maintenance between 2022 and 2025 and is also funding technology trials at more than 70 suitable higher-rated coal tip sites. These aim to identify technologies that could contribute to the safe and effective management of disused tips.
- Subject to Ministerial agreement, the Welsh Government will introduce a Bill on Disused Spoil Tip Safety in the third year of the government's legislative programme

2023. Stipulations are set to include a new hazard assessment approach, which considers the full range of ecological impacts and receptors, a new management regime including management plans, inspections and maintenance requirements.

- A climate resilience task and finish group is also being established to integrate climate change into management plan for legacy coal industry infrastructure.

Source: CCC (2021) CCRA3 Technical report; Welsh Government (2023) Coal Tip Safety; Welsh Government (2023) Response to the report on regulating coal tip safety in Wales.

(c) Outcome 3: Long-term, sustainable, coastal erosion management plans

Plans to adapt to coastal change in Wales are partially in place.

There are **partial policies and plans** in place to prepare and adapt towns and cities to the risk of coastal change in Wales. Policies for ensuring sustainable coastal management are only partially in place and plans to manage long-term change are not statutory or guaranteed funding.

- **There is no statutory legislation and regulation for shoreline management in Wales.** Four Shoreline Management Plans (SMPs) cover the entire Welsh coastline. SMPs describe how the coast will be managed over three time periods to 2105.* There are four approaches which can be applied to SMP policy units for each period: 'hold the line', 'advance the line', 'managed realignment' and 'no active intervention'. The Welsh Government's FCERM policy states that coastal risk management authorities should consider how to implement a future change in management approach before it is included in SMPs. SMPs are not statutory, which means it is difficult to monitor their delivery or guarantee their funding, and there is no clear mechanism to regulate how changes to the plans are considered. Furthermore, the roles and responsibilities and co-ordinating governance of different landowners are not clear in current FCERM policy and may not feed into SMPs.
- **Natural Resources Wales has led a project with the Coastal Groups to refresh the SMPs and produce updated Supplementary Guidance.** This guidance supports the maintenance and delivery of the plans to complement the original guidance from 2006. Phase 2 of the refresh is ongoing. This will populate Action Plans for each SMP. Updated SMP policies and actions must be delivered with a long-term view that considers how boundaries and catchments may change under future conditions. Future policies for shoreline management may not be appropriate to protect communities and achieve the Well-being of Future Generations Act goals. This is recognised in the Prosperity for All progress monitoring, which highlights that guidance will support risk management authorities to implement changes in SMP policies (guidance will support in implementing a change to 'managed realignment' and 'no active intervention' policies specifically), as well as consider wider coastal change.
- **Improvements to the evidence-base must feed into SMP action plans as part of an overarching vision for adaptation monitoring.** There is currently no consistent adaptation monitoring across the coast which includes all actions, such as those implemented by private landowners, alongside the delivery of SMP policy. Further evidence for assets at risk should continue to be incorporated into SMPs, with risks to infrastructure, such as historic landfill sites (Box 9.6), included. Policy frameworks for community engagement

* SMP Epochs are: Short Term 2005-2025; Medium Term 2023-2055; and Long Term 2055-2105.

Roles and responsibilities for the diverse landowners at the coast are not clear in current policy and plans.

and co-development of policies are not yet clear but will be key to work with communities towards coastal adaptation (see Chapter 12).

- **Guidance for flood and coastal erosion risk management authorities in Wales has been updated with more recent climate change projections for sea level rise but not wave climate.** This guidance updates sea level rise climate change allowances to reflect more recent UKCP18 climate projections. Stormier conditions and higher energy waves can result in more loading on the coastline and coastal defences and wave climate projections should be monitored in future.
- **The Welsh Government has committed to funding for coastal assets through the Coastal Risk Management Programme (CRMP) but long-term resource commitments for community support are missing.** This provides funding to local authorities for coastal management in line with SMP policies. The CRMP was set up in 2016 and closed to new projects in 2023. Under the programme, the Welsh Government provides 100% funding to local authorities for project development and 85% of construction costs, via increases in revenue funding. Local authorities pay for works by borrowing from the Public Works Loan Board or using their capital reserves.³⁷ However, there is no strong commitment from central Welsh Government to provide sufficient and long-term resource to support relocation, demolition, and adaptation for at-risk communities.
- **There is increasing support for coastal adaptation planning, habitat restoration and nature-based solutions but no clear delivery framework.** NRW is working on coastal assessments at sites which have failing assets, intertidal habitat creation potential, poor cost-benefit ratios and Shoreline Management Plan (SMP2) policy changes. Nature-based solutions and nature recovery form a key theme of this work, but there remains no clear delivery framework, standards or legislation for nature-based coastal protection. Coastal adaptation and managed realignment are also impacted by other competing and poorly aligned legislation (including Marine Licensing, Public Rights of Way, Highways and Habitat Regulation). Overlaps between these legislations should be reviewed.

Box 9.6

Landfill sites at risk of coastal erosion and flooding

In 2018, Natural Resources Wales conducted an assessment of flood risk to landfill sites in Wales and identified sites considered to be at risk from coastal erosion, for example in areas around the Bristol Channel. NRW has also mapped historic landfill sites, allowing those at risk of coastal erosion and flooding to be identified. This has helped to identify areas of shoreline frontage for 'hold the line' policy to minimise risk of contamination.

NRW are also undertaking an exercise to identify landfill sites of particular impact on Marine Protected Areas and to identify measures to prevent or mitigate adverse impacts.

Source: Welsh Government (2022) *Prosperity for All: A Climate Conscious Wales, Progress report*; NRW (2023) *Shoreline Management Plans*.

- **The Welsh Government has established a Wales Coastal Monitoring Centre (WCMC) to provide coastal authorities with consistent monitoring and evidence.** The centre is managed by a consortium of local authorities and the Welsh Local Government Association (WGLA), and the Wales Coastal Group Forum (comprising coastal groups, NRW, WLGA, National Trust and Network Rail) acts as an advisory panel. The National Coastal Erosion Risk Map (NCERM) is managed by the UK Environment Agency. NCERM is

currently undergoing updates which include projections that take account of future climate and sea level rise scenarios, and a digital platform for the risk maps and SMPs, which should be available at the end of 2023.

(d) Outcome 4: Urban heat risks to towns and cities are managed

The Welsh Government does not have robust policies in place to adapt to urban heat island impacts.

There are **insufficient policies and plans** in place to minimise urban heat island impacts. While there are some emerging plans to increase urban greening, Welsh Government policy does not have a vision for monitoring and regulating urban heat risks at the national scale.

- **There is no clear legal requirement to protect and enhance public green and blue space.** Planning Policy Wales refers to the need for the planning system to allocate land and water resources for recreation and encourage development which integrates conservation. [Technical Advice Note 16](#) (TAN 16) sets out guidance for Open Space Assessments and [TAN 5](#) provides advice about protecting biodiversity. However, neither national policy nor this accompanying guidance prescribes standards of provision and quality of green space in towns and cities. There is no statutory requirement for local councils to run and manage public parks. Urban street trees also lack statutory protection, with only trees specifically listed by a tree preservation order legally protected.
- **Funding commitments are required to maintain parks, trees and green spaces, without risks of stop-start investment.** While the Welsh Government has introduced targets for woodland planting, there are no targets or funding streams for trees in urban areas. This will require more secure resource to local government and communities than is currently planned. Options for financing some of the wider benefits of green space and green design – including physical and mental health, recreation, education – may provide an opportunity to subsidise green spaces.
- **Green Infrastructure Assessments are required to inform Development Plans but there are no clear legislative standards or targets.** These assessments can enable better planned and targeted urban greening. However, there are no accompanying mandatory targets for biodiversity and nature gain, and they lack guidance to ensure that interventions are ecologically coherent and of good quality. Current plans lack frameworks for monitoring and evaluation to help build a picture of whether measures are successful.
- **There are no policy mechanisms to mandate green infrastructure in new and retrofit development.** New developments are not required to install green infrastructure, such as green roofs and street trees. There is no legislation or policy to encourage retrofit greening and street trees by mandating assessments during other maintenance (e.g. highways) works.
- **There are no national-level resilience standards or overarching vision for adapting to urban heat risks.** Furthermore, there are no accompanying standards for building fabric, managing heat from traffic and urban surfaces, or standards for monitoring urban heat risk.
- **Data collection on urban heat impacts and adaptation uptake is not sufficiently included in current plans.** Mandatory monitoring and reporting of green infrastructure within urban areas would improve ability to track and understand their effect on heat risks, as well as possible trade-offs. NRW's assessment of urban trees is a positive monitoring initiative. Current policy frameworks are not sufficient to support local authorities in reporting

Green Infrastructure Assessments are required to inform spatial planning but have no clear standards or targets.

Plans for urban environments do not have a vision for managing and monitoring urban heat.

and evaluating urban heat risks and adaptation interventions, which requires co-ordination across stakeholders, including developers.

(e) Outcome 5: A planning system which prioritises future climate resilience

There are **insufficient policies and plans** in place within Wales's planning system to enable adaptation in towns and cities. Key policy milestones are missing or outdated, and the landscape-scale approach of Planning Policy Wales is not matched with specific mechanisms for promoting adaptation on the ground.

Spatial planning policies are outdated and not sufficiently robust to enable adaptation in towns and cities.

- **Current guidance to restrict planning in the floodplain is outdated and does not consider climate change.** The current [Technical Advice Note 15 \(TAN 15\)](#) for planning in areas at flood risk is out of date.⁴⁹ An updated TAN 15, with more stringent risk assessments which consider climate change, was due to be introduced in December 2021. It was delayed after local councils raised concerns that such restrictions could be in opposition to growth and development in some areas. TAN 15 was redrafted while authorities updated their flood risk assessments and has gone through consultation again. It has suffered further delays and is not expected until later in 2023. During this time, while it is recommended that planning applications use the updated flood map for planning, permitted development is still rooted in the outdated TAN 15.

Planning guidance for new development at flood and erosion risk is outdated and does not consider climate change.

- **There is no clear regulation of spatial planning in areas at coastal erosion risk.** The TAN 15 currently in place (from 2004) does not specify that development should be avoided in areas at risk of coastal erosion or ensure that appropriate risk management authorities are consulted. The proposed updates to TAN 15 include this guidance but do not mandate the use of erosion risk mapping. Local authorities do not have to designate areas at risk nor link these to Local Development Plans. In 2022, the Welsh FCEC proposed that such areas should be identified within Local Development Plans.

- **There is no policy mechanism to retrofit green infrastructure in Welsh planning policy.** The mandating of SuDS through Schedule 3 and Green Infrastructure Assessments for Development Plans are good progress. However, both frameworks are targeted at new developments, with a lack of plans for retrofitting existing areas in towns and cities, or standards for retrofit infrastructure.

There are no national targets or regulation which require local plans to consider adaptation retrofit.

- **Mandatory SuDS and guidance for Green Infrastructure Assessments for new developments are promising but there are inconsistencies in their adoption and maintenance.** Mandating SuDS on new developments should help to meet targets for surface water run-off and quality. However, there are currently no overall statutory target standards for the quality and continued maintenance of adaptation interventions, nor monitoring or evaluation of their impacts and benefits.

- **There are no overarching national targets for embedding adaptation in planning and no mechanisms for monitoring delivery of adaptation interventions.** There is a lack of mandatory reporting on adaptation within the planning system and current plans lack a clear approach to monitoring and evaluating green infrastructure and other interventions. Such monitoring would require data sharing across actors and a clear governance framework for this does not currently exist.

Current policy mechanisms provide limited incentives for developers and landowners to incorporate adaptation.

- Incentives for developers and landowners to install green infrastructure and plan for future climates lack ambition.** There is limited financial incentive for developers to include sustainable drainage and green design beyond that required to reach statutory SuDS standards. The Welsh Government will likely be required to provide subsidies and incentives for cross-sector collaboration needed to bridge the adaptation gap. Incentives could focus on the wider benefits of green infrastructure.

(f) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for towns and cities (Table 9.2).

| Table 9.2 Recommendations | | |
|--|--|--------|
| Primary responsibility | Recommendation | Timing |
| Finance and Local Government; Climate Change | Planning policy should be reformed to ensure that climate resilience is a priority, with mandatory adaptation consideration for all climate risks on built-environment projects and development plans. | 2026 |
| Finance and Local Government; Climate Change | The Welsh Government should implement TAN 15 to ensure that assessments for built development include, at a minimum, a full assessment of current and future flood and erosion risk, considering climate change and adaptation measures where development is allowed to proceed. | 2023 |
| Climate Change | The Welsh Government should address the proposals from the Flood and Coastal Erosion Committee on the maintenance and monitoring responsibilities for flood and coastal risk management authorities and seek to clarify roles and legal responsibility. | 2023 |
| Rural Affairs | The Sustainable Farming Scheme should incentivise practices to manage water flow across catchments and reduce flood risk. | 2024 |
| Climate Change | The Welsh Government should respond to the recommendations for the review of the implementation of Schedule 3 and set out a plan to update implementation of the policy. | 2023 |
| Climate Change; Finance and Local Government | Local government SuDS Approval Bodies must be provided with a framework to report on and monitor the location, type and standard of SuDS installed in their areas. | 2024 |
| Climate Change; Health and Social Services | The Welsh Government should investigate and consult on strategy to address and monitor urban heat risks in towns and cities. | 2024 |
| Climate Change | The Welsh Government should consider making Shoreline Management Plans statutory, ensuring that the most recent erosion mapping is used and roles and responsibilities for carrying out actions and evaluation in the plans are clear. | 2024 |
| Climate Change | The Welsh Government should investigate mechanisms to leverage retrofitting adaptation measures into the built environment. This should include investigating frameworks for private funding and partnership funding to help embed adaptation during other routine work. | 2024 |

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Chapter 10

Buildings

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Introduction

Table 10.1

Progress summary – Buildings

| | Delivery and implementation | Policies and plans | Summary |
|--|-----------------------------|---------------------------------|--|
| Outcome 1: Buildings do not overheat during heatwaves | Unable to evaluate | Limited policies and plans | <ul style="list-style-type: none"> There are insufficient data on residential and non-residential overheating and several other key indicators are missing to monitor progress against this outcome. There are updated buildings regulations which address overheating in some new buildings, but there are no regulations for existing buildings and there are no policies or financial instruments to support adaptation of the building stock in Wales. |
| Outcome 2: Buildings are prepared for flooding | Unable to evaluate | Insufficient policies and plans | <ul style="list-style-type: none"> There are insufficient data to evaluate property-level adaptation to flood risk in Wales, although more households at flood risk can access multiple insurance quotes. There are no clear policy mechanisms designed to accelerate the uptake of property flood resilience measures in Wales or regulate building design. |
| Outcome 3: Buildings resilient to other climate risks | Not scored | Not scored | <ul style="list-style-type: none"> Given the uncertainty related to the climate risks to building fabric, regarding how the risks will vary over time and what an appropriate adaptation response should be, scores for this outcome are not included in this assessment. However, a recent study commissioned by the Welsh Government aims to improve the knowledge base of these hazards in Wales. |

Relevant risks from CCRA3:
Risks to health and wellbeing from high temperatures (H1); Risks to people, communities and buildings from flooding (H3); Risks to building fabric (H5); Risks and opportunities from summer and winter household energy demand (H6); Risks to health and social care delivery (H12); Risks to education and prison services (H13).

This chapter assesses progress in adapting Wales' buildings to a changing climate. Buildings should be healthy and comfortable places to spend time in all year round. This means warm in winter, cool in summer and resilient to climate hazards such as flooding. The building stock includes residential and non-residential buildings, such as commercial buildings (offices and factories) and public buildings (e.g. schools, prisons, hospitals and care homes).*

Changes to the Welsh climate will increase the severity of several important weather hazards that impact on buildings and their occupants:

* Adaptation of hospitals and care settings are covered in Chapter 11 (Health). Commercial buildings and the impacts to workers are largely captured in Chapter 13 (Business).

Changes to the Welsh climate will increase the severity of several important weather hazards that impact on buildings and their occupants.

- Higher summer temperatures and more intense heatwaves will increase the risk of overheating within residential and non-residential buildings. This can lead to health problems for people in buildings, particularly those who are vulnerable or have underlying health conditions (such as heart and respiratory conditions), and even lead to increased heat-related deaths. Overheating in buildings also leads to impacts on productivity directly (e.g. working from home) and indirectly (e.g. through poor sleep).
- Periods of more intense rainfall are also associated with warmer air temperatures throughout the year. High intensity rainfall events can result in surface water and river flooding. More frequent and intense flooding events will increase the number of properties at risk of flooding. In addition, sea level rise will increase the risk of flooding from the sea for buildings in coastal communities. Flooding can destroy or damage contents within the building and can also undermine a building's structural integrity. Flooding is already affecting properties in some parts of Wales and the number of buildings at risk of flooding is likely to increase in future (see Chapter 9).
- Changes in other hazards that can affect buildings – such as wind strength and storminess – remain uncertain. These hazards can have a significant impact on buildings.
- Some hazards impacting buildings and their occupants may become less likely in the future, such as extreme cold and snow. However, the burden of ill-health from cold will remain significant in the UK and is a priority for public health and Government action.

Risks from climate to buildings depend on several other factors.

Risks from climate to buildings depend on the type of building (e.g. single-aspect, mid-floor and top-floor flats that lack sufficient ventilation are more likely to overheat than houses), the tenure, the occupancy, the location of new and existing buildings, the vulnerability of their occupants (such as age and health) and the severity of the changes in hazards.¹ Socioeconomic factors, such as income levels or mobility of building occupants, also have a significant impact on risk levels in buildings.

Ensuring that buildings across the country are safe and comfortable in periods of weather extremes will have benefits across society. Buildings that do not overheat (now or in the future) will reduce the health burden of high summertime temperatures and will have benefits for economic productivity. Property-level flood protection will have a significant social and economic benefit due to the level of disruption flooding causes.*

For new and existing buildings, the key policy areas of planning, building regulations and property-level flood protection are devolved to the Welsh Government. Buildings are covered within Prosperity for All: A Climate Conscious Wales (Box 10.1).

This chapter focuses on actions related to the building design and operation that can help address these many climate-related risks. The indirect risks arising from the interaction of building design with other areas are covered elsewhere in this report. The efforts to adapt buildings to climate change have strong overlaps with adaptation actions in other chapters:

* Property level flood protection, whilst critical, will not by itself offer sufficient protection from flooding hazards. Property level actions will need to be integrated with wider 'settlement' scale flood defences, which are covered in Chapter 9.

The efforts to adapt buildings to climate change have strong overlaps with adaptation actions in other chapters.

- **Towns and cities.** Urban design strongly influences the climate risks faced by buildings and their occupants. Urban areas (such as large towns and cities) can be significantly warmer than surrounding countryside – particularly overnight – meaning the indoor air temperatures are also higher.²
- **Health.** Overheating in buildings can result in increased deaths and increases in the prevalence and severity of some health conditions. Some buildings are also critical to the operation of the health and social care system (e.g. hospitals and care homes) – with overheating in these buildings often impacting on particularly vulnerable people or causing stress to the operation of the health system.
- **Water supply.** Homes and non-residential buildings consume water provided through the public water system. A key action to increase resilience to future drought extremes is reducing water demand within buildings.
- **Business.** Climate change impacts on commercial buildings, such as extreme heat, can make it difficult for staff to conduct their roles. Without adaptation measures, there is a risk of resulting productivity losses.
- **Community preparedness and response.** This chapter covers ensuring local heritage, including different types of heritage buildings, is conserved under a changing climate.

There are two additional policy goals for buildings relevant to adaptation efforts:

Decarbonisation policy and building safety are two important goals for buildings in addition to adaptation.

- **Decarbonisation.** Policy to reduce emissions from buildings focusses on reducing energy demand and replacing fossil fuel fired heating systems with low-carbon ones. The decarbonisation of the building stock should be done in an integrated way taking into consideration overheating and indoor air quality risk. This avoids potential unintended consequences such as making homes more airtight to improve energy efficiency, which can degrade indoor air quality and potentially increase overheating risk.
- **Building safety.** Another key policy objective is building safety. This means, in the context of this chapter, ensuring that buildings do not overheat, have good levels of indoor air quality, meet fire safety standards, do not have indoor moisture problems such as mould and damp and are resilient to flooding.

Box 10.1

Buildings within Prosperity for All: A Climate Conscious Wales

Commitments on buildings within Prosperity for All: A Climate Conscious Wales:

- HP2: Influence the design of homes and buildings to protect them from the impacts of climate change.
- HP3: Improve measures to protect homes and communities from the risks of flooding.

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for All: A Climate Conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress towards a well-adapted building stock

In this chapter we propose a monitoring map (Figure 10.1) of the key outcomes, enablers and policy actions needed to ensure that buildings in Wales are fit for now and the future, including being resilient to future climate extremes.

Buildings should not overheat during heatwaves, should be prepared for flooding and should be resilient to other climate risks.

There are three top-level outcomes that need to be achieved to ensure buildings are resilient to the range of climate impacts that they face:

- **Buildings do not overheat during heatwaves.** This requires that new buildings are built to meet a robust standard on overheating and existing buildings that are vulnerable to overheating are retrofitted with (primarily passive) cooling and insulation measures where necessary. Beyond the properties of the building, residents and occupants of buildings should understand how to manage internal temperature effectively and take appropriate actions during heatwaves.
- **Buildings are prepared for flooding.** New and existing buildings, in areas of flood risk, should have the necessary property-level flood resilience (PFR) and resistance measures installed. Flood-resistant construction, such as flood doors or air brick covers, can prevent water entering buildings up to depths of around 0.6 metre.³ Flood resilience measures aim to minimise damage when a building is flooded. This includes use of resilient building material such as concrete and tiled floors, waterproof plaster and raising electrical sockets. These measures increase preparedness to flood events, minimise the damages when flooding occurs and increase the ability of occupants to recover quickly after flooding.
- **Buildings are resilient to other climate risks.** Beyond overheating and flooding, additional direct and indirect risks to buildings are likely to increase over time. These include subsidence due to drought and dry soil, or structural damage due to high winds. At present, little is known about how climate will affect these risks.⁴ Further research is required to understand the extent that these risks will change in future climate scenarios, the household costs for damage associated with these climate hazards and the most appropriate policy response. Modelled estimates show that climate change is likely to reduce the burden of cold-related mortality (connected to cold buildings), however the overall burden remains high, even to the end of the century, and population aging is likely to offset some of the benefits from warmer winters for cold-related mortality. Policies to improve energy efficiency and reduce winter fuel poverty are therefore still required.

Enabling factors that need to be in place to deliver outcomes are wide-ranging.

Enabling factors that need to be in place to deliver these outcomes are wide-ranging, from ensuring private funding and investment in building retrofit, to education and awareness about climate risk and adaptation strategies:

- **Governance.** Ensuring policies for buildings decarbonisation include climate adaptation is a key priority, especially given the risk of increased energy efficiency standards potentially exacerbating the risk of overheating and poor indoor air quality. There is also a need for enforcement of the planning system to ensure that any building in areas of flood risk considers appropriate property-level resilience measures. The planning system can

help ensure that development at future risk is constructed and designed with adaptation measures, as discussed in Chapter 9 (Towns and cities).

- **Funding and investment.** Most of the investment in adaptation measures for the building stock will be private. Low-cost finance, which enables households and businesses to install adaptation measures, is needed. Finance can be accessed through instruments such as green mortgages, property-linked finance and flood insurance.
- **Education and awareness.** High levels of awareness of climate risks and adaptation actions amongst the public would ensure that people know how to prepare buildings for, and behave during, extreme weather events. Occupants and residents of buildings need to know how to operate and manage building temperatures.
- **Research.** Additional research on heat thresholds, overheating, adaptation options and how to retrofit buildings to achieve co-benefits across energy efficiency, thermal comfort, air quality and ventilation would help target action and understand synergies and trade-offs better.
- **Data and monitoring.** There is currently a lack of large-scale monitoring of overheating incidences and flood risk across the building stock. Without monitoring, people may be unaware that there is a risk that they should be mitigating.
- **Skills and construction.** The construction and engineering industry are key actors enabling property flood resilience (PFR) and widespread understanding and skills in this industry are key. Professional standards are important to this. For example, the PFR Code of Practice was developed in a collaborative project by the Construction Industry Research and Information Association (CIRIA), and the Chartered Institute of Water and Environmental Management (CIWEM) is involved with PFR industry training. There is also a need for building control officers to have the skills to check that regulations are being met.

We identify a number of policy milestones that would be required to help deliver the climate resilience outcomes and put in place the set of wider enabling factors:

Building regulations and the planning system are the Government's key levers for ensuring that new buildings are built to a high standard and have limited overheating and flooding risks.

Financial mechanisms should be in place to support building-level adaptation investment.

- **Legislation and regulation.** Building regulations and the planning system are the Government's key levers for ensuring that new buildings are built to a high standard and have limited overheating risks (including under both current and future climate conditions). Regulations and policy to help adapt existing buildings are also needed. PFR measures can be installed by multiple actors, including through government-funded local council schemes. Regulation and guidance are required to ensure the long-term maintenance and quality of installations and the PFR industry, with building-level surveys a regulated part of the installation process. Building regulation should require PFR in new buildings in areas at flood risk.
- **Financial instruments.** Mitigation packages for adapting to overheating risks can come with a high cost, although there are also several low-regret, low-cost options. Funding mechanisms should be put in place by the Government to support private and public investment in building-level adaptation; this is particularly important for vulnerable private households. The biggest role for public funding is expected to be supporting reduced overheating risk as a co-benefit of investment in greenhouse gas emissions reductions through energy efficiency improvements to buildings. Access to

affordable insurance is required for quick and effective recovery from flooding events. Finance mechanisms should consider socioeconomic and vulnerability characteristics of building stock and building occupants in the allocation of post-event grants.

- **Standards.** There are standards for building health and safety (such as the Welsh Housing Quality Standard and Housing, Health and Safety Rating System) that should include consideration of overheating. Standards for new and retrofit PFR are key to ensuring a good quality market and installation industry. Standards should consider resilience as well as resistance measures to ensure new buildings are capable of dealing with being flooded should resistance measures fail.
- **Information and reporting.** Information and guidance to homeowners and building occupants for overheating and flood risk is key to enable them to use buildings effectively and reduce risks. Homeowners should be able to check their flood risk and access information about how to prepare their homes for flooding and other climate risks. This could be via mechanisms similar to EPCs. Organisations should produce adaptation strategies, planning for at least 2°C global temperature rise, outlining actions to be taken and improving knowledge. Local engagement is needed to trigger behavioural change at the household or building level.

Information and guidance to homeowners and building occupants for overheating and flood risk is key to enable them to use buildings effectively and reduce risks.

Contextual factors can influence vulnerability to climate hazards and ability to respond to them.

Contextual factors have a significant impact on adaptation outcomes in the building and how the outcomes are distributed across society. Factors such as building type, location and condition, occupant age, health and income level, and even social networks can influence vulnerability to climate hazards and ability to respond to them (Box 10.2).

Box 10.2

Contextual factors

Contextual factors in buildings – relating to hazard, exposure and vulnerability – have a significant impact on the outcomes and how they are distributed across society. This box presents available data and evidence regarding some important factors for the UK or Wales.

Type of building. Flats often represent the type of building most at risk of overheating compared to other types of buildings. Modern, urban flats often have high levels of glazing with little shading and limited natural ventilation and are single aspect and many have no easy access to outdoor green space. Multi-tenement flats can also be hard to alter given that the agreement of all households is needed to make changes. There is also the difficulty in attributing costs and benefits of measures to each flat. In 2021, 12.5% of households in Wales lived in a flat, maisonette or apartment.⁵ Other types of building, such as schools, prisons, care homes and hospitals, are occupied by people that may be more vulnerable to climate risks.

Tenure and occupancy. Tenure is important for considering barriers and incentives to climate change adaptation and mitigation measures. A person in rented accommodation is more likely to be in fuel poverty, which may mean they have limited resources for measures such as energy efficiency and property-level adaptation. A person living alone, especially if they are vulnerable, may also be at greater risk of climate impacts. Since 2011 there has been a decrease in the proportion of households in Wales owning their accommodation (66.4% in 2021 compared to 67.8% in 2011) and an increase in people renting (33.5% in 2021, up from 30.6% in 2011).⁶ The number of people living alone in the UK has increased by 8.3% between 2011 and 2021.⁷

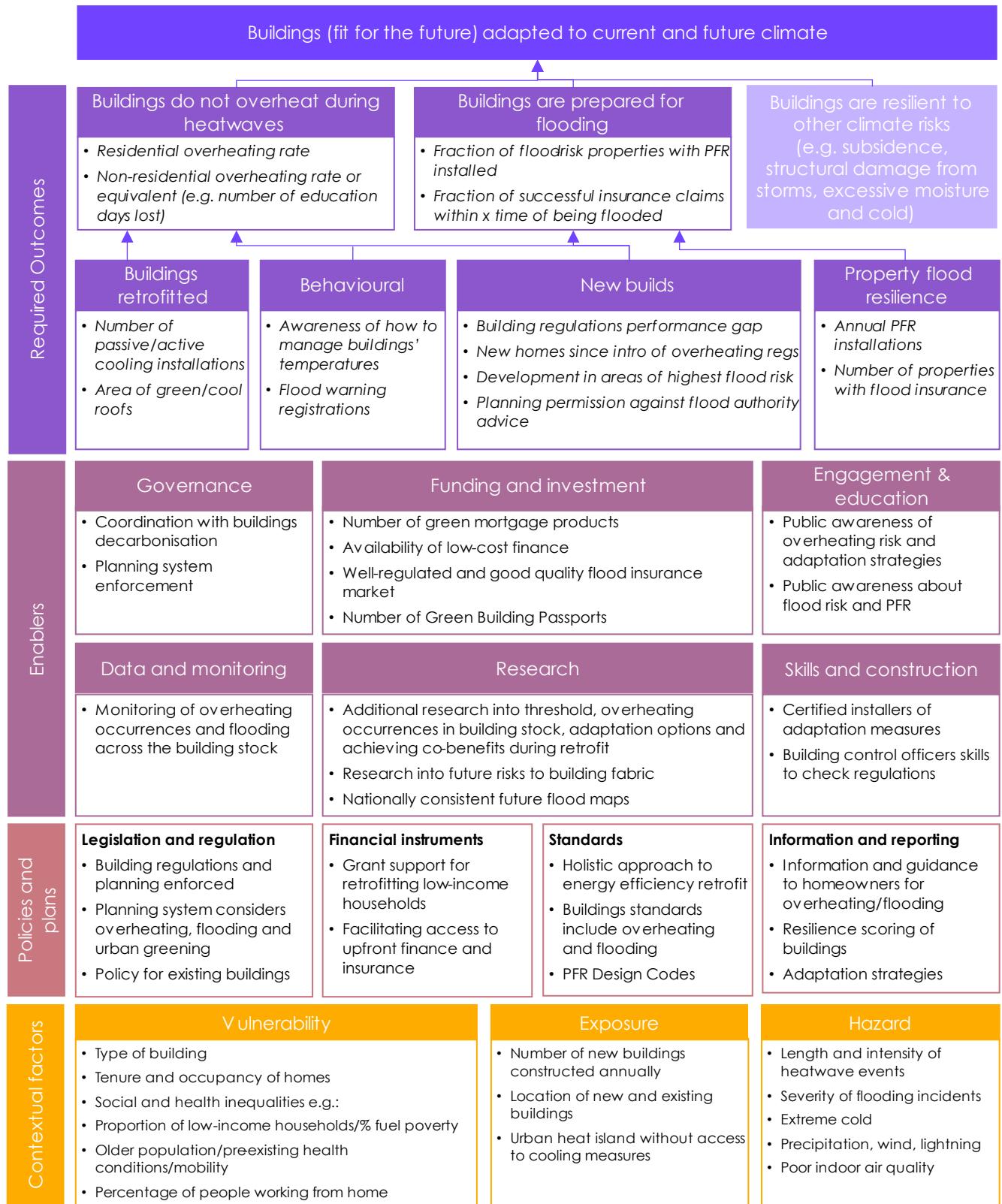
Proportion of people working from home. There have been increasing numbers of people working from home (from around 5% working exclusively from home each week before the COVID-19 pandemic to around 14% in May 2022).^{8,9} In May 2022, 24% of workers were hybrid working. This may increase the exposure of much of the population to high

temperatures during the daytime. One consequence of a shift to people working from home could be a greater productivity impact of summertime overheating.

Income and vulnerability. Income levels are one means of assessing the adaptive capacity of a population to respond to climate hazards such as heatwaves or flooding. People with lower incomes or households in fuel poverty may find it more difficult to adapt their homes. Studies have shown that there are many regions in the UK which have high levels of exposure to climate risks and where income levels are below average.^{10,11} In 2021, there were an estimated 14% of households in fuel poverty in Wales, up from 12% in 2018.^{12,13}

Other social and health inequalities. The UK population is growing and growing older, increasing the demand for housing. As well as age, underlying health conditions and mobility can impact a person's risk level. These are discussed in more detail in Chapter 11.

Figure 10.1 Monitoring map for buildings



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Buildings do not overheat during heatwaves

We are **unable to evaluate** overall progress towards adapting the building stock in Wales for the current and future climate. There are insufficient data on residential and non-residential overheating.

There are insufficient data on residential and non-residential overheating.

- **Data on overheating in residential buildings is very limited.** There is no regular data collection to monitor overheating rates in residential buildings nor data on the number of passive cooling measures installed. Individual studies can provide some indication of the proportion of buildings which are overheating, but we are unable to assess whether this is changing over time.
 - Recent research carried out by Arup for the CCC provided further modelled evidence that a proportion (24%) of the residential building stock across Wales, Midlands, Northern England and Northern Ireland is currently overheating. This was based on the CIBSE TM59 criteria for bedrooms which are difficult to pass. The proportion overheating was estimated to rise in these regions to 100% in both 2°C and 4°C warming scenarios.¹⁴
 - A recent study for the Welsh Government found that there has been increased incidence of summertime overheating in a majority of dwellings across Wales.¹⁵ The best performing dwellings were pre-1919 dwellings and dwellings with solid stone walls. The poorest performing were post-1990 dwellings, flats and properties with internal wall insulation.
- **Data on non-residential overheating are not available.** There are no available data on overheating in schools. Some monitoring is happening in prisons, but not consistently across all locations.
 - The Ministry of Justice (MoJ) is currently monitoring temperature, humidity and carbon dioxide levels in a sample of prisons of varying building archetypes (age, condition, building fabric). There are plans to extend the project to other locations and types of prison in 2023 to gain a better understanding of the extent of overheating and assess possible interventions.
- **Several other key indicators are missing to monitor progress against this outcome.** Additional indicators for this outcome sit in the third row of the monitoring map (Figure 10.1): the annual number of cooling measures installed in homes, area of green roofs, awareness amongst the public about how to manage internal temperatures, and the in-use performance of new-build homes passing Part O of building regulations. There are no datasets for Wales for most of these indicators.

(b) Outcome 2: Buildings are prepared for flooding

There are no datasets which monitor progress in installations of property-level flood resilience.

The score for delivery and implementation of this outcome is **unable to evaluate** because data on property level flood resilience installations and successful insurance claims are not available.

- **The total number of buildings at risk from flooding is around 294,000 and this is likely to increase in the future.** Around 37% of the total are at high risk of river, tidal or surface water flooding. The majority of risk is within the residential building stock, with approximately 11% of Wales's residential housing stock at flood risk.¹⁶ Climate change projections suggest that the number of residential and non-residential buildings at significant* risk will increase by around 16% under a 2°C warming scenario, with low population growth and current levels of adaptation by 2050. Under this scenario, the number of buildings such as schools and hospitals at significant risk are also expected to increase, by 14% and 4% respectively.¹⁷
- **Flooding is already affecting parts of Wales, with 1,476 properties flooded in 2020 in Rhondda Cynon Taf following Storm Dennis.** In February 2020, there was a flooding incident in the town of Pontypridd and the Rhondda valleys, during Storm Dennis. The estimated cost to infrastructure was £60 million. In the Rhondda Valleys, there were further flooding incidents in June 2020, with 18% of survey respondents reporting they were flooded both times. 44% of respondents in Rhondda had to move out of their house due to the damage and many had not moved back in several months later at the time of the survey. 73% of respondents in Rhondda and 87% in Pontypridd said they had difficulty getting hold of sandbags.¹⁸
- **Data on flood risk properties with flood resilience and resistance measures are not available.** There are no centralised or consistent data on the number of properties with existing flood resilience measures or the number of new installations. Property-level measures may be installed by a range of actors, including local authorities, water companies and individual building owners. This makes centralised data collection and monitoring difficult.
- **There are some isolated examples of small-scale investment and delivery of PFR by local authorities.** For example, Anglesey invested £28,000 and Neath Port Talbot £74,000 on flood doors between 2016-2019, and 180 properties were surveyed as part of the Dinas Powys PFR scheme, after they were severely impacted by floods in December 2020.^{19,20} Vale of Glamorgan Council have since received £1.5 million funding from the Government to supply and install the measures, with the project currently under construction.²¹ However, data are lacking to assess wide-scale delivery. Furthermore, the maintenance status and effectiveness of installed measures remains unknown.
- **More households at risk of flooding can access multiple insurance quotes.** The proportion of at-risk households in the UK with recent flood claims (in the last five years) able to obtain more than 10 different quotes for insurance has steadily increased since the introduction of Flood Re[†] (which covers the whole of the UK, including Wales), from 1% in early 2016 to a high of 98% in November 2021, declining to 93% in June 2022, where it has remained

The number of households at flood risk who can access multiple insurance quotes has steadily increased since 2016.

* Properties at 'significant' risk in the Third Climate Change Risk Assessment are those in areas which, in a given year, have a greater than 1 in 75 chance of flooding.

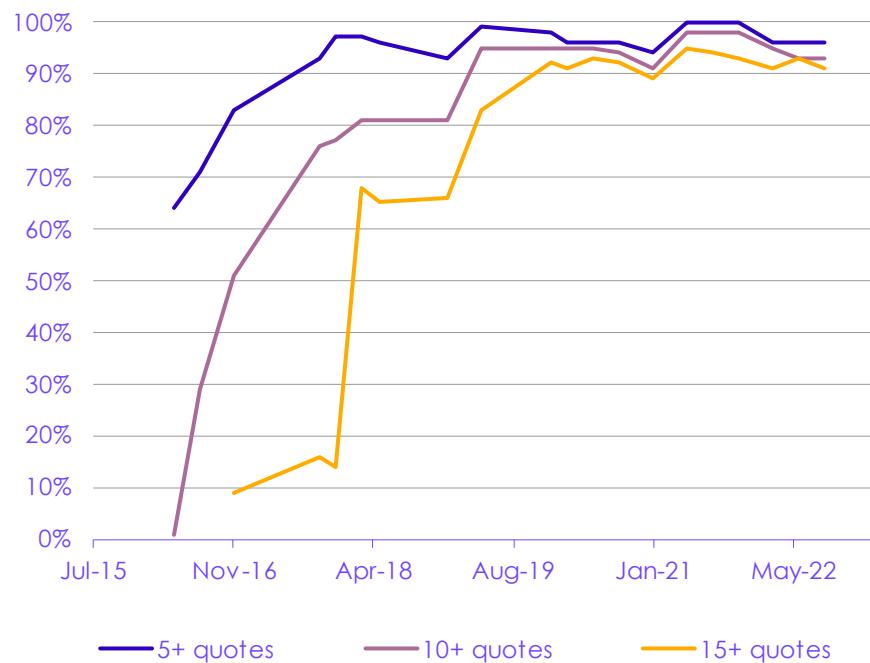
[†] Flood Re is a reinsurance company which allows other insurance companies to insure themselves against losses because of flooding, meaning more households in flood risk areas can access affordable home insurance. The pool of money to cover claims comes from policy charges and a levy from all home insurers in the UK.

steady since (Figure 10.2).²² Most homes built before 2009 – and contents for tenanted properties – in high flood risk areas are eligible.

- **There are no available data about the fraction of successful insurance claims at the national-scale and the time taken for pay-outs.** Data from insurance providers could enable better tracking of the preparedness and risk assessment of buildings. For example, data from the Association of British Insurers suggests that the average domestic flood insurance claim value in the UK 2021 was £20,094. This is in comparison to £2,771 for other domestic weather-related claims.²³ Costs of damages to homes and possessions from previous flood events in Wales varies considerably, with homes who experienced high levels of internal flooding (50-120 cm) in Dinas Powys in December 2020 reporting costs of up to £70,000.²⁴

More data are required to assess progress in building-level resilience and insurance pay-outs.

Figure 10.2 Proportion of UK households at flood risk able to obtain insurance quotes from multiple providers



Source: Flood Re (2023) Data provided on request.

Notes: Households with recent flood claims are those who have made claims in the last 5 years. The number of insurance quotes was obtained and combined across two price comparison websites. Prices fell throughout 2022, which appears to be a direct result of the General Insurance Pricing Practices reforms by the FCA, which means companies have to offer the same price to everyone.

(c) Outcome 3: Buildings are resilient to other climate risks

In addition to overheating and flooding, there are other risks to both new and existing buildings in the UK. Climate hazards which can damage building fabric include subsidence caused by drought and dry soil, excessive moisture due to flooding and heavy rain, and structural damage due to high winds. As we do not yet have indicators to assess progress against this outcome it has **not been scored**.

A recent study commissioned by the Welsh Government aimed to improve the knowledge base for these hazards (and overheating) in Wales.²⁵ Findings included:

- All locations in Wales will experience increases in indoor relative humidity in the summer which can have impacts on health and wellbeing.
- The climate vulnerability modelling indicates that there will be a modest reduction in the service life of building materials of between 1-7% and an associated increase in repair and maintenance costs, due to increases in and changing patterns of precipitation and subsequent moisture ingress.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

(a) Outcome 1: Buildings do not overheat during heatwaves

There are currently only **limited plans and policies** in place to ensure that buildings do not overheat during heatwaves. There are updated buildings regulations which address overheating in some new buildings, but there are no regulations for existing buildings and there are no policies or financial instruments to support adaptation of the building stock in Wales.

There remains no policy in place to incentivise adaptation in the existing building stock.

- **There are no policies or financial instruments to support adapting the existing building stock.** The UK Green Building Council states that 80% of those homes that will exist in 2050 are already built but there is no policy in place to incentivise adaptation in the existing building stock.²⁶ There are currently no financial mechanisms in place to support building-level adaptation investment for any buildings. This is particularly important for vulnerable private households. Green Building Passports or home retrofit plans could provide holistic guidance and help to unlock green finance, but these are not currently in use.
- **Updated buildings regulations will mitigate the risk of overheating in new residential buildings.** In November 2022 updated regulations came into force which introduced new requirements under Part O (with associated guidance in Approved Document O), to mitigate the risk of overheating in new residential type buildings.* The measures in the Approved Document are mostly applicable to limiting overheating in flats and institutional residential settings. New-build houses are only required to meet the mitigation measures if they will not have appropriate cross-ventilation, e.g. through noise or pollution issues. This update is a significant step forward in ensuring that new residential buildings are resilient to summertime overheating, although it does not include conversions from non-residential to residential and there are no similar regulations in place for refurbishments. The Welsh Government has also reviewed Part L (conservation of fuel and power) and Part F (Ventilation) of the Building Regulations, simplifying the guidance on ventilation requirements in new dwellings.
- **Social housing standards do not consistently mention overheating.** All social housing in Wales was required to meet the Welsh Housing Quality Standard by December 2020.^{27,28} This standard does not explicitly mention overheating. The Welsh Government consulted on a Welsh Housing Quality Standard 2023 (WHQS2023) to improve the quality of social homes in Wales in 2023 and is currently reviewing responses.²⁹ The Housing health and safety rating system (HHSRS) does explicitly include a requirement to establish whether tenants are experiencing excess heat.³⁰

* Such as: dwellings, halls of residence and institutional residential settings (including living accommodation for care or support of older and disabled people, due to illness or other physical or mental condition and people under the age of five).

Energy efficiency, overheating and ventilation should be considered together during building retrofit.

- **Recent research has provided more information on overheating risks.** Recent research has been undertaken to provide a broad understanding of the impacts of climate change on building fabric and indoor air quality of the Welsh housing stock (see Outcome 3 below), including risks from overheating.³¹ The research concluded that improved indoor environmental quality can be achieved through: the adoption of building appropriate cooling and drying strategies; and mitigating overheating by minimising internal and external heat gains, and managing ventilation, with an emphasis on passive ventilation strategies and increasing night-time ventilation. The second phase of research will focus on the creation of factsheets for asset managers, retrofit coordinators and social housing building professionals to help understand the impacts of climate change on building stock, highlighting known vulnerabilities, the relationship between mitigation and adaptation, and potential interventions.³²
- **Adaptation action for public buildings includes:**
 - The MoJ is updating their adaptation strategy, due to be published in 2023. It is also doing post-occupancy evaluations of new-build prisons.
 - Education Wales published a 21st Century Schools and Education Funding Programme Guide in 2018 to ensure educational facilities are sustainable, covering both mitigation and adaptation. The first phase of the programme lasted between 2014 to 2019, with a total investment of £1.4 billion, delivering 170 education projects and benefitting over 100,000 pupils. The next phase aims to invest more than £1.5 billion.³³

(b) Outcome 2: Buildings are prepared for flooding

Policies and plans do not enable action at the scale required to prepare buildings in Wales for flooding.

There are currently only **insufficient plans and policies** in place to ensure that buildings are prepared for flooding. While some schemes funded by the Welsh Government's flood risk management programme may focus on property-level resilience, there are no overarching plans for increasing uptake in Wales specifically.

- **The national strategy for flood and coastal erosion risk management (FCERM) highlights the importance of property-level flood resilience (PFR), but no plans were found to increase the uptake of PFR.** The 2019 Section 18 report* on Flood and Coastal Erosion Risk Management for 2016-2019 found that there had been limited investment and implementation of PFR and highlighting the lack of standards and accreditation of products as one barrier. Since this report, a BSI Kitemark standard for flood resistance products has been introduced. A UK-wide Code of Practice for PFR has been developed by the Construction Industry Research and Information Association (CIRIA) with input from all governments in the UK, including the Welsh Government.
- **There have been limited further mentions of PFR in the Welsh Government's policies and plans.** There is no reference to PFR in the adaptation programme and no reference to initiatives to encourage stakeholders to address building-level adaptation to flood risk. This includes a lack of direction and supporting regulatory frameworks for Lead Local Flood Authorities and water companies. Updates to planning policy (Technical

Property-level resilience is mainly addressed through local government schemes.

* Section 18 reporting is required under the Flood and Water Management Act 2010. The 2019 report was made to the Cabinet Secretary for Environment, Energy and Rural Affairs.

Advice Note 15) are currently under consultation (see Chapter 9). If introduced, they would enforce stricter regulation for building-level measures in new developments at risk.

There are no central government grants or regulations to encourage building-level uptake of flood resilience and resistance measures.

- **There is no policy to help finance PFR installation.** There are no Welsh Government grants for post-flooding repairs or PFR installation for building owners. Flood Re's Build Back Better scheme* enables homeowners to install PFR measures up to the value of £10,000 over the cost of work to repair damage, after a flood. It is too early to evaluate the uptake and delivery of this scheme. There is no comparative incentive or subsidy to support PFR installation in non-residential and public buildings. Local authorities may qualify for funding for responding to flood events under the Emergency Financial Assistance scheme.
- **Public body reporting regulations could improve information from local authorities on uptake of property-level flood resilient measures.** There is a lack of baseline data and monitoring of schemes carried out at the local authority level, which makes the adaptation gap harder to assess.
- **The Welsh Government has committed to engaging with communities and providing better information about how to prepare for, respond to and recover from a flood.** However, current policy does not focus on engaging homeowners and business-owners about PFR. Awareness-raising is key to the effectiveness of PFR. For example, Rhondda Cynon Taff council noted that during flooding in 2018/19, many homeowners did not properly utilise installed PFR.²⁰

Community engagement is key to improve uptake of PFR at the household level.

(c) Outcome 3: Buildings are resilient to other climate risks

Given the uncertainty related to the climate risks to building fabric, regarding how the risks will vary over time and what an appropriate adaptation response should be, a policy score for this outcome is not included in this assessment.

- **Research undertaken in Wales has shown that risks to building fabric from moisture, wind and driving rain are particularly associated with solid masonry walls and are likely to accelerate erosion.**³⁴ Climate vulnerability modelling of domestic buildings in Wales was conducted to gain a better understanding of the risks under future climate change from moisture, wind and driving rain. A second phase of the research is ongoing to create factsheets for asset managers and retrofit coordinators and develop a vulnerability map for all regions of Wales. This research is a positive first step to understanding the risks better and could provide insights for other parts of the UK. The study also found that Welsh building regulations and related national reference standards should address the lack of consistent messaging on the interconnectedness of climate change, building fabric and occupant health.

(d) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for Chapter 10 (Table 10.2).

* Build Back Better is a Flood Re initiative introduced following the Flood Reinsurance (Amendment) Regulations in April 2022. Customers can access reimbursement costs over and above work to repair damage and loss from flooding. Grants are paid for via the same pool of money which covers flood claims.

Table 10.2

Recommendations

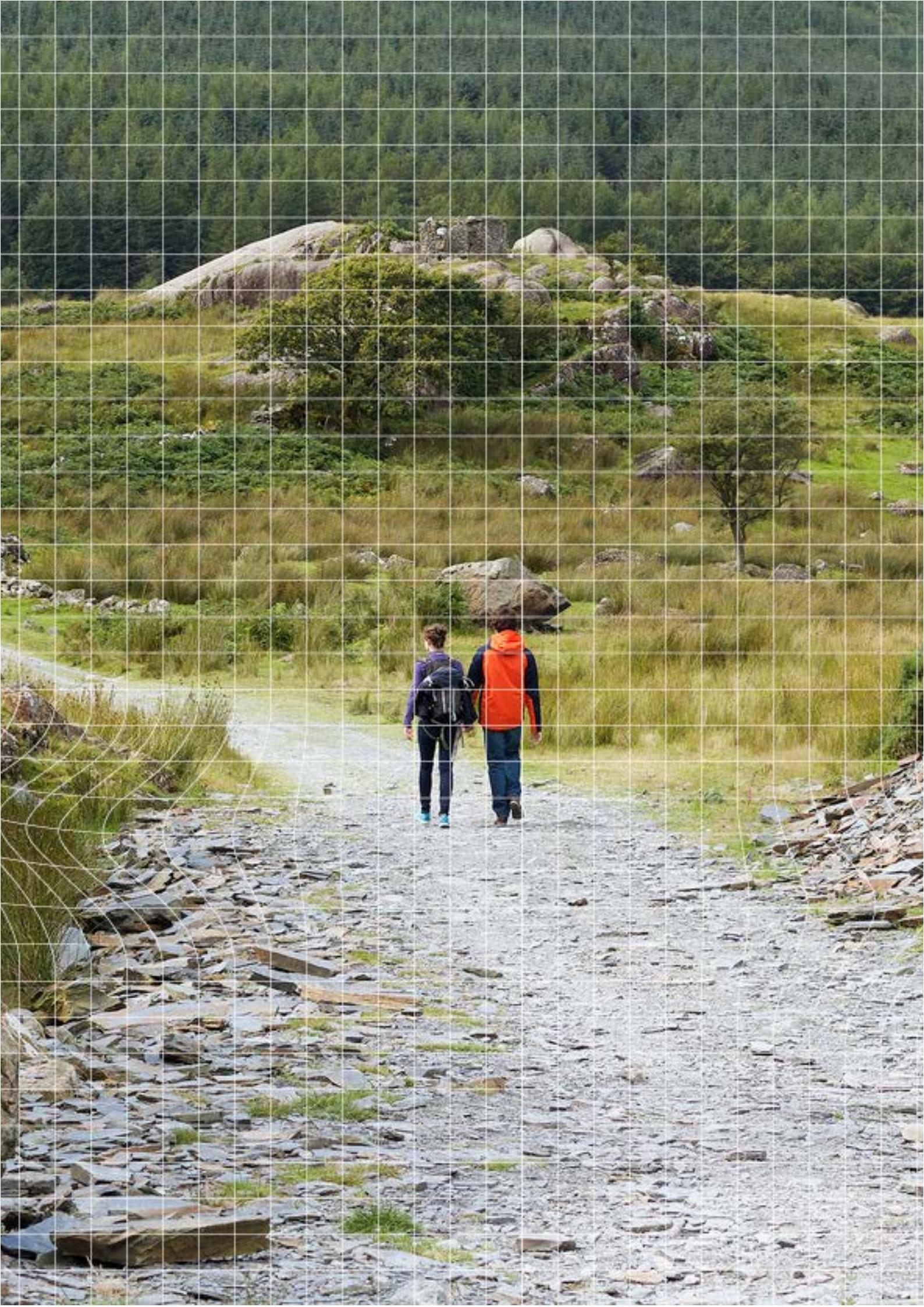
| Primary responsibility | Recommendation | Timing |
|-------------------------------|---|---------------|
| Climate Change | The Government should ensure that retrofit programmes take a holistic approach to improving dwellings' thermal, moisture and indoor air quality performance throughout the whole year and use the findings from the research to produce a holistic retrofit plan/strategy for existing buildings. | Ongoing |
| Climate Change | Building regulations suitable for refurbishments of existing buildings and conversions of non-domestic buildings to residential to minimise the risk of overheating should be brought into place. | 2023-24 |
| Climate Change | Make finance available to install proactive adaptation measures for overheating and flood resilience. | 2023-24 |
| Climate Change | The Government should investigate how to integrate plans to accelerate the uptake of property-level flood resilience in Wales into flood risk management and buildings policy, for example through regulations for new buildings and targeted funding. | 2025 |
| Climate Change | The Government should facilitate reporting on and standards for property-level flood resilience installation and property survey quality. | 2025 |

Endnotes

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Chapter 11

Health

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Introduction

Table 11.1

Progress summary – Health

| | Delivery and implementation | Policies and plans | Summary |
|---|-----------------------------|---------------------------------|---|
| Outcome 1: Protect population health from the impacts of climate change and utilise potential benefits | Insufficient progress | Limited policies and plans | <ul style="list-style-type: none"> Heat-related mortality has increased in recent years and the abundance of vectors is increasing. There are limited actions on health and well-being in the current adaptation plan and some surveillance of vector-borne diseases. |
| Outcome 2: Quality and accessible healthcare delivery during extreme weather | Unable to evaluate | Insufficient policies and plans | <ul style="list-style-type: none"> Healthcare settings are at risk of flooding, but data on disruption to health and social care services is not available. Adaptation planning is at an early stage of development and long-term funding for adapting healthcare settings is not available. There are building standards for health buildings and a health impact assessment which considers climate resilience. |

Relevant risks from CCRA3:
H1 Risks to health and wellbeing from high temperatures; H2 Opportunities for health and wellbeing from higher temperatures; H3 Risks to people, communities and buildings from flooding; H7 Risks to health and wellbeing from changes in air quality; H8 Risks to health from vector-borne diseases; H12 Risks to health and social care delivery.

This chapter covers the need for adaptation to ensure that the effects of climate change on population health are minimised. To be well-adapted to climate change, population health should be protected under current and future climate scenarios, and the health and social care system should continue to operate during extreme weather events, while also reducing emissions.

Population health, both physical and mental, may be affected by a range of climate hazards:

Extreme heat will increase risk of heat-related mortality and create stress on the functioning of the health and social care system.

- Increased frequency and intensity of extreme heat will increase people's exposure to heat stress and increase risks of heat-related mortality (death) and morbidity (disease and illness). Periods of extreme heat can also create significant stress on the functioning of the health and social care system.
- Warmer temperatures may make the UK (including Wales) more suitable for vectors of infectious diseases (such as ticks and mosquitoes). This would increase the populations' potential risks of exposure to conditions such as Lyme disease and dengue fever.¹
- A decrease in the frequency and intensity of cold weather will help to reduce the mortality and morbidity impacts of cold weather to some extent. However, this will be offset somewhat by an aging population and the annual rates of cold-related deaths are projected to remain around three times higher than those related to heat by the end of the century.²

- Other hazards such as flooding can also result in mortality and morbidity (including impacts on mental health).
- There may also be some benefits to physical and mental health from spending more time outdoors.

The risks to people's health from climate change are not only affected by the severity of the changes in hazards (Box 11.1), but also by vulnerability and exposure, such as socio-economic factors leading to health inequalities, equitable access to green and blue space, and levels of existing resilience.

Box 11.1

Changes to the climate in Wales affecting health

Analysis from the third climate change risk assessment found a number of climate hazards at a population-wide scale that will affect the health of people in Wales:³

- Higher temperatures and heatwaves causing additional morbidity and mortality (on both patients and workforce), plus impacts on infrastructure, equipment and medicines and potential increases in vector-borne diseases.
- Projections of heat-related mortality for Wales show that heat-related deaths could more than double by the 2050s. Interactions between risks from high temperatures through combined exposures from air pollution, drought and wildfires are increasingly being recognised as significant.
- Changes to rainfall patterns, resulting in more frequent and intense flooding events at some times, and water scarcity in others can have a direct impact on people's physical and mental health. Projections show an increase in the number of emergency services assets and care homes in Wales at flood risk under all future climate scenarios, with smaller increases for GPs surgeries and hospitals.

The key policy levers for adapting the health system are devolved to the Welsh Government. Health features within the Welsh Government's Prosperity for All: A Climate Conscious Wales adaptation plan (Box 11.2). There are several organisations responsible for public health and health and social care services in Wales:

Key policy levers for adapting the health system are devolved to the Welsh Government.

- **Welsh Government Health and Social Services Group (HSSG).** The overarching department responsible for supporting the Government to deliver health priorities, whilst also providing leadership to the NHS and Social Services in Wales.
- **NHS Wales Executive.** A new national support function, established in 2023, to drive improvements in the quality and safety of care.
- **NHS Wales.** The National Health Service, delivering services through seven local health boards and three NHS trusts (including Public Health Wales). Local health boards are responsible for planning and delivering NHS services in their areas. NHS trusts look after public health, ambulance services as well as cancer and blood services.
- **Public Health Wales.** The national public health agency working to protect and improve health and well-being and reduce health inequalities for the people of Wales.

Since 2020 the healthcare system in the UK has been under increasing pressure.⁴ These pressures may affect the ability of health agencies to make progress in other areas of work including climate change.

There are strong overlaps between health and other chapters, especially buildings.

The impacts of climate change to health will be somewhat determined by how well the built environment is adapted to the future climate. There are therefore strong overlaps with the Buildings chapter (Chapter 10). There are also other important overlapping areas in other chapters of this report:

- **Food.** Continued food security and safety from climate-sensitive food-borne diseases under future climate conditions.
- **Towns and cities.** Urban design, new developments, planning and reducing the urban heat island effect.
- **Communities.** At local levels, ensuring that communities are prepared for and can respond to climate shocks, helping to minimise knock-on impacts on public health.
- **Business.** Productivity losses due to the impacts from overheating on workers, both arising directly in the workplace and indirectly from disrupted sleep.

Box 11.2

Health within Prosperity for All: A Climate Conscious Wales

Commitments on Health within Prosperity for All: A Climate Conscious Wales:

- SH1: Increase understanding of the risk increased temperatures bring to public health and well-being.
- SH2: Continue tackling fuel poverty through the Welsh Government Warm Homes Programme.
- SH3: Update and revise plans and advice in line with research to increase understanding of the future risk extreme weather brings to health and social care delivery.
- SH4: Ensure climate change risk is considered in future policy development to improve air quality in Wales.
- SH5: Increase understanding of the risks from vector borne pathogens.

Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for all: A Climate conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress to climate change health impacts

Being well-adapted to climate change means that the direct impacts of changes in the UK's climate on people's health are minimised and that the delivery of health and social care through the health system is not disrupted by weather extremes.

We identify several key outcomes that need to be delivered to achieve a healthy population under current and future climate (Figure 11.1):

The impact of climate change on population health should be minimised and potential benefits realised.

Inequalities in health that increase the burden of climate change should be addressed such that the burden is reduced.

The health system should be able to provide quality accessible healthcare during and after extreme weather.

- **Protect population health from the impacts of climate change and utilise potential benefits.** The impact of summertime overheating and flood events on mortality and morbidity, including mental health impacts, should be limited.
 - Surveillance mechanisms should be implemented to properly understand any changes in the prevalence of infectious diseases that may become more widespread or established due to changes in the climate.
 - Ambient and indoor air quality levels should be improved, or at least not degraded by any actions taken to reduce greenhouse gas emissions. Actions to decarbonise and improve air quality should be aligned with adaptation objectives.
 - Explicit attention should also be given to actions which will address inequalities in health in order to help reduce the burden of climate change on the population and maximise the health co-benefits of adaptation actions across other sectors (such as adapting the built environment).
 - As well as adapting to the potential adverse effects of a warming climate, Government policy should also encourage increased use of outdoor greenspaces during warm weather which can have a positive impact on population health.
- **Quality and accessible health and social care delivery during extreme weather.** Health and social care delivery must be able to continue during extreme weather events. Primary and secondary care facilities, social care and other health settings will need to be adapted to ensure they do not overheat during heatwaves, are not at significant flood risk, or vulnerable to climate-related failures of dependent infrastructure systems. Adaptation options, focusing on health and social care organisations, can offer a targeted approach for reducing heat-related mortality in vulnerable groups. Low-regret options include: better forecasting of events, better information about (and monitoring of) risks, enhanced risk preparedness and enhanced risk response. These should be actioned alongside a wider set of adaptation actions for reducing heat exposure in buildings in general and the urban environment.

The enabling factors that need to be in place to deliver these outcomes are wide-ranging: from ensuring agency coordination, providing funding and investment in buildings, to training, education and awareness about climate risks and adaptation strategies.

Enabling factors that need to be in place to deliver outcomes are wide ranging.

- **Governance.** Appropriate cross-sectoral governance arrangements between different health and social care agencies are essential to ensure that Wales adapts to risks. Clear coordination and leadership on public health responses to extreme weather events and adaptation is required.
- **Funding and investment.** Protected public and private funding needs to be in place to adapt health and care settings, as well as funding for nationwide vector and disease surveillance and provision of local greenspace.
- **Engagement and education.** Increasing awareness levels amongst the general population, health and social care staff, and workers across local government organisations is essential. Educational needs vary among clinicians and healthcare staff. Education and engagement should cover risks to health, the costs and benefits of adaptation and the potential opportunities (e.g. from spending more time outside in nature). This can be achieved through training, risk communication, education and guidance provision.
- **Research.** A better understanding of the costs, benefits and effectiveness of interventions to reduce overheating in health and social care facilities would help health authorities to target action. There is also a need for better understanding of the interactions between heat and air pollution, and extreme events on vector breeding and disease transmission.
- **Data and monitoring.** Regular monitoring of overheating, flooding incidences and air quality levels in health and social care settings is needed. This could be built into pre-existing reporting requirements. In addition, continued and widened monitoring of those vectors and infectious disease prevalence impacted by climate change is required.
- **Skills.** The Welsh healthcare workforce needs sufficient numbers of public health professionals and staff who are able to plan for and respond to extreme weather events.

Funding, regulations, standards, adaptation planning, and guidance are some of the policies required.

We have identified the following roles for policy as key to help deliver the identified outcomes and help put in place enabling factors.

- **Funding and investment.** Continued public funding for surveillance of vectors and vector-borne diseases is needed to ensure knowledge of this risk remains up to date. Long term and protected funding, at sufficient levels, is required to adapt hospitals, care homes and other healthcare buildings to the impacts of climate change.
- **Legislation, regulation and standards.** Building regulations and standards for healthcare buildings that address overheating risk would ensure that new and refurbished buildings do not overheat. The sector regulator should regularly inspect the readiness of health and care providers to manage overheating and other extreme weather.
- **Information and reporting.** The Government should require adaptation plans for NHS Trusts and care home providers. An integrated and coordinated plan that takes account of future climate change impacts of health from pathogens would also be beneficial. The Government should ensure that the public, health workers and local authorities have appropriate guidance on heat avoidance, spending time outdoors safely, flood risks and tick safety. Further guidance should be available on how to

ensure that overheating and air quality risks are considered alongside energy efficiency installations.

Health risks will continue to be distributed inequitably with vulnerable populations and regions differentially affected unless these are considered across all policies to improve resilience to climate change.

The over-65 population is most vulnerable to health impacts from heat. People with cardiovascular and respiratory conditions also have a higher risk of adverse health outcomes, in particular to extreme heat and cold.

The risks to people's health from climate change are also affected by vulnerability and exposure such as through socio-economic factors leading to health inequalities, the location of healthcare buildings, equitable access to greenspace and levels of existing resilience (Box 11.3). Health risks will continue to be distributed inequitably with vulnerable populations and regions differentially affected unless these are considered across all policies to improve resilience to climate change.

Box 11.3

Contextual factors

Contextual factors in health, relating to hazard, exposure and vulnerability, have a significant impact on the outcomes and how they are distributed across society. This box presents data and evidence regarding some of the factors affecting vulnerability.

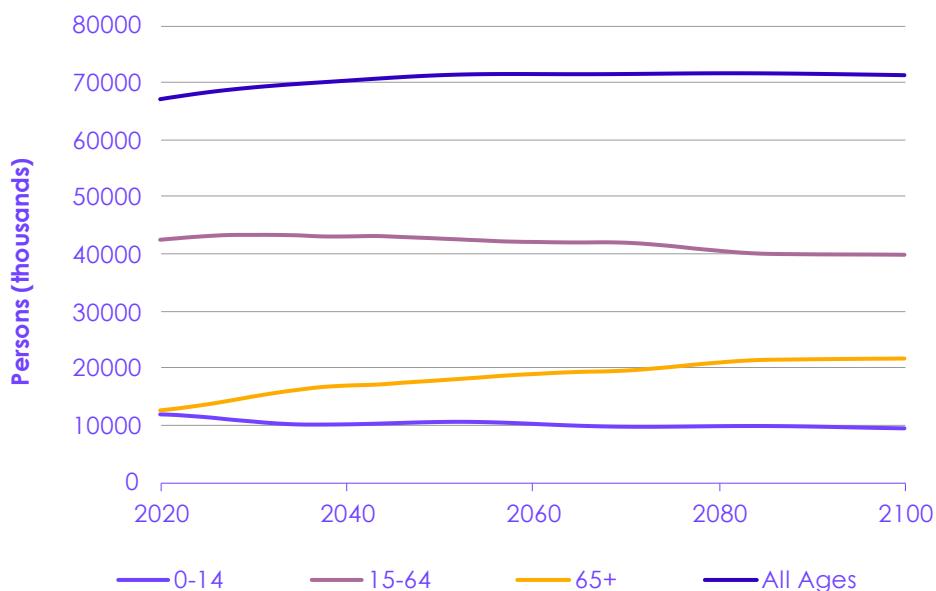
Poor quality housing particularly impacts the health of people and can exacerbate health inequality (see Chapter 10).

Deprivation level. More-deprived areas have less access to high-quality green and blue space which contributes to differing disease burdens and life expectancy.⁵ In Wales in 2021-22 11% of all adults were classed as materially deprived; this is a reduction since the last report in 2019-20 when 13% were materially deprived.⁶

Ageing population. The over-65 population is most vulnerable to health impacts from heat. The ONS' population projections for the UK show that the proportion of the population aged over-65 is estimated to grow faster than other age groups out to 2100 (Figure B11.3).⁷

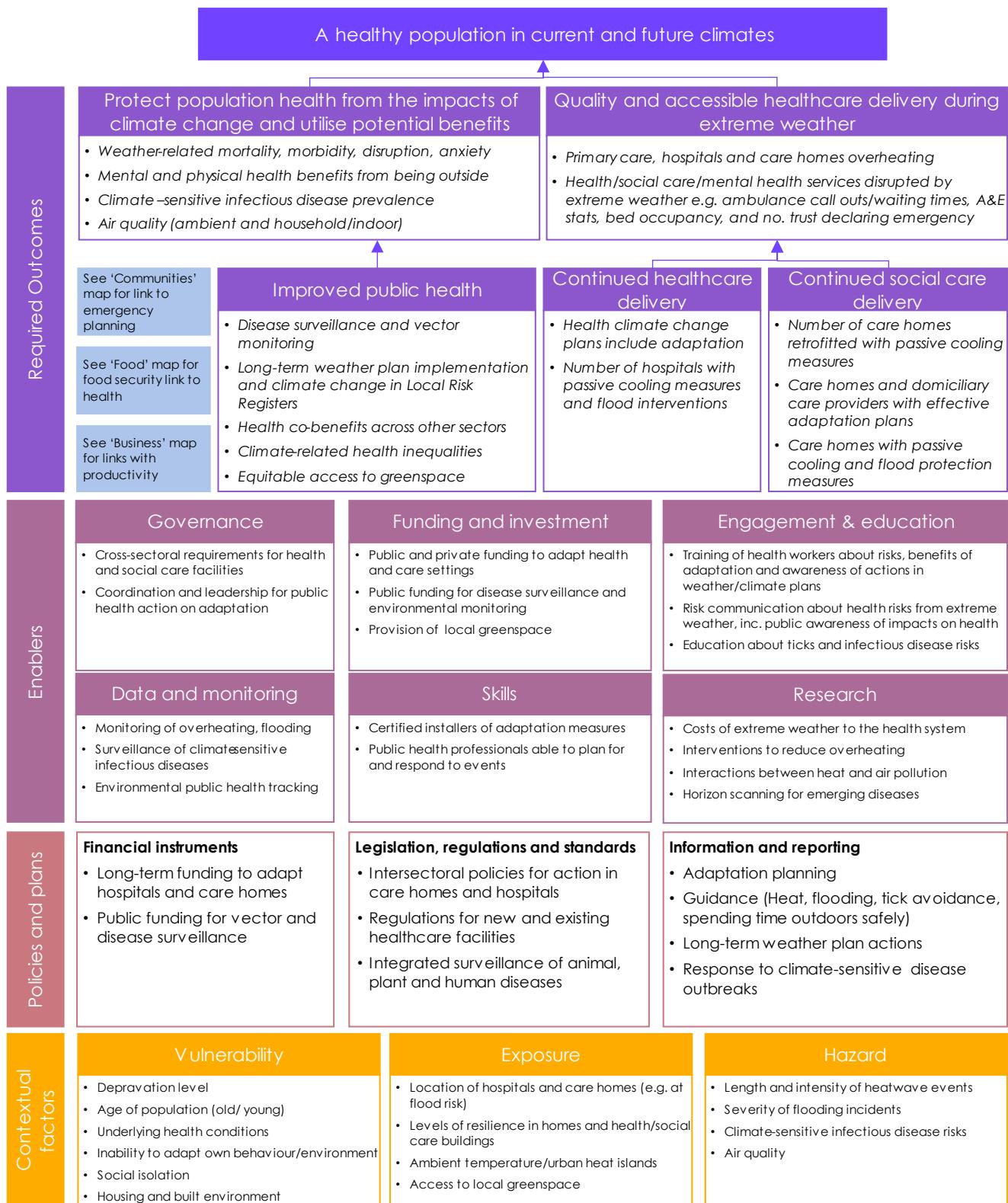
Underlying health conditions. People with cardiovascular and respiratory conditions have a higher risk of adverse health outcomes, including to extreme heat and cold. In 2021-22, 8% of adults in Wales had respiratory system complaints.⁸

Figure B11.3 Population projections for United Kingdom, by age group



Source: CCC analysis of ONS (2022) Principal projection – UK population in age groups.

Figure 11.1 Monitoring map for health



Source: CCC analysis.

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

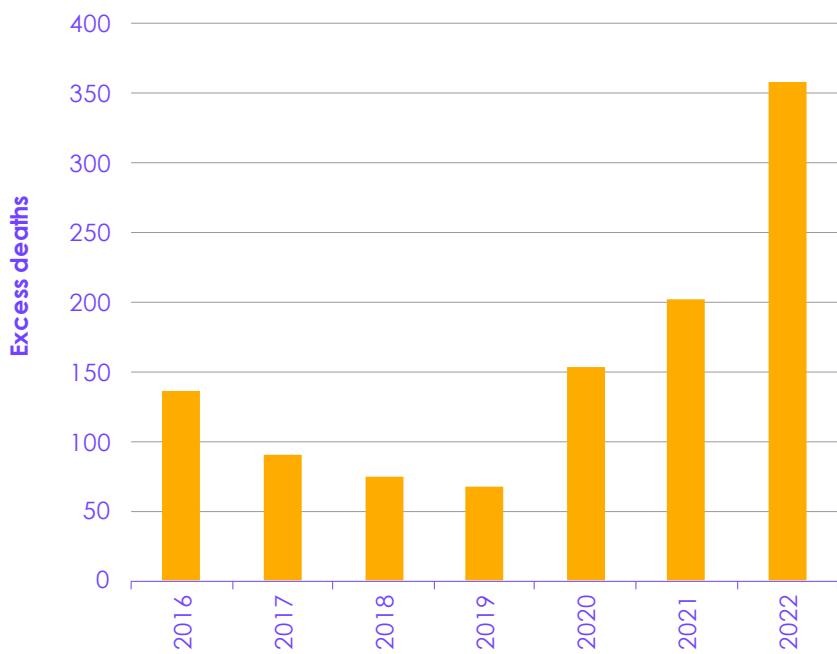
This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Protect population health from the impacts of climate change and utilise potential benefits

Indicators for this outcome show **insufficient progress** towards ensuring good population health under current and future climate. Heat-related mortality has increased in recent years and vector abundance is increasing.

- **Wales experienced record levels of heat-related mortality in 2022.** There were 358 excess deaths from people over the age of 70 in Wales during heatwaves in 2022, higher than any of the previous six years (see Figure 11.2).^{*9} This corresponded to the record-breaking heatwave experienced across the UK, with 37.1°C recorded at Hawarden Airport in Flintshire in July 2022, the hottest temperature ever recorded in Wales.¹⁰

Figure 11.2 Proportion of UK households at flood risk able to obtain insurance quotes from multiple providers



Source: ONS and UKHSA (2022) *Excess mortality during heat-periods: 1 June to 31 August 2022*.

Notes: This analysis uses the UK Health Security Agency (UKHSA) definition of a heat-period. The UKHSA (previously Public Health England (PHE) defines a heat-period in their mortality monitoring reports as either: day(s) on which a Level 3 Heat Health Alert (HHA) is issued; or day(s) when the mean Central England Temperature (CET) is greater than 20°C. In addition, the preceding and subsequent days to those identified using the threshold(s) above are also included as part of the heat-period.

* The methodology for the Welsh data differs to that used by the CCC to monitor heat-related deaths in England. Please see the heat mortality study by ONS and UKHSA for details of the different methodologies.

- **Data to track other impacts on mortality and morbidity is not regularly recorded.** There are no robust data, such as hospital admissions or GP appointments, available to monitor the impacts to health from weather events. The impacts of climate change, as well as the concern about climate change itself, are negatively affecting mental health and emotional wellbeing.¹¹ One of the greatest burdens of ill health from flooding is likely to be due to the impacts on mental health, however there is no regular monitoring of impacts. One study in England has shown that three years after being flooded, mental health impacts still existed, although were reduced.¹² Evacuation and displacement due to flooding, particularly without warning, increases the risk of anxiety and post-traumatic stress disorder.
- **Access to outdoor space is high across Wales but varies by property type.** Access to greenspace can provide important benefits including urban cooling in heatwaves, as well improvements to air quality and mental and physical health. In Wales, 91% of properties have access to private outdoor space; although this varies between social groups, household ethnicity and the type of property. It is also unclear whether the space is good-quality greenspace. 64% of flats in Wales have access to private outdoor space compared to 96% of houses.¹³ In Wales people live on average 432m from a public park, garden or playing field.¹⁴
- **Vector abundance is increasing.** Warmer weather is contributing to increases in the abundance and activity of ticks and the potential exposure of people to tick-borne diseases (such as Lyme disease and Tick-Borne Encephalitis).¹⁵ The abundance of some mosquito species (such as Aedes albopictus – a vector for diseases such as dengue fever) is also increasing; and these vectors are spreading through Europe due to warmer temperatures.¹⁶ Specific data on changes to climate-related vectors in Wales was not available.
- **Vulnerability to air quality.** The benefits of additional adaptation to target climate induced changes in outdoor air quality are likely to be low, although more evidence is needed on the interactions between heat and air pollution. Vulnerability to outdoor air pollution, measured by the total number of people living with chronic respiratory conditions (those with chronic obstructive pulmonary disease and asthma), has stayed relatively constant over recent years. There is little evidence of monitoring of indoor air quality occurring in existing homes as a regular programme of measurement.
- **Better data is needed to track flood-related mortality, and heat and flood related morbidity and disruption.** There would also be value in data to track the mental and physical health opportunities from being outside.

There is limited data available to assess progress in achieving enablers for this outcome.

(b) Outcome 2: Quality and accessible healthcare delivery during extreme weather

We were **unable to evaluate** indicators for this outcome. Healthcare settings are at risk of flooding, but data on disruption to health and social care services is not available.

- **Care homes, GP surgeries and hospitals are likely to be at significant risk of flooding by the 2050s.** CCRA3's flood projections show that across Wales, 71 care homes, 55 GP surgeries and 17 hospitals are projected to be at risk of significant river, surface water or coastal flooding by 2050s, under a low population growth, 2 degrees warming scenario (see Chapter 9, Towns and cities for further analysis on flooding).¹⁷
- **Data on disruption to health and social care services by heatwaves or floods is not available.** There is no data available to show the extent to which health and social care services have been disrupted by heatwaves or flooding. Data is available for several factors such as A&E attendance and ambulance call out statistics, but these cannot be attributed to extreme weather. However, extreme weather is having an impact on healthcare services in Wales. In 2018, flooding led to the partial closure of the hospital in Welshpool. The birth centre was temporarily closed, with cases diverted to a nearby hospital.¹⁸
- Further unavailable indicators include: the number of health and social care facilities with passive cooling measures or flood protection measures, heat management plans, or effective adaptation plans in care homes.

(c) Progress on enablers

Public awareness of the impacts of climate change on health is high. A Public Health Wales survey found that respondents think climate change will increase the spread of infectious diseases (69%); and increase levels of mental ill-health (77%) and physical illness (69%). 20% said they had already experienced ill-health caused by extreme weather.¹⁹

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

(a) Outcome 1: Protect population health from the impacts of climate change and utilise potential benefits

There are **limited policies and plans** in place relative to what is needed to ensure that population health is adequately protected from impacts of climate change. There are limited actions on health and well-being in the Welsh Government's Prosperity for All: A Climate Conscious Wales adaptation plan.

- **There is no longer-term plan for managing heatwaves or extreme weather, however advice is provided when extreme weather is forecasted.** Public Health Wales (PHW) issues advice to the public when the Met Office notifies it about a forecast of extreme or unusual weather. This is a service which runs all year round.
 - In November 2021 PHW published a series of infographics which highlighted the importance of climate change impacts on the health and wellbeing of the population in Wales, and which aim to support public bodies and businesses to take action to address any impacts.
 - In July 2022, to further support health system partners, 'Heat Health Advice' was published by the Welsh Government, which aims to be the first in a series of health-related adaptation planning tools.²⁰
- **There is some surveillance of vector-borne diseases (VBD).** The Welsh Government funds PHW's surveillance of vector-borne diseases and UKHSA currently monitors invasive and endemic mosquitoes and tests endemic mosquitoes for viruses. UKHSA also have a tick surveillance scheme, with ticks being tested for pathogens through research programmes. Having an integrated and coordinated plan in place that takes account of future climate change impacts on health from pathogens would be beneficial but does not currently exist. The Public Health Wales Communicable Disease Surveillance Centre (CDSC) is monitoring the incidence of VBD. Monitoring is ongoing at sea and airports for mosquitoes in collaboration with the association of Port Health Authorities, as well as surveillance at imported tyre companies, passive surveillance with Environmental Health and more recently at motorway service stations and truck stops.²¹ In addition, risk assessments and guidance have been produced for tick-borne encephalitis, West Nile virus, Chikungunya virus, and Zika virus since 2017. UKHSA trains local authorities on vector surveillance and has produced guidance on how to ensure wetland creation, management and expansion does not increase pathogen risk. A tick awareness toolkit for local authorities was updated in March 2022.²²
- **Welsh Government have published a plan for improving air quality in Wales.** The Clean Air Plan for Wales: Healthy Air, Healthy Wales was published in August 2020 and sets out a range of cross-sector actions to deliver improvements in air quality for public health, biodiversity and the natural environment.²³ The Clean Air (Wales) Bill will be introduced in 2023. Wildfires

(which may become more frequent under future climate change) can also impact air quality and are discussed in Chapter 2, Nature.

(b) Outcome 2: Quality and accessible healthcare delivery during extreme weather

There are **insufficient policies and plans** to help meet the key milestones required to ensure quality and accessible healthcare delivery during extreme weather. Adaptation planning is at a very high level and long-term funding for adapting healthcare settings is not available. There are building standards for health buildings and a health impact assessment which considers climate resilience.

- **Adaptation planning for the healthcare sector is at an early stage of development and actions are not scheduled until 2026.** The Welsh Government Health and Social Care Climate Emergency National Programme Board provides strategic leadership and assurance for delivery of the [NHS Wales Decarbonisation Strategic Delivery Plan](#), the [Decarbonising Social Care in Wales Route Map](#), the [Greener Primary Care Framework](#) and National Adaptation activity.^{24,25,26} Adaptation is currently at a high level but there is an opportunity to utilise the board to produce something specific for the health and social care sector. The Welsh Government should develop an intersectoral plan to address the risks of overheating and other climate risks in care homes and care facilities, including a consideration of domiciliary care, as well as individual effective adaptation plans for care homes and domiciliary care providers. The Net Zero social care Route Map sets out plans for the sector to be Net Zero by 2030.²⁷ While adaptation is mentioned in the plan (along with biodiversity), work would not start until 2026. This should be much sooner with adaptation actions integrated into the plans for decarbonisation.

The Welsh Government's national adaptation plan ([Prosperity for All: A Climate Conscious Wales](#)) includes a policy commitment to revise plans and advice in line with research to increase understanding of the future risk extreme weather brings to health and social care delivery via increasing understanding and improved contingency planning. However, there is little evidence of discourse and analysis on climate risk to health and social services in strategy or governance.

- **Public Health Wales has carried out a Health Impact Assessment on climate change, which will be published in July 2023.** The health impact assessment identifies the main health and wellbeing impacts of climate change in Wales to support action on climate adaptation. It includes an analysis of population groups who are most vulnerable to climate change as well as areas for future policy action.
- **There are Building Standards tailored for healthcare buildings which include consideration of climate resilience.** A resilience Building Note from 2014 includes the strategic approach to resilience planning for healthcare estates, procurement, design and planning, building services, and engineering.²⁸ This focuses on impacts of severe weather incidents, flood risk, coastal change, water supply and changes to biodiversity and landscape and wildfires. However, the extent of implementation and influence is not understood, although reference to it does feature in elements of health and social care planning in Wales.²⁹

- **There is limited funding for adapting healthcare settings to climate change.** Long-term funding to adapt hospitals, care homes and other healthcare buildings to the impacts of climate change is not currently available from Government. It is therefore difficult for the health and social care sector to make long-term decisions and act on adaptation.

The Welsh Government needs to work with health and social care system partners to strengthen its evidence base and ensure this is factored into the right level of adaptation planning and action across the health and social care sector in Wales.

(c) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for Chapter 11 (Table 11.2).

| Table 11.2 Recommendations - Health | | |
|---|---|---------------|
| Primary responsibility | Recommendation | Timing |
| Health and Social Services | Develop a long-term cross-sector approach to address risks in the social care sector. This could be as part of the Net Zero social care route map, where adaptation action should be integrated into plans for decarbonisation and actioned from the start. | 2023 |
| Health and Social Services | Make available long-term, protected funding to adapt hospitals, care homes and other healthcare buildings to the impacts of climate change. | Ongoing |
| Health and Social Services | Develop, agree and implement a health and social care indicator suite. | 2025 |
| Health and Social Services | Ensure a joined-up approach between mitigation and adaptation to ensure there is not an increasing demand on the health sector. | Ongoing |

Endnotes

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Chapter 12

Community preparedness & response

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Introduction

Table 12.1

Progress summary – Community preparedness and response

| | Delivery and implementation | Policies and plans | Summary |
|---|-----------------------------|----------------------------|--|
| Outcome 1: Communities are prepared for climate shocks | Insufficient progress | Limited policies and plans | <ul style="list-style-type: none"> Flood defences offer protection for many homes but there is insufficient action to address other climate impacts, and a lack of coordination at local level. Communities are prepared for some shocks, particularly on flood risk, but adaptation roles and responsibilities are complex and overlapping, hindering coordination. |
| Outcome 2: Communities can respond to climate shocks | Unable to evaluate | Limited policies and plans | <ul style="list-style-type: none"> Data is limited on impacts and recovery from extreme weather events. Some of the key policy milestones are in place for emergency response. Further work on a Wales Risk Register is underway. |
| Outcome 3: Local cultural heritage is conserved | Unable to evaluate | Partial policies and plans | <ul style="list-style-type: none"> Climate risk to cultural heritage is increasingly well mapped, but there is limited data to assess progress to date on actions addressing risks. There is a comprehensive sectoral plan to map cultural heritage risks across Wales, linked to the National Adaptation plan. |

Relevant risks from CCRA3:
H1 Risks to health and wellbeing from high temperatures; H2 Opportunity for health and wellbeing from warmer summers and winters; H3 Risks to people, communities and buildings from flooding; H4 Risks to viability of coastal communities from sea level rise; H11 Risks to cultural heritage; N18 Risks and opportunities from climate change to landscape character.

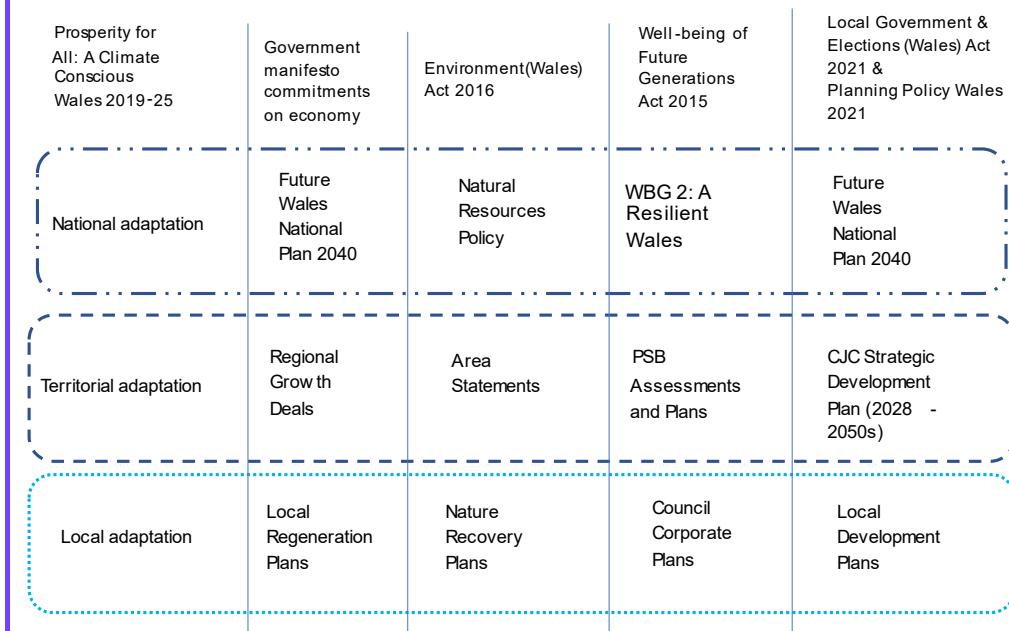
This chapter covers community-level awareness, planning and response to weather and climate impacts. It also considers the protection of cultural heritage (which is run by local and national organisations) from the effects of climate change. Local communities and services will be impacted by all climate hazards, including extreme heat, flooding, storms and sea level rise. These impacts are already being felt in Wales, for example the notable impacts from flooding and storms in February 2020.

Community-level adaptation is fully devolved and, in many cases, relies on local government. Guidance and standards may be provided from national government but planning and actions typically take place at the local council level, often in collaboration with other local actors.

Emergency preparedness and response work is driven by the UK Civil Contingencies Act 2004, despite being devolved to the Welsh Government.

The UK Civil Contingencies Act (2004) is the legislative basis for the UK's emergency response frameworks, setting out the arrangements for emergency preparedness and civil protection, including the roles and responsibilities of local responders. Local-level preparedness to extreme weather events sits across multiple layers of planning, as shown in Figure 12.1. Cultural heritage adaptation is also an important part of the community chapter and in Wales this is covered by a range of legislation (Figure 12.4).

Figure 12.1 Climate Adaptation Governance Context in Wales



Source: Netherwood, A, Flynn, A, O'Neill, K, Nash, T (2023) *Climate risk and adaptation in Wales: addressing the governance gap*. Working Paper, School of Geography & Planning, Cardiff University.¹

Notes: The above illustrates the wide scope of relevant policies and plans to community-level adaptation. Additional policies and structures not featured include civil contingencies/emergency preparedness and response structures, and UK-wide drivers such as the Climate Act 2008.

The Well-being of Future Generations (Wales) Act (2015) requires public bodies to establish 'Well-being Objectives' to maximise their contribution to achieving seven 'Well-being Goals'. The goals include 'A Resilient Wales', and 'A Wales of Cohesive Communities' which ties it to community networks and a sense of belonging. Other goals include 'A Healthier Wales' and a 'More Equal Wales'. Alongside the Welsh Government, a range of other local and regional organisations and partnerships play an important role in delivery. Key actors are:

- **Natural Resources Wales (NRW)** is responsible for flood & coastal erosion risk management in Wales. It also leads on development of seven 'Area Statements' which take a 'place-based' approach to examining the challenges and priorities set out in Natural Resources Policy.²
- **22 local authorities in Wales** which are 'Category 1 Responders' under the Civil Contingencies Act 2004, and form a key part of local resilience forums tasked with multi-agency planning and preparedness and response activities.³
- **Four Local Resilience Forums (LRFs)** are multi-agency partnerships made up of representatives from local Category 1 and 2 Responders, and operate within the four Police Force areas: South Wales, North Wales, Dyfed-Powys and Gwent. LRFs monitor and mitigate risks and emergencies at a local level.⁴
- **28 Risk Management Authorities (RMA)** which are designated by the Flood and Water Management Act 2010. This includes NRW, all 22 local authorities, water companies, fire service and Welsh Government (Highways).⁵

A wide range of local and regional organisations play a role in community-level adaptation.

- **13 Public Service Boards (PSBs)** set up under the Well-Being of Future Generations Act (Box 12.4). The membership of each Board includes the local leaders for public services in the area and other organisations that can contribute to the aims. Every five years, the Public Services Boards must undertake a well-being assessment of their area and publish a local well-being plan (Box 12.6).⁶
- **Historic Environment Group**, a high-level forum made up of representatives from organisations in Wales with historic environment interests. **Cadw** is the Welsh Government's Historic Environment service.

Community preparedness and response is strongly linked to resilience across several other chapters. Key interactions include:

Communities are impacted by adaptation progress across a range of other chapters, including health and buildings.

- **Health.** Preparedness and resilience to climate impacts within communities is strongly linked to the provision of public and mental health support.
- **Towns and Cities.** Increased risk of flooding, heatwaves and coastal erosion in towns and cities present significant risks to communities in Wales. In addition to adaptation in the built environment, community preparedness and response is an important part of adaptation.
- **Buildings.** Impacts such as overheating in homes, moisture ingress to building fabric or access to support for property flood resilience play an important role in community preparedness and response and the maintenance of historic buildings.
- **Transport, Energy, Telecoms and ICT, Water.** Climate risks and resilience related to infrastructure systems have a significant impact at local level.

Risks to cultural heritage are also included in Chapter 2 (Nature) and Chapter 10 (Buildings).

Box 12.1

Community and cultural heritage in Prosperity for All: A Climate Conscious Wales

Preparedness and Response is featured across 'Safe Homes and Places', 'Protecting our Coasts and Seas', and in the 'Strategic Approach'. Key relevant actions are:

- **HP4 & HP5:** Deliver adaptation and capacity building at the community-level; Work with Public Service Boards to support adaptation and capacity building at the regional level.
- **MC2:** Provide updated policy and guidance on coastal adaptation.
- **ST2:** Integrate the consideration of climate risks in all future policy and business planning within the Welsh Government and encourage the same in all other public bodies.

'Caring for the Historic Environment' is identified as one of the seven key sectors. Key relevant actions are:

- **HE1, HE2, HE3, HE4:** Complete and publish the Historic Environment and Climate Change Sector Adaptation Plan; Improve understanding of the threats and opportunities for the historic environment from a changing climate; Develop the methodologies, tools and guidance needed to build adaptive capacity; Increase resilience of the historic environment by implementing actions to respond and adapt to the risks.

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for all: A Climate conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress towards community-level adaptation

Well-adapted communities are adequately prepared to minimise climate risks and respond to weather emergencies. Maintaining thriving communities also requires conservation of key cultural heritage under future climate change conditions. Our monitoring map for assessing adaptation progress in community preparedness and response is shown in Figure 12.2 and identifies several key outcomes for community-level adaptation:

We have identified three adaptation outcomes for community preparedness and response.

- **Communities are prepared for climate shocks.** Preparing for climate shocks and stresses requires proactive adaptation planning and support at local authority level, in coordination with other actors. The potential for increased frequency and intensity of extreme weather events should be factored into relevant local plans.
- **Communities can respond to climate shocks.** Responding to climate shocks when they occur requires strong local-level coordination during an extreme weather event to minimise damage and provide ongoing support for recovery after the event. Targeted recovery support may be required for vulnerable communities, and the mental health impacts of suffering damages should also be considered.
- **Cultural heritage is conserved.** Heritage conservation should manage change to sustain or even enhance a heritage asset, recognising that it may not always be possible to conserve in every situation.⁷ This requires an understanding of climate risks and a plan for the most appropriate way to conserve different types of heritage, such as archaeological sites, buildings, historic landscapes, wrecks and museum collections. We must also consider intangible heritage such as folklore, traditional language, knowledge and practices.

Enabling factors that need to be in place to deliver these outcomes include:

Targeted support for vulnerable communities will be needed at local level to support them in preparing for and recovering from extreme weather events.

- **Funding and investment.** Targeted support is needed at local level to support vulnerable communities to prepare for and recover from extreme weather events. Psychosocial support will also be needed as part of recovery from events such as flooding. Funding for adaptation should be ring-fenced at local level, to enable authorities to blend funding streams into coherent projects that can deliver wider benefits.
- **Engagement and education.** The public should be well-informed about future climate risks to enable household-level adaptation decisions. Long-term planning requires clear risk mapping, information and warning systems and local authority commitment to build sustained and engaged relationships through community dialogue.
- **Research.** Further research is needed to understand local impacts of climate change, including social vulnerability mapping to different hazards, in order to better understand distributional effects of climate change. Research is also needed on the effectiveness of different types of behaviour change for adaptation.

- **Data and monitoring.** Data is needed on local-level adaptation actions and forums which may already be in place. Data sharing between organisations and early warning systems will also be important for local action. Community-led heritage asset surveys can provide useful data on heritage assets and their potential exposure to climate change.
- **Governance.** Local authority roles and responsibilities should be clearly defined to reduce duplication and encourage bottom-up action towards national adaptation programmes. Local public services and institutions can be stress-tested for climate impacts, including responding to cascading climate impacts. Local resilience groups (e.g. Local Resilience Forums in Wales) should ensure coordinated responses between incident responders.

Our monitoring framework highlights policy mechanisms which must be in place to achieve outcomes for well-adapted communities under the following categories:

- **Legislation and regulation.** National legislation should enable local preparedness and response to extreme weather events, with clear roles and responsibilities for responder organisations. Regulations should also support protection and appropriate conservation of heritage assets.
- **Standards.** National resilience standards should support best practice among responder organisations, and national guidance should be provided on local community response to extreme weather events. Building standards for heritage assets should support the appropriate restoration or management of heritage assets affected by climate change.
- **Financial instruments.** Sufficient and stable funding is required for local resilience groups to ensure long-term planning, relationship building and preparedness. Funding should also be provided to support vulnerable groups implementing local or household adaptation measures.
- **Information and reporting.** Local authorities, emergency responders and organisations responsible for heritage should all be required to report on local adaptation actions and community risk registers should include consideration of vulnerable groups. Public engagement and deliberation are critical for adaptation actions, particularly for irreversible and contentious adaptation policies (see Box 12.2).

Local authorities have an important role to play in community preparedness and response efforts.

Local authorities and organisations responsible for heritage should be required to report on their adaptation actions.

Box 12.2

Community engagement and deliberation in adaptation planning

There has been growing interest in engaging communities to be part of climate change planning and strategy, for example, through Climate Assembly UK in 2020 and citizens' juries like the Blaenau Gwent Climate Assembly in 2021. Community engagement and deliberation is equally important for adaptation:

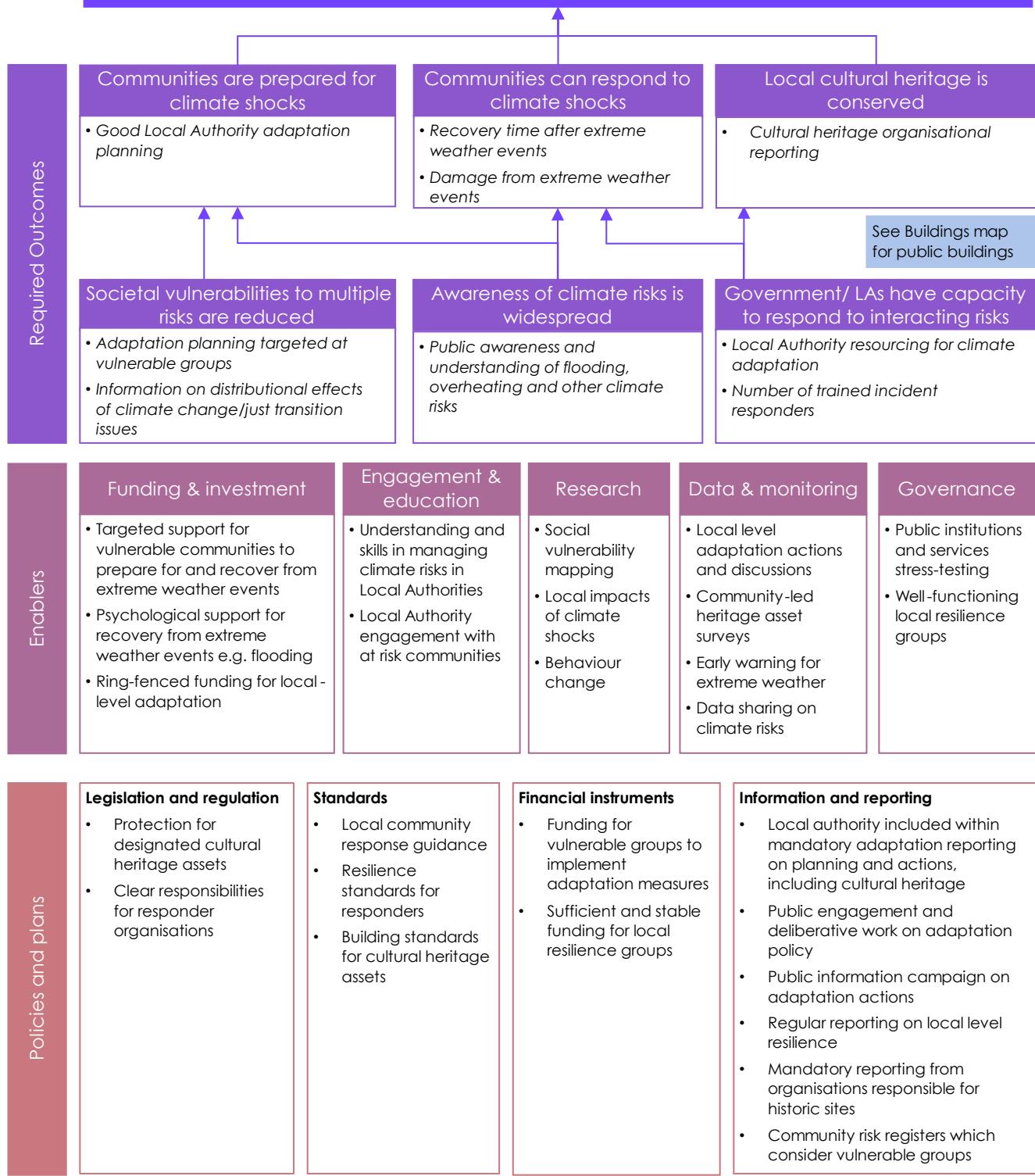
- Adaptation interventions should be tailored to the specifics of their local geographical and social context to be effective in reducing risks for the most vulnerable. This means that inclusive consultation and co-design are necessary through the policy design, implementation, and evaluation phases.
- It is important that both individuals or groups who could be negatively impacted by climate change impacts and adaptation actions are adequately included in this process.
- For irreversible and contentious adaptation policies, such as managed retreat from low-lying coastal settlements, this process will need to be extensive, highly transparent and allow sufficient time for a thorough public deliberation on the options and their likely costs and benefits, as well as the anticipated costs and impacts without adaptation.

Source: CCC (2022) *The Just Transition and Climate Change Adaptation*; University of Lancaster (2022) *The role of deliberative public engagement in climate policy development*.

Figure 12.2 Monitoring map for community preparedness and response



Communities in UK are prepared for and can respond to weather & climate shocks



Source: CCC analysis

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section provides an assessment of progress towards delivery and implementation for each of the outcomes in the monitoring map (Figure 12.2).

(a) Outcome 1: Communities are prepared for climate shocks

Indicators for this outcome show **insufficient progress** in preparing communities for the impacts of climate change.

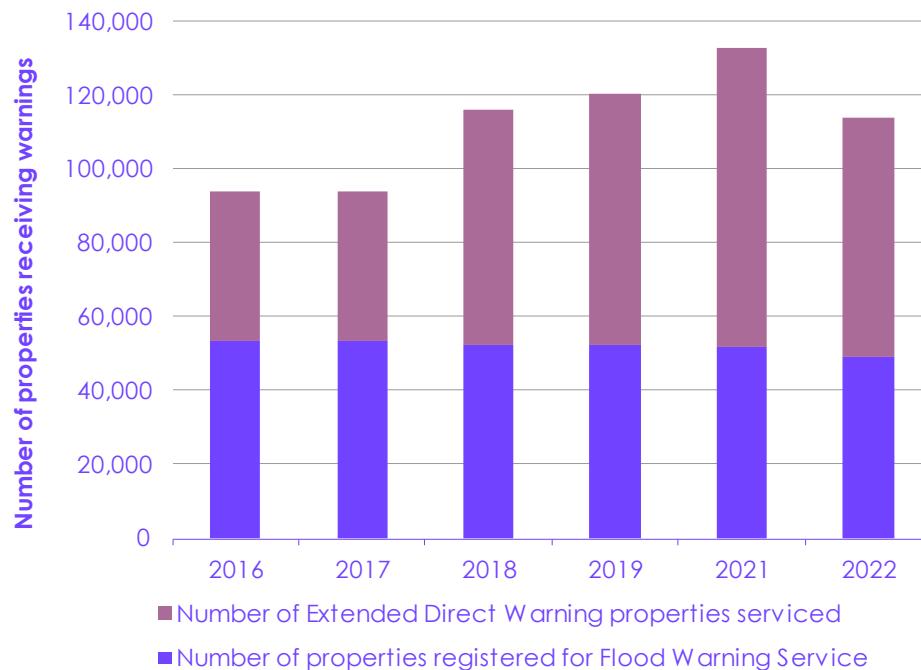
- **Welsh Government is increasing funding for flood risk management and local authorities in Wales.** Over 245,000 properties in Wales are at some risk of flooding from river, the sea or surface water (see Chapter 9).⁸ Around 3,000 key services, including schools, health and emergency services, are also at risk.⁹ Central funding for flood risk management in Wales has increased, with a record £75 million investment confirmed for 2023/24, in comparison to £59.6 million in 2021/22.^{10,11} As part of the programme, total funding for local authorities has increased from £13.9 million in 2016/17 to £26.7 million* in 2022/23.¹² During severe flooding in February 2020 (Box 12.3), Natural Resources Wales (NRW) estimates that around 73,000 properties were protected by defence infrastructure.¹³
- **Community preparedness is part of the overall revenue spend on flood risk management.** Forecasting and issuing flood warnings was 10% of the NRW budget in 2021/22 (£2,268,000), and community engagement and resilience was 3% (£571,428), up from 1% (£237,000) in 2020/21.^{14,15}
- **There is increasing engagement from communities in preparing for flooding, although the number of properties registered for flood warnings declined last year.** NRW has 74 community flood plans currently in place and supports a Wales-wide network of 513 Community Flood Volunteers (up from 409 in 2020/21) by facilitating and delivering Volunteer Network events to support Communities at risk of flooding. Its quarterly "Flooding Matters" newsletter had nearly 3000 subscribers as of March 2022, a 38% increase since the previous year.^{16,17} In 2022, NRW's webpages for how to prepare for flooding, what to do in a flood and what to do after a flood had around 8,000 combined views. This is double the number of views in 2021, with more views associated with Storms Eunice and Franklin in February 2022.¹⁸
 - However, the number of properties signed up to receive flood warnings declined by 14% between 2021 and 2022 (Figure 12.3)¹⁹ due to a combination of declining landline use in society, members of the public not updating their registrations when they move property and/or change of mobile or landline phone numbers and some members of the public choosing to de-register from the service. In 2020/21, out of the properties at risk which were able to receive flood warnings in Wales, approximately 40% were registered to receive flood warnings.²⁰ However no data was available for subsequent years.

Funding for flood risk management and community preparedness is increasing in Wales.

Community engagement on flood preparedness is increasing overall, and flood warnings play an important role.

* In real terms, 2022/23 prices.

Figure 12.3 Number of properties registered to receive flood warnings in Wales



Source: NRW (2019) *Flood and coastal erosion risk management in Wales 2016-2019*; NRW (2021) *Flood risk management annual report 2020-21*; NRW (2022) *Flood risk management annual report 2021-22*.

Notes: NRW communicates warnings to those signed up via the flood warning service in Wales. Further properties are serviced by the Extended Direct Warning Service, where phone companies provide the data.

- **Overall, there are an insufficient number of adaptation plans at the local level across Wales.** 2021 data indicates that only 18% of Welsh local authorities (4 of 22) had some form of climate adaptation plan.²¹ Published data indicates that other local structures such as Public Service Boards have not yet demonstrated sufficient consideration of adaptation (Box 12.4).
 - A 2023 review of local government corporate plans found that a minority of local authorities had meaningfully considered adaptation. 10 of 20 plans reviewed made no mention of climate risk or adaptation. Three made commitments to using nature-based solutions to help with adaptation, three focused solely on flood risk management, three linked climate risk to strategic agendas of the Council. Only one council (Conwy and Denbighshire) committed to a systematic climate risk assessment for the authority.²² A separate survey of local authorities found that 69% believed their service level risk registers contained risks associated with climate change. However, most local authority officers involved in the survey felt that local authorities could better integrate climate adaptation and risk into decision-making across all timescales, but particularly for short- and medium-term decisions.²³
 - Public Service Boards (PSBs) were set up under the Well-being of Future Generations Act 2015 to encourage public sector collaboration on wellbeing at a local level. A June 2023 review of available plans (draft and adopted) indicates that one PSB has committed to implement a climate adaptation strategy; four PSBs committed to undertake a climate change risk assessment for their area in the next five years;

and eight refer to climate risks as part of general commitments to climate change, predominantly focusing on nature-based solutions to climate change and flood risk management. At the time of writing, further NRW research on adaptation in PSB well-being assessments and the 2023-28 plans is ongoing, and some plans are still being finalised. Yet, these early indicative numbers suggest that there remain significant gaps on local climate risk assessment and adaptation planning in several PSBs' well-being assessments and plans.²⁴

Public Service Board plans will play an important role in delivering and coordinating local adaptation planning.

- There are seven regional Natural Resources Wales 'Area Statements' which focus local partners on challenges to the natural environment, actions to address them and better ways to manage natural resources for future generations. Only two of the seven Area Statements provide detail on how climate risk and adaptation should be approached.²⁵

- **National Trust is working on community preparedness in 30 key adaptation locations around the Welsh Coast.** 25% of coastal 'hotspot' sites for National Trust are located in Wales. The 30 sites cover almost the entire length of the Welsh coastline. Each has designated a range of short-, medium- and long-term actions ranging from education and training, to shoreline management and adaptation pathways, and collaborating with partners on capital works in areas such as Llyn Peninsula, where Gwynedd Council is spending £350,000 to provide resilience up to the 2050s.²⁶
- **Community Risk Registers are in place for each of the four Local Resilience Forums (LRFs).** These risk registers are typically reviewed every two years in line with the UK risk register, and provide scores for Natural Hazards like fluvial and pluvial flooding, heatwaves, air quality, storms and snow. However, while useful, these consider shorter-term impacts of two to five years as opposed to long-term adaptation and changes of governance, deliberation or approach.
- **Public perception of climate risks is high.** A recent Public Health Wales survey found that the majority (82%) of participants were fairly or very concerned about climate change, with 61% stating that climate change is already having an impact in Wales. Over two-thirds (68%) of people had experienced at least one impact, from flooding in their home or local area (51%), travel disruption from extreme weather (55%) or ill-health caused by extreme weather (20%).²⁷
- **However, information is limited on vulnerability and distributional effects of climate change, especially for climate impacts other than flooding.** The Public Health Wales Health Impact Assessment, due for publication in July 2023, will provide additional information on other impacts such as heat. The existing evidence base on vulnerability is disproportionately linked to flood risk.

(b) Outcome 2: Communities can respond to climate shocks

We were **unable to evaluate** indicators for this outcome. Data on the impacts and recovery from extreme weather events in Wales is limited.

- **Expected annual damages from flooding is significant, but there is limited data on actual annual damages.** Expected annual damages from flooding in Wales are around £94.5 million but data for damages from other weather events are unavailable. There was an estimated £81 million of property damage from the February 2020 floods (Box 12.3).^{28,29}

- **Emergency response is a significant part of NRW's overall revenue spend on Flood Risk Management.** Responding to and managing incidents was 8% (£1,827,000) of spend in 2021/22, which is 1% less than the previous year, even though the actual spend remained the same.^{30,31}

The Committee were unable to evaluate progress on community response to climate shocks due to a lack of evidence.

Box 12.3

February 2020 storms

- February 2020 brought devastating flooding to Wales with successive storms and record rainfall levels. More than 2,000 homes and 600 businesses suffered internal flooding, with areas that had not seen flooding for decades being affected.
- Most of Wales was affected, with significant damage to properties in communities including Llanrwst, Llanfair Talhaiarn, Tylorstown, Nantgarw, Pontypridd, Pentre, Llanhilleth, Crickhowell and Mountain Ash.
- River levels in many places hit record or near-record heights. In some places along the Taff, levels were 80 cm higher than the 1979 floods. Across Wales, NRW estimates that around 73,000 homes were protected due to the network of defences.
- An emergency flood relief-funding scheme was launched to support flood victims across communities, businesses and affected Local Authorities. 100% grant funding was also made available by the Welsh Government to enable NRW and Local Authorities to carry out £4.4 million of emergency repairs to flood risk infrastructure, defences and culverts.
- A special Flood Recovery Review was commissioned by NRW after the storms. The review highlighted 74 actions, of which NRW has now completed 46.
- Key outstanding work within the review includes repairs to over 100 flood defences and structures, set to cost in the region of £1.9 million, as well as repairs to assets on the NRW land estate, costing an estimated £800,000.

Source: Welsh Government (2020) National Strategy for Flood and Coastal Erosion Risk Management in Wales; NRW (2022) Flood risk management annual report 2021-2022; NRW (2020) February 2020 Floods in Wales.

- **The number of staff working in flood risk management has remained constant but more workers will be required to meet future response needs.** NRW monitors the number of staff working in flood risk management, which has remained at around 350 full-time equivalent in 2021 and 2022.^{32,33} NRW acknowledges that insufficient workforce capacity is impacting on aspects of its core work, including its assessment of the condition of flood defence assets, flood warning work and planning advice, and it will require more staff to sustain their response service.³⁴
- **For other indicators, information was either too limited to make an assessment or unavailable.** This includes: national-scale data on the impact of flooding on services (such as average business and school days lost, damages to public buildings, and commercial insurance claims); data on extreme weather events other than flooding; recovery time after extreme weather events; information on public response to flood warning information; local authority resourcing for climate adaptation; number of trained incident responders or volunteers.

(c) Outcome 3: Local cultural heritage is conserved

We were **unable to evaluate** indicators for this outcome in reducing vulnerability and exposure of cultural heritage to climate change. Climate risk to this significant sector is increasingly well mapped, but there is limited data available on actions to address these risks, forming a barrier to an assessment of progress.

Risk to cultural heritage is increasingly well understood in Wales, but there was not enough evidence of action to date to assess progress.

- **Cultural Heritage is at risk in Wales.** 9% (17,151) of sites on the Welsh Historic Environment record (186,571) are within areas with the highest flood risk (Flood Zone 3). This includes 12% of scheduled monuments (538) and 12% of Listed Buildings (3,655).³⁵ Wales has a coastline over 2,700 km long containing over 100,000 historic assets of all periods and types: 16% are at risk from sea level rise.³⁶
- **National Trust is working on preparedness in 30 key adaptation locations around the Welsh Coast.** The 30 sites cover almost the entire length of the Welsh coastline, and each has designated a range of short-, medium- and long-term actions which include protection of cultural heritage assets at locations such as Plas y Rhiw and Llanrhidian Marsh (Cwm Ivy).³⁷
- **There are a significant range of indicators listed for Cultural Heritage in Prosperity for All: A Climate Conscious Wales. However, much of the data was unavailable at the time of writing, and some indicators may need to be amended.**
- **No public body reporting on climate risk is in place across Wales, so there is limited data on cultural heritage interventions to date.** Many assets are privately owned, which makes understanding the true scale very challenging.

(d) Progress on enablers

The outcomes for community-level adaptation require multiple enabling factors to be in place. Information is limited, but our assessment captured the following:

- **Citizens' assemblies are engaging people at local level.** Regional Citizens Assemblies are being used as part of a public engagement approach, for example the Blaenau Gwent Climate Assembly and Rhondda Cynon Taf's 'Let's Talk Climate Change' online conversation.³⁸ This is a positive step towards better integration of communities in decision-making processes.
- **Community asset surveys and reporting on cultural heritage are taking place in Wales.**
 - Community surveys have been used as part of the EU-funded CHERISH project, including at sites such as the Dinas Dinlle Coastal Hillfort in North Wales.³⁹ CHERISH published guidance in 2023 on methods used to survey and record heritage sites threatened by climate change in targeted coastal communities. This offers information on approaches which can be used by individuals and community groups looking for quick and cost-effective ways to monitor 'at-risk' sites and understand the value of certain tools in relation to monitoring climate risks. It can also be used by heritage professionals and site managers to advise upon, cost and instigate new monitoring and investigation as part of climate strategies.⁴⁰
 - Pembrokeshire Coast National Park Authority (PCNPA) established a volunteer monitoring programme for publicly accessible scheduled monuments in 2020. 17 heritage volunteers were trained to visit sites and submit information and photos through an online system. In total, 128 monuments are monitored (almost half of all scheduled monuments in the area) and, by the end of 2022, 311 visits had taken place.⁴¹

Some communities in Wales are involved in deliberation or actions relating to climate adaptation.

3. Policy and planning progress

This section assesses the extent to which key policy milestones identified within the Community monitoring map (Fig 12.2) are in place.

(a) Outcome 1: Communities are prepared for climate shocks

There are **limited policies and plans** in place to ensure communities are prepared for climate shocks. Recent evidence suggests that a complex system of local governance is creating a lack of joined-up adaptation planning and community involvement in preparing for climate shocks. Options for community funding to implement adaptation actions are lacking in Wales. There is also a significant focus on mitigation at the expense of adaptation in local government.

Community preparedness for climate shocks is considered in policies for Flood and Coastal Management, however complex governance structures may impact delivery.

- **The National Strategy for Flood and Coastal Risk Management has a strong focus on preparing communities at risk.** The Strategy for Flood and Coastal Risk Management is to reduce the risk to people and communities from flooding and coastal erosion. This includes objectives to improve risk communication, build preparedness and consider at-risk communities. In its role in delivering Flood Risk Management Plans, Natural Resources Wales (NRW) is considering social vulnerability through the Communities at Risk Register (CARR).⁴²
- **However, roles and responsibilities for managing flood risk are complex, which could impact community preparedness.** In its 2022 review of flood management, Audit Wales noted that flood risk management's 'roles and responsibilities are complex and may require legislative change'.⁴³ Flooding is the most pressing climate risk for Wales and yet for all the good progress made through collaboration across forums, the level of policy complexity also risks hindering action. The Flood and Coastal Erosion Committee's 2022 review of resources says the flooding sector is not good at involving the public in flood risk management, with public bodies not doing enough to prepare the public for flooding nor for the impact of long-term decisions about managed coastal realignment.⁴⁴ The numerous forums and committees, flood groups and coastal groups also overlap with other layers of policy, for example civil contingencies structures or Public Service Boards. Without proper oversight, this creates a risk of duplication, competing priorities or workstreams. It may also result in a lack of transparency over which body is accountable for certain actions, and who communities should engage regarding adaptation and preparedness.⁴⁵
- **Multiple reports have found gaps in addressing preparedness at a community-level in Wales.** In 2020, NRW published a report on progress implementing the previous National Strategy for Flood and Coastal Risk Management 2011, which highlighted challenges in engaging with communities. Audit Wales found that although the new 2020 National Strategy reinforced the importance of community resilience, little progress had been made by 2022.⁴⁶ A 2022 Flood and Coastal Erosion Committee review found that a lack of joined-up policy and funding arrangements is restricting Risk Management Authorities' (RMA) collaboration with each other, with other public services, and with the private sector. It also highlighted insufficient workforce and capacity to deliver meaningful engagement with communities, effective collaboration and partnership working.⁴⁷

There are gaps in community preparedness at a local level in Wales.

In 2021, the Senedd Climate Change, Environment and Rural Affairs Committee's inquiry recommended that the Welsh Government set out how it will support local authorities and NRW to engage effectively with communities. The Welsh Government's response did not say who would lead efforts to address the capacity and capability issues that are widely known to hamper community engagement.⁴⁸ A 2023 review by Cardiff University detailed a picture of 'unintentional neglect' of climate risk assessment in multiple arenas of work from most local authority corporate and decarbonisation plans, public service boards, NRW Area Statements and Regional Growth Deals.⁴⁹

Box 12.4

Public Service Boards in Wales

Public Service Boards (PSBs) were implemented as part of Well-being of Future Generations Act 2015 to encourage public sector collaboration. There are 13 across Wales, as some of the 22 local authorities chose to amalgamate their PSBs. Membership of each Board includes the local leaders for public services in the area and other organisations that can contribute to their aim of improving well-being together. Every five years, the Public Services Boards must assess the well-being of their area and then publish a local well-being plan. PSBs will publish new 2023-28 well-being plans in 2023, but not all were available for assessment at the time of writing.

- PSBs are a statutory partnership as opposed to an entity. Each member organisation takes responsibility for delivery of actions relevant to its remit.
- PSBs and their actions are not core-funded by central government. Welsh Government provides around £500,000 per annum, which supports delivery of the secretariat for all 13 PSBs.
- Current scrutiny arrangements mean that PSBs report to councils and communities rather than Welsh Government.

Public Service Boards in Wales are required to have regard to the most up to date UK Climate Change Risk Assessment when undertaking their local wellbeing assessments. NRW is analysing progress on integration of climate risk into the second round of wellbeing assessments and plans (2023-28). However, this was not published in time to be assessed for this report.

Source: Welsh Government (2023) [Provided on request](#).

Welsh Government has numerous policy commitments which influence community preparedness to climate shocks and stresses.

- **The Welsh Programme for Government includes commitments which impact on community preparedness to climate impacts.** These include a target to get 30% of population working remotely, development of more than 50 local community hubs to co-locate front-line health and social care and other services, and support for cooperative housing, community-led initiatives, and community land trusts.⁵⁰
- **The Welsh Government is working with local Coastal Groups to support coastal management policies which prepare communities for future climate risks.** The work will include guidance on community preparedness and engaging with local people and stakeholders (Box 12.5).
 - Read the accompanying CCC Briefing on the links between [Adaptation and social justice](#).

Box 12.5

Community engagement in Fairbourne

- Fairbourne, south-west Gwynedd, is a village developed on an area of low lying land which backs on to the Afon Mawddach river estuary to the north, Snowdonia mountains to the east and the Cardigan Bay coastline to the west.
- Approximately 700 people live in the village permanently and around 460 properties are at risk of flooding. Ground levels in Fairbourne are generally only around 2.5 m above sea level, which is lower than the average high spring tide. The village is protected from the sea by a natural shingle bank, reinforced with a wall, and from the estuary by a tidal embankment. Projections suggest that sea levels will rise by approximately 1 m over the next 100 years, which will place the village at increasing risk.
- In the long-term, maintaining defences will be increasingly costly and there is increased risk to life should they fail. Predictions and monitoring for the area's 2013 Shoreline Management Plan (SMP2) suggested that at some point between 2025 and 2055, it will likely be necessary to move from 'Hold the Line' to 'Managed Realignment' policy. All SMPs in Wales are currently being updated based on the most recent evidence.
- When the SMP2 policy was approved, concerns and challenges were raised by the local community about the plan and its implications, and a lack of consultation around it. The case attracted local and national media attention.
- In 2014, Cyngor Gwynedd (Gwynedd Council) established Fairbourne Moving Forward, a multi-agency partnership with members from the local community council, NRW, Welsh Government, engineers and other stakeholders, including Network Rail and Welsh Water. Fairbourne Moving Forward has a full-time project manager to coordinate community links and meets quarterly. The partnership carries out continued community engagement and has funded counselling sessions. The community also established a flood warden scheme.
- In July 2019, a Multi-Agency Flood Evacuation plan was approved, owned by the council and the North Wales Councils Emergency Planning Service.
- The Fairbourne Preliminary Coastal Adaptation Masterplan, an advisory document, went for public consultation in Autumn 2019. The Masterplan is dynamic and will be informed by the updated SMP.
- On behalf of the Fairbourne Moving Forward Project Board, Cyngor Gwynedd have been conducting a Health Impact Assessment to consider health and well-being within the community. Results will inform future projects in the community.
- The Welsh Government and local councils have recognised the need for clear communication and stakeholder co-development in coastal areas. They are currently developing Coastal Adaptation Guidance, informed by ongoing research in places like Fairbourne. This guidance will be used to help communicate updated SMPs.

Source: Fairbourne Moving Forward Partnership (2019) *Fairbourne: A Framework for the Future*; Gwynedd Council (2019) *Fairbourne Multi Agency Flood Evacuation Plan*; Welsh Government (2020) *The National Strategy for Flood and Coastal Erosion Risk Management in Wales*; Cyngor Gwynedd (2023).

Public health policies and information sharing plays a key role in community preparedness.

- **Public Health Wales (PHW) plays an important role in risk assessment and information campaigns to enable community preparedness, particularly on non-flood impacts.** Public Health Wales (PHW) has updated public health guidance, advice, and messaging for episodes of extreme heat, cold, and flooding. In November 2021, PHW published a series of infographics which highlight the importance of climate change impacts on the health and wellbeing of the population in Wales, and which aim to support public bodies and businesses to take action to address any impacts.⁵¹ Other work includes a health impact assessment, due for publication in July 2023, which identifies the main health and wellbeing impacts of climate change

in Wales to support action on climate adaptation, as well as an ongoing collaboration with the Met Office to issue advice to the public and health and social care workers during extreme or unusual weather.⁵²

- **Corporate Joint Committees offer an opportunity to streamline the vision for adaptation in Wales.** Corporate Joint Committees (CJCs) were established by Welsh Government in 2022 to provide the regulatory framework for local authorities to work together to deliver more effective outcomes for communities, for example on regional planning, transport and other infrastructure.⁵³ This includes delivery of regional Strategic Development Plans which will be developed from 2023 and 2028 and have a plan period of at least 25 years.⁵⁴ While the CJCs are in the early stages of their development, the breadth and timescales associated with the process provide a major opportunity to engage communities in a long-term vision for adaptation in Wales, and to ensure that risks are minimised in plans and projects to mid-century.

Box 12.6

Community adaptation case study – Climate Ready Gwent

Climate Adaptation was identified in 2017 by the five Gwent Public Services Boards as a regional priority following their first local Well-being Assessments. The project was managed by a Climate Ready Gwent Steering Group made up of local authority PSB co-ordinators, with project overseen by Natural Resources Wales.

In 2019, working through the Gwent Strategic Well-being Action Group (GSWAG), the Climate ready Gwent network facilitated a series of involvement opportunities for the public and third sectors and communities, designed to improve collective understanding of local and regional climate resilience. This project worked with focused, diverse groups to learn from the lived experience of past extreme weather events in order to identify methods to improve future climate resilience. The aim of this project is to inform local Well-being Assessments and Well-being Plans and identify opportunities for regional collaboration.

The partnership has worked with people and places throughout Gwent, including the Blaenau Gwent Children's Grand Council, the Blaenau Gwent Older People's Forum, Blaenavon Town Council, Blaenavon World Heritage Site (WHS), Transition Monmouth, Living Levels Partnership, Goldcliff Town Council, Gwent's agricultural community and stakeholders in the Cwmcarn and Abercarn areas.⁵⁵

Source: Natural Resources Wales (2023) *Climate Ready Gwent*.

(b) Outcome 2: Communities can respond to climate shocks

There are **limited policies and plans** in place to ensure communities can respond to climate shocks. Some of the key policy milestones are in place around defined responsibilities in legislation and standards across a range of hazards. Further work on a Wales Risk Register is underway.

- **There are clear responsibilities for responder organisations in Wales, particularly on flooding.** Under the Civil Contingencies Act 2004, NRW and Local Authorities are Category 1 Responders giving them duties to warn and provide information to the public, play a lead role in emergency planning and recovery after a flood event and control or reduce the impact of an emergency. Water companies in Wales are Category 2 Responders, and are responsible for maintaining plans which can be used in an emergency for reducing, controlling or mitigating flooding.⁵⁶

Wales has extensive civil contingencies structures in place to respond to a wide range of events, including natural hazards.

- At the local level, LRFs bring together all responder organisations that have a duty to co-operate under the Civil Contingencies Act, alongside other relevant organisations. Each of the four has a Risk Register which includes natural hazards such as fluvial and pluvial flood, heat wave and storms, and is used to inform planning and capacity priorities in each region.
- A range of other coordination forums exist at different scales across Wales on both preparedness (see Outcome 1) and response. Examples dealing with response include:
 - Local Authority Emergency Planning Managers Forum which is made up of Local Authorities and has two Local Government co-chairs.
 - The Wales Resilience Forum is chaired by the First Minister for Wales and seeks to improve emergency planning across agencies and services, supported by a range of sub-groups to develop resilience across Wales.
 - A Joint Emergency Services Group brings together all the emergency services in Wales. This includes NHS Wales, Welsh Government and armed forces at the most senior level. They consider their contribution to civil contingencies and counter-terrorism in Wales and also address wider cross-service issues of joint interest.
- **Welsh Government now has a Principal Risk and Preparedness Advisor.** This is a newly created role that started in Spring 2023 and will work with partner agencies and LRF Risk Groups to develop a Wales Risk register. The Wales Risk register will include an assessment of preparedness for risks and will be used to prioritise areas to improve preparedness and address capability gaps.
- **Local community response guidance is available.** The NRW website hosts advice that the public can refer to at different stages of flooding. These are 'Preparing for a flood', 'What to do in a flood' and 'What to do after a flood'.⁵⁷ The Community Resilience in Urban Areas (CRUA) project information is made available through the British Red Cross. The toolkit includes a Community Resilience guide and a guide to psychosocial support during flooding.⁵⁸
- **There is a Welsh Government-funded partnership programme to reduce the impact of wildfires across the South Wales Valleys.** It brings together South Wales Fire and Rescue Service, along with Natural Resources Wales, Rhondda Cynon Taf Council and the Wildlife Trust for South and West Wales with an aim to work with communities and support practical steps to minimise impact of wildfires.⁵⁹
- **Local Authorities can access funding to respond to large-scale events.** In cases of exceptional events which create an 'undue financial burden' from providing relief and carrying out immediate work (threshold is 0.2% of the local authority annual budget), Welsh Government can make special financial assistance available to local authorities through the Emergency Financial Assistance Scheme (EFAs). Authorities are expected to make reasonable provision in their budgets to deal with contingencies and are

Financial assistance is not routinely offered to households after flood events, but it has been provided in recent years.

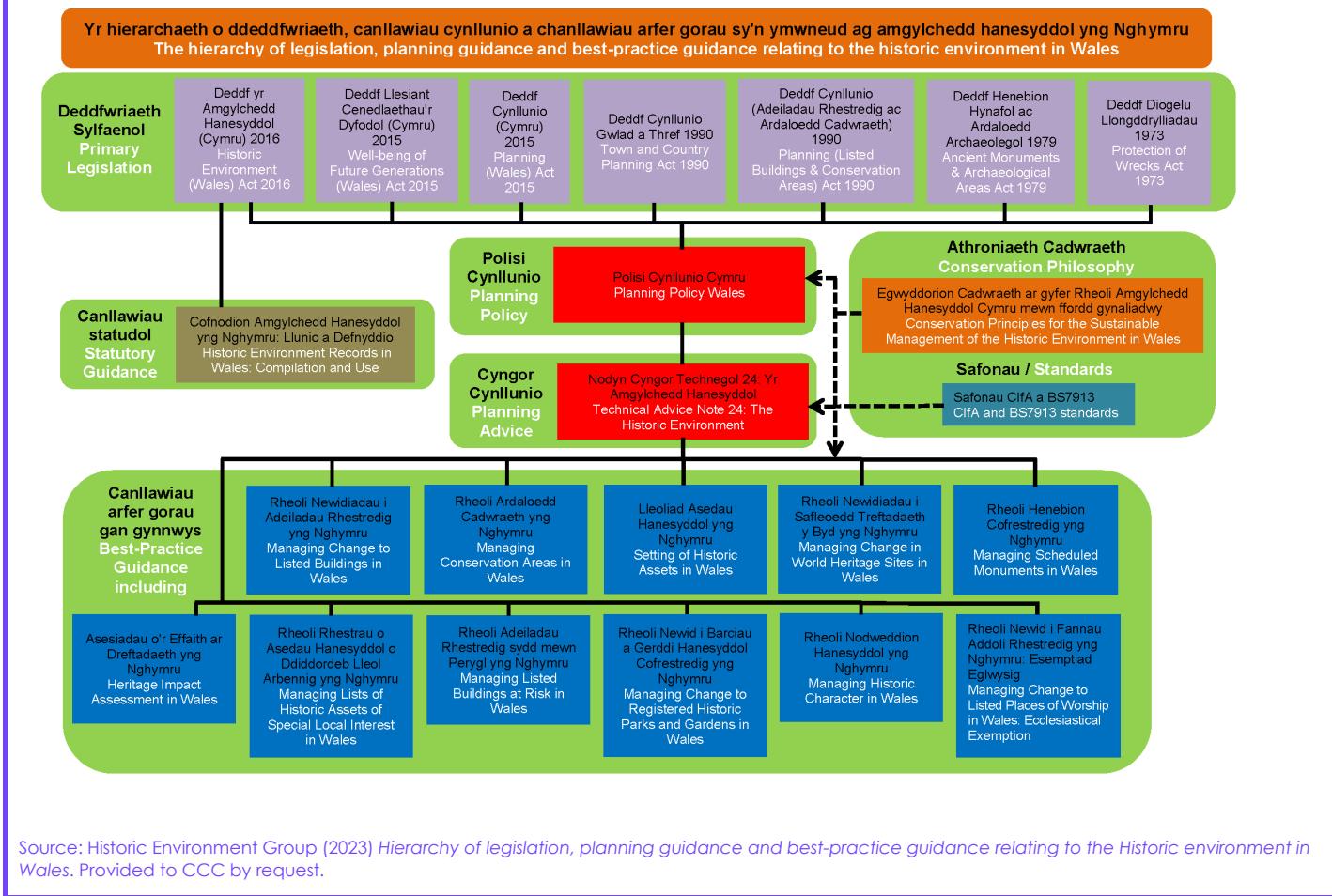
expected to meet (or to have already met during an earlier notified emergency event) all eligible expenditure up to the level of its threshold.⁶⁰

- **Financial assistance for communities after events is not routinely available, but there is a precedent for it to be developed**, as was the case for households and businesses after the series of storms in February 2020 (Box 12.3).
- **Resilience standards for responders will be developed across the UK.** A National Resilience Standards review will be led by the UK Government, but in consultation with Wales, Scotland and Northern Ireland where appropriate. The UK Resilience Framework sets out a series of other training and mock exercise programmes, some of which will be available to Welsh responders.
 - Devolved administrations should be involved in providing information for an annual resilience report to Parliament from 2025. These reports should include resilience to all climate risks, not just flooding, which may impact local communities.

(c) Outcome 3: Local cultural heritage is conserved

There are **partial policies and plans** in place to ensure local cultural heritage is conserved. The sectoral plan which maps risks across Wales (both terrestrial and marine risks) alongside annual reporting linked to the Climate Conscious Wales plan is positive. Further work is needed to publish data on actions taken to address climate impact and improve reporting to help assess progress.

Figure 12.4 Cultural Heritage Governance Context in Wales



Source: Historic Environment Group (2023) *Hierarchy of legislation, planning guidance and best-practice guidance relating to the Historic environment in Wales*. Provided to CCC by request.

The cultural heritage sector has a climate change adaptation plan and undertakes substantial risk assessment.

- The Historic Environment Group (HEG) sectoral climate adaptation plan details risks and actions for protection of Cultural Heritage.** The HEG Climate Change Subgroup has been charged with assessing and reporting to HEG on how the historic environment sector in Wales should address the challenge of climate change. This led to the publication of a climate adaptation plan for the sector in 2020, which is divided into seven themes under the three overarching and linked objectives of knowledge, capacity and resilience. It is aimed at policy makers and planners, including those in Welsh Government, local authorities and other public and third sector organisations, as well as non-governmental organisations, including academic institutions. All of these organisations have a vital role to play in developing and implementing the actions identified. Yet, stakeholders do acknowledge that more staff resource is required to deliver both action and monitoring to meet the ambitions in the plan.
- Funding is available to support conservation of cultural heritage in Wales.** Cadw developed a Historic Buildings Maintenance Grant pilot scheme providing small grants of up to £10K for the repair and maintenance of community assets. It also issues revenue grants to the wider historic environment sector, for example, a total of nearly £1.4 million to the four Welsh archaeological trusts in 2021-22. This was to support Trusts to deliver essential regional archaeological advisory services and undertake a range of projects, including some aimed at managing the threats facing historic assets from the effects of climate change. The grants supported pilot

projects to define methodologies for recording historic assets within and alongside rivers, which are environments that have been identified as particularly vulnerable within the sectoral Climate Change Adaptation Plan.⁶¹

- **Cadw will build on existing work to oversee development and piloting of adaptation pathways and research for cultural heritage in Wales from 2023.** Cadw hosted a Welsh Government-funded Climate Resilience Embedded Researcher, investigating the risks and adaptation of buildings, including risk assessment and adaptive decision pathways for buildings built before 1919.⁶² Findings have helped inform the new Wales Housing Quality Standards, as well as training standards and emerging guidance.⁶³ Cadw will host a researcher to develop and test the Adaptation Pathways approach and develop guidance and training for policy makers, asset owners and practitioners in the historic environment sector. It also intends to add climate into the next 'building at risk' assessment contract. Climate change has a powerful multiplier effect, and a building that is already suffering from lack of repair and maintenance is going to be less resilient to climate change. It is hoped that monitoring the condition of listed buildings and structures, and identifying the trends over successive surveys will support the development of evidence-based policy (e.g. targeted grant schemes), help owners understand the risks and prioritise action, and support local authorities to take enforcement action when needed.

Thresholds and adaptation pathways approaches are increasingly being developed to conserve cultural heritage in Wales.

- **Climate Adaptation Guidance has been developed for flood risk to cultural heritage in Wales, but it is unclear to what extent it is being used.** 'Flooding and Historic Buildings in Wales' is a Cadw guidance document on assessing flood risk and preparing for possible flooding by installing protective measures. It also recommends actions to be taken during and after a flood to minimise damage and risks. Aimed principally at homeowners, owners of small businesses and others involved with managing historic buildings, the guidance explains how to approach the protection of traditional buildings and avoid inappropriate modern repairs in the event of flood damage.⁶⁴
- **National Trust is planning to implement processes of Evidence Based decision-making in Wales.** National Trust guidance for climate adaptation thresholds and pathways planning will be used for sites in Wales, for managers and caretakers looking after historic and beautiful sites using decision pathways to better understand hazards, features at risk and associated adaptation pathways and actions. This work will build on a range of resources developed by the National Trust in the last few years, including a UK-wide hazard map of all its sites (including historic, commercial and tenanted sites) which illustrates the threats posed by climate change. Working to a worst-case scenario model, the map plots places alongside existing data on climate change-related events, such as heat and landslides.⁶⁵
 - Building on the map, the National Trust has implemented other initiatives such as a 'sustainable development tool' which is used for all spending over £35,000. A major part of this tool includes future climate and its effects on projects and builds in adaptation and climate risk at the concept stage. The organisation is also undertaking climate impact workshops across Wales to gain the 'lived experience' perspective from its staff and volunteers, and to gather greater depth on observations of property climate impacts to support existing hazard data.⁶⁶

Reporting will form an important information source for cultural heritage, given the proportion of privately owned assets.

- **There is no mandatory reporting from owners of historic sites.** Annual updates tend to have been quite high-level to date. The introduction of reporting requirements by Welsh Government would offer the potential for important additional information on heritage assets.

(c) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for community preparedness and response (Table 12.2). Primary responsibilities are assigned to ministerial portfolios.

Table 12.2

Recommendations – Community preparedness and response

| Primary responsibility | Recommendation | Timing |
|--|--|-----------|
| Finance and Local Government, Climate Change | Include adaptation questions in addition to existing decarbonisation questions in annual 'service delivery plans' reporting for local authorities. | 2024 |
| Finance and Local Government, Climate Change | Develop adaptation guidance and templates for local authorities and public service boards to support consistent adaptation assessment and reporting. | 2025 |
| Finance and Local Government | Develop and regularly update information on existing government and non-government funding streams available to local actors, such as local authorities and public service boards. | 2024 |
| Finance and Local Government | Create targeted funds for local actors to undertake risk assessment and adaptation planning at a local level. This could include financing for community adaptation. | 2024 |
| Finance and Local Government, Climate Change | Ensure that Corporate Joint Committees embed adaptation and mitigation at the core of engagement and all eventual plans. | From 2023 |
| Health and Social Services, Social Partnership | Conduct a regular survey of public perceptions of risk, resilience and preparedness to better understand requirements for support and identify what interventions should be prioritised. | From 2024 |
| Climate Change | Include community engagement activities (such as citizens assemblies) in the next adaptation programme, to put fairness at the centre of efforts to implement a vision for a well-adapted Wales. This engagement programme should focus on exploring issues of fairness in some of the most challenging aspects of adaptation and in the provision of public funding for adaptation. | 2025 |
| Economy, Arts Sport and Tourism | Provide dedicated resource for climate adaptation in the Cultural Heritage sector. | 2024 |
| Economy, Arts Sport and Tourism | Review cultural heritage indicators in the next adaptation programme to ensure they accurately reflect the way information can be gathered and reported. This could include considering joint indicators with government stakeholders outside Welsh Government. | 2024 |

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- ⁵⁹ South Wales Fire and Rescue Service (2023) *Healthy Hillsides*, <https://www.southwales-fire.gov.uk/your-safety-wellbeing/your-community/healthy-hillsides>.
- ⁶⁰ Welsh Government (2014) *Emergency Financial Assistance Scheme*, <https://www.gov.wales/emergency-financial-assistance-bellwin-scheme-local-authorities-html>.
- ⁶¹ Cadw (2022) *Annual Report 2021-22*, <https://cadw.gov.wales/sites/default/files/2023-03/Cadw%20Annual%20Report-2021-2022.pdf>.
- ⁶² Hayles, C. for the Welsh Government (2022) *How resilient are buildings in the UK and Wales to the challenges associated with a changing climate?*, <https://www.gov.wales/sites/default/files/publications/2022-06/resilience-of-buildings-to-challenges-associated-with-climate-change.pdf>.
- ⁶³ Welsh Government (2022) *Historic Environment and Climate Change in Wales: Sector Adaptation Plan Actions and Activities Evidence Gathering 2022*, <https://cadw.gov.wales/sites/default/files/2023-01/SAP%20ActionActivities%20Survey%20Info%20%20Document%202022%20FINAL%20ENGLISH%20100123.pdf>.

⁶⁴ Welsh Government (2019) *Flooding and Historic Buildings in Wales*,
<https://cadw.gov.wales/sites/default/files/2019-07/Flooding%20and%20Historic%20Buildings%20in%20Wales%20Eng.pdf>.

⁶⁵ Atkins (2023) *Evidence based decision making to support climate change adaptation*. National Trust provided to CCC by request.

⁶⁶ National Trust (2023) *Provided by request to the CCC*.



Chapter 13

Business

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Introduction

Table 13.1

Progress summary – Business

| | Delivery and implementation | Policies and plans | Summary |
|--|-----------------------------|---------------------------------|---|
| Outcome 1: Public and private adaptation measures are implemented to minimise risks to business sites | Unable to evaluate | Limited policies and plans | <ul style="list-style-type: none"> There is limited time-series data on changes in flood risk for business sites as well as a lack of data on indirect risks and other hazards. Flood and coastal risk management schemes are in place and provide some protection to businesses, but there is no water reduction target or sufficient information for businesses to adapt to climate change. |
| Outcome 2: Businesses have access to insurance and capital including for adaptation | Unable to evaluate | Partial policies and plans | <ul style="list-style-type: none"> There is a lack of consolidated and large-scale collected information for business access to insurance and capital for adaptation. There are some examples of grants or loans targeted to business adaptation, but they are not long-term commitments at a scale necessary. |
| Outcome 3: Productivity losses due to physical climate risks are minimised | Unable to evaluate | Insufficient policies and plans | <ul style="list-style-type: none"> There is a lack of quantified and comparable data on productivity losses in Wales due to climate risks. Further investigation is needed to understand potential climate risks to productivity in Wales. Limited policies and plans exist to ensure that buildings do not overheat during heatwaves. |
| Outcome 4: Supply chain risks are identified and managed | Unable to evaluate | Limited policies and plans | <ul style="list-style-type: none"> There is a lack of assessment of climate risk exposure of Welsh supply chains. Recent developments place resilience to climate change within public procurement duties. |
| Outcome 5: Risks and actions are disclosed and managed by businesses | Mixed progress | Limited policies and plans | <ul style="list-style-type: none"> Available indicators demonstrate mixed progress for this outcome, with disclosure coverage growing but gaps found in relation to reporting on adaptation action and risk management. UK-wide reporting schemes are driving climate-risk reporting, but small and medium-sized enterprises (SMEs) are outside many of these schemes currently. |

Relevant risks from CCRA3:

B1 Risks to business from flooding; B2 Risks to businesses and infrastructure from coastal change; B3 Risks to businesses from water scarcity; B5 Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working env

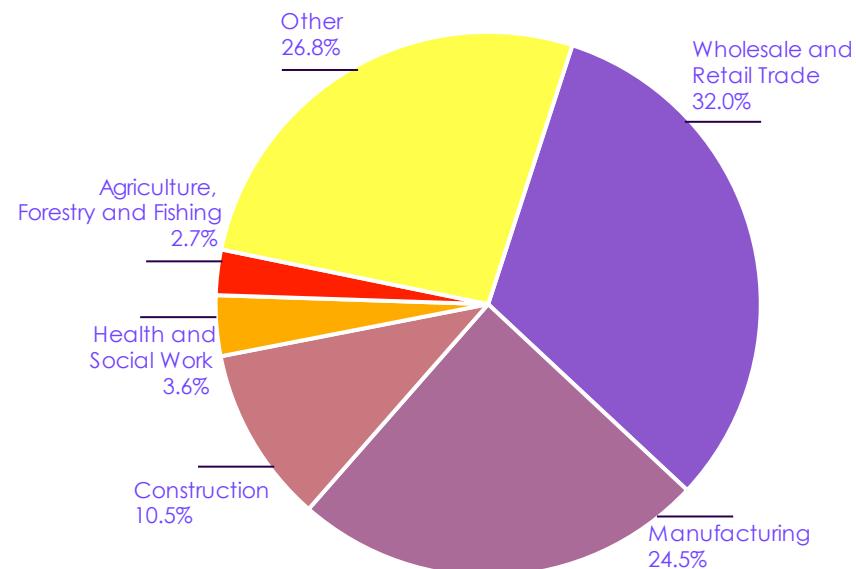
This chapter covers adaptation to climate change by businesses located in Wales. The focus is on assessing the Welsh Government's contribution in supporting businesses to adapt to climate change. Business sites, commercial activities and supply chains can be directly disrupted by flooding and storms; coastal change due to erosion; risks of reduced water availability; and higher temperatures in working environments.

Businesses are also indirectly exposed to the full range of weather and climate risks (both domestically and internationally) through infrastructure failure, disruption of supply chains and shocks to the prices of key commodities. Some business sectors also have opportunities from a changing climate. Warmer summers may lead to possible opportunities for increased tourism, improved growing conditions for agriculture (for particular products such as wine) and opportunities to provide goods and services to meet a growing need for adaptation across the economy.

The largest components of Welsh industry sectors are wholesale and retail trade, manufacturing and construction.

The largest components of Welsh industry sectors are wholesale and retail trade (32%); Manufacturing (25%); and Construction (11%). Wales has a greater contribution from health and social work than other nations in the UK (Figure 13.1). SMEs account for 51% of turnover, compared to 44% in England.¹ Agriculture, Forestry and Fishing is covered in detail in Chapter 3 Working land and seas.

Figure 13.1 Welsh private sector turnover



Source: BEIS (2022) Business population estimates for the UK and regions 2022.

Notes: 'other' includes Mining and Quarrying; Electricity, Gas and Air Conditioning Supply; Water Supply; Sewerage, Waste Management and Remediation Activities; Transportation and Storage; Accommodation and Food Service Activities; Information and Communication; Financial and Insurance Activities; Real Estate Activities; Professional, Scientific and Technical Activities; Administrative and Support Service Activities; Education; Arts, Entertainment and Recreation; Other Service Activities.

Climate impacts for businesses will vary depending on depending on sectors, size and type of business, and geographic location (Box 13.1). For example, the agri-food sector and water-intensive industries are highly vulnerable to physical climate- and nature-related risks. The energy sector's challenges are in ensuring security, equity and sustainability; the built environment is facing new demand for sustainable and functional structures that can withstand climate-related impacts.²

Box 13.1

Changes to the climate in Wales affecting businesses

CCRA3 Wales findings.

- Flooding of business sites: Climate change will increase the number of business and industry properties at risk of flooding from all sources and these could be in areas that have not previously been at risk of flooding.
- Coastal business locations and infrastructure: Future sea level rise will increase the coastal flood and erosion risk and increase exposure of businesses in coastal zones.
- Water scarcity for production processes: Water resource regions in England and parts of Wales are projected to be in deficit under a central population scenario and a +4°C at 2100 scenario without additional adaptation.
- Reduced employee productivity: There is some evidence available on future risks to labour productivity in the UK related to outdoor labour productivity, and urban productivity in the financial sector of city economies for industrial and construction sectors. In 2020, the Welsh Government commissioned a survey of Welsh businesses to identify how best to support them to adapt to higher working temperatures and infrastructure disruption because of climate change. Key findings are that most business do not currently see climate risk as a pressing issue: they are unclear on the risks, few are acting and they have insufficient information.
- Changes in demand for goods and services: Further investigation is needed in Wales to identify how climate change could affect production, comparative advantage and demand for certain goods and services.

Source: Netherwood, A (2021) *Evidence for the third UK Climate Change Risk Assessment (CCRA3) Summary for Wales*.

Physical climate risks and their impact on businesses cut across many aspects of society and are also covered elsewhere in this report.

A number of key business functions or sectors are also covered elsewhere in this report:

- **Nature and Working land and seas** (Chapters 2 and 3): Changes in the natural environment impact natural capital, particularly in agriculture and fisheries as business sectors.
- **Infrastructure** (Chapters 5 – 8): Most business functions depend on reliable infrastructure, with disruptions posing a key risk for site operations, access to markets, supply chain and distribution networks, and employee productivity.
- **Buildings** (Chapter 10): Overheating of buildings poses risks to employee well-being and productivity, and the state of the built environment and adaptation responses depend on business action, including investment and construction procedures.
- **Finance** (Chapter 14): Global exposure of UK financial sector through international transactions.

Relevant policy in this area is largely devolved with key divisions within Welsh Government namely 'Economy, Treasury and Constitution' and 'Climate Change and Rural Affairs'. However, macro-economic policy and certain corporate reporting schemes are largely controlled by the UK government. International trade is a reserved matter.

Within the Welsh Government's adaptation plan 'Prosperity for All: A Climate Conscious Wales (PfACCW)', coverage of climate risks and adaptation for businesses mainly focused on building the knowledge base (Box 13.2).

Box 13.2

Business within Prosperity for All: A Climate Conscious Wales

'Successful Businesses' is the section of the Welsh Government's adaptation plan which seeks to ensure Welsh businesses are prepared and protected from the impacts of climate change both now and into the future.

Specific actions include:

- SB1: Do more to understand the risks to businesses from infrastructure disruption and higher working temperatures.
- SB2: Provide support to businesses to help them adapt to the future risks from climate change.

Source: Welsh Government (2019) *Prosperity for All: A Climate Conscious Wales*; Welsh Government (2020) *Prosperity for All: A Climate Conscious Wales: monitoring and evaluation framework*.

1. Monitoring progress towards a well-adapted business sector

The overarching goals for a well-adapted business sector include a reliable supply of goods and services, and a thriving economy, that is maintained despite climate change; and that, where they exist, the economic opportunities of climate change are realised. Adaptation also limits the extent of damages, losses and disruption to business sites, production processes and the workforce.

While often used in conjunction with 'resilience' within the business community, the focus of this chapter is specifically on responding to physical climate risks, and not broader actions to deliver a low-carbon economy that is resilient to changing markets or regulations.

A number of policy actions and enabling factors are needed to deliver a well-adapted business sector.

We have identified key outcomes to deliver a well-adapted business sector. A number of policy actions and enabling factors are needed to deliver these outcomes (Figure 13.2). The key adaptation outcomes that need to be achieved for Welsh businesses are:

- **Public and private adaptation measures are implemented to minimise risks to business sites.** Physical climate impacts, such as extreme weather events, pose a risk to business sites and operations. Climate impacts on resource availability, such as water, can also impact organisations' ability to deliver goods and services. Adaptation to these will require adaptation actions from business themselves (such as preventing workplaces from overheating) as well as wider public adaptation (such as flood management schemes).
- **Businesses have access to insurance and capital including for adaptation.** Businesses will need capital to take adaptation actions and insurance to insulate them from climate shocks – access to these markets, at reasonable cost, is therefore a key element of climate resilience for all business sectors.
- **Productivity losses due to physical climate risks are minimised.** Climate change impacts, such as extreme heat or weather-related travel disruption, can make it difficult for staff to conduct their roles. Without adaptation measures, there is a risk of resulting productivity losses, ultimately impacting on business output and profitability. This risk is not currently well understood in Wales and was identified as requiring further investigation in CCRA3.
- **Supply chain risks are identified and managed.** Businesses in Wales rely on well-functioning supply chains, both domestically and internationally, to deliver goods and services. There are a multitude of risks to supply chains from climate change, such as transport disruption and loss of produce.*
- **Risks and actions are disclosed and managed by corporates.** Businesses will need to undertake robust climate risk assessments to identify the necessary adaptation actions they will have to take. Government coordination with businesses to create a transparent information disclosure regime can in turn drive possible incentives for those businesses that are taking effective action (for example from customers and investors).

* Trade policy is reserved to UK Government.

Both large business and SMEs have an important role to play in delivering adaptation across the wider economy.

Businesses of all sizes need to adapt to manage material risks, adhere to regulations or realise potential new opportunities. Importantly, the policies and enablers to support businesses of varying sizes are different. Both large businesses and SMEs have an important role to play in delivering adaptation across the wider economy through implementing adaptation actions and providing the goods and services that can help make Wales more resilient. There is a risk of lock-ins that occur when business decisions 'lock in' future climate risk that may be irreversible or costly to revert later. This can occur through businesses' decisions on choices such as operating models, site locations, supply chains, technologies, or pre-existing adaptation actions, which may increase exposure to long-term risks.

Enabling factors that need to be in place to deliver these outcomes are wide-ranging and include:

- **Governance.** Companies need to embed climate change risks and adaptation into their internal risk governance strategies. This includes development of climate-sensitive business continuity plans, integration of adaptation into climate-related mandatory reporting structures, assigning Board-level responsibility for climate adaptation and establishing responsible investment policies.
- **Engagement and education** is needed to embed climate adaptation skills within companies. Establishing capacity for risk assessment and scenario analysis helps companies identify key risk areas and potential effective actions. Developing the skills needed to raise finance successfully for adaptation is important, along with dedicated engagement with suppliers on climate adaptation. For SMEs, there should be good access to adaptation guidance and tools.
- **Funding and investment** are needed to deliver adaptation interventions, for example through adaptation-linked financial products. Insurance products designed for adaptation can catalyse adaptation action. Government funding for pilots and support for development of new markets is a powerful enabler.
- **Data and monitoring** are essential to enable robust risk assessment, tracking of effective actions, quantifying adaptation intervention costs and benefits, and understanding of interdependencies. Building greater evidence to quantify and monetise benefits of adaptation action can enable investment.
- **Research** is needed to drive innovation in future-ready goods and services, business processes and supply chains, along with identifying any opportunities from climate change.

Key policy milestones to deliver a well-adapted business sector in Wales are related to a mixture of devolved and reserved.

Key policy milestones to deliver a well-adapted business sector in Wales are related to a mixture of devolved and reserved responsibilities. For our assessment we focus on policy levers in the control of Welsh Government but consider reserved policy where relevant for adaptation implementation.

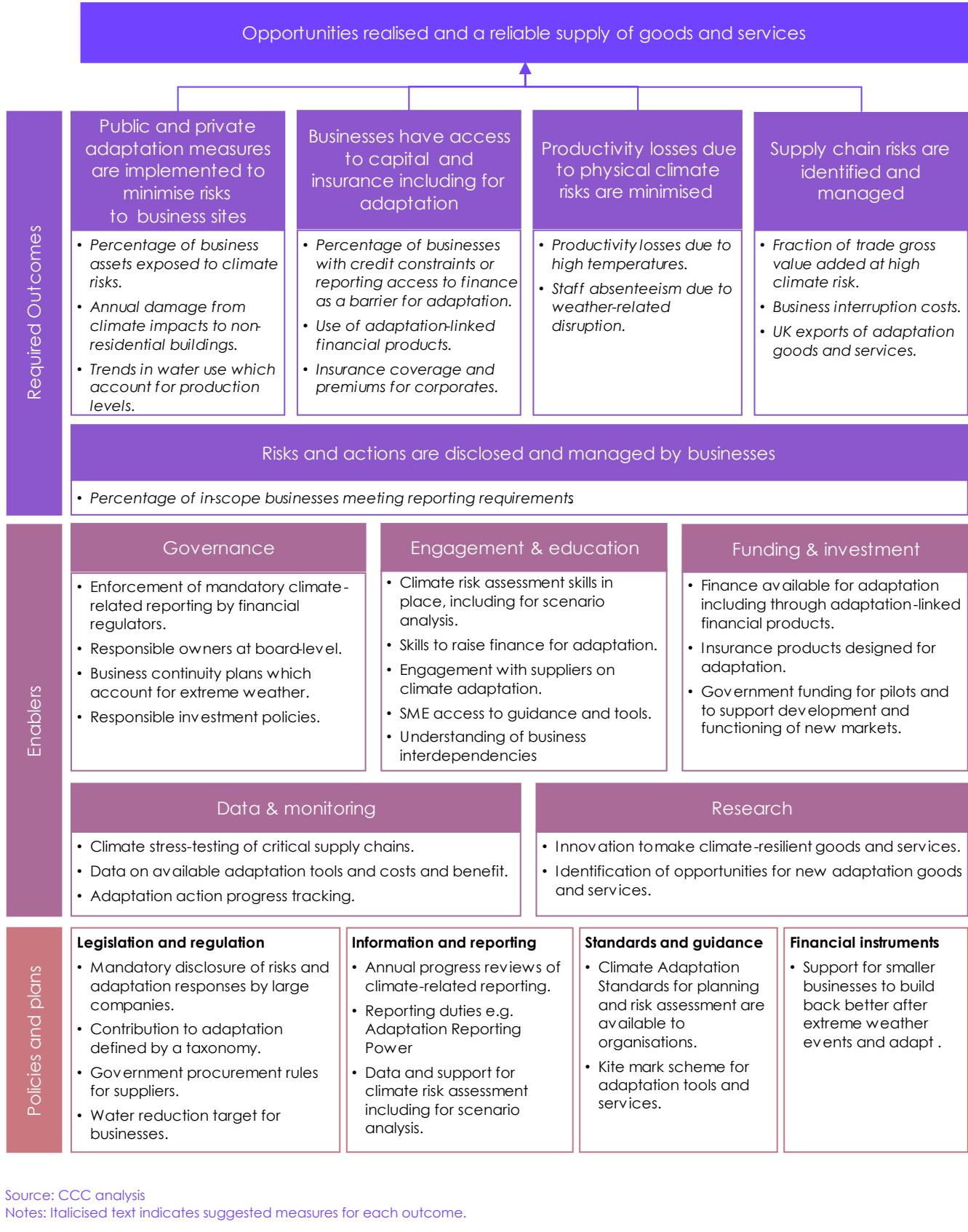
- **Legislation and regulation.**
 - **Welsh scope.** Government procurement rules that give weight to adaptation plans for suppliers can establish high standards and provide incentives, for example for design of climate resilience products and services and by setting of water reduction targets.

- **UK wide.** Mandatory disclosure of business risks and adaptation responses by large companies, along with green finance taxonomies that cover adaptation can drive transparency and enable effective decision-making. Setting a water reduction target for businesses to drive water efficiency is needed to address water availability risks. Large businesses operating in Wales will be influenced by major UK-wide sustainability reporting initiatives, like the Taskforce on Climate-related Financial Disclosures (TCFD) and Transition Pathway Taskforce requirements.

The Welsh Government has an important role in determining consistent standards, scenarios and data provision for businesses.

- **Information and reporting.** Larger businesses often have greater organisational capacity for undertaking climate risk analysis and developing adaptation actions in response, though government still has an enabling role in determining consistent standards, scenarios and data provision. Smaller businesses have less capacity to assess their risks, devise responses and recover after extreme weather events. They require clear central resources, where they can access the information they need to make business continuity plans for extreme weather and changes in the climate.
 - **Welsh scope.** Reporting powers could be used to gather information on reporting authorities plans for adapting to climate change. Other policy levers include data and assessment support for climate-related scenario analyses and reporting.
 - **UK-wide.** The adaptation reporting power is in place and covers required key sectors to gather information on the current and future predicted effects of climate change on their organisation and their actions taken and future proposals for adapting to climate.
- **Standards.**
 - **Welsh scope.** Consistent guidance for adaptation planning, tools and services relevant to business context in Wales.
 - **UK wide.** UK-wide standard setting institutions establish consistent standards for adaptation goods and services, for example through a Kite mark scheme.
- **Financial instruments.**
 - **Welsh and UK-wide scope.** The impact of extreme weather events can be damaging for businesses, and additional grants and subsidies can reduce the time for which they are unable to trade, the likelihood of them closing down and economic and social consequences. Insurance products designed for adaptation can catalyse adaptation action.

Figure 13.2 Monitoring map for business



Source: CCC analysis

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section.

(a) Outcome 1: Public and private adaptation measures are implemented to minimise risks to business sites

A lack of available information means we are **unable to evaluate** progress on this outcome. There is limited time-series data on changes in flood risk for business sites as well as a lack of data on indirect risks and other hazards.

Tidal flooding poses a high risk to non-residential properties in Wales, and flood risks are predicted to increase under climate change.

- **Tidal flooding poses a high risk to non-residential properties in Wales, and flood risks are predicted to increase under climate change.** More non-residential properties are at high risk from tidal flooding (4,424 properties) than medium (1,835 properties) and low (1,154 properties) combined (Figure 13.3). Sayers and Partners (2020) data indicates that the number of non-residential properties in Wales at all types of significant flood risk could increase by 16% under a 2°C current levels of adaptation scenario by 2050.* For fluvial flooding, the increase is 11%. For surface water flooding, the increase is 22%. For coastal flooding, the increase is 2%.³
- **Expected flood damages to non-residential properties in Wales are disproportionately high.** The expected direct annual damages for non-residential properties in Wales at present is estimated at £51 million, comprising of 8% of total UK damages.⁴ This is a higher proportion than the proportion of total businesses in Wales compared to the UK, which in 2022 accounted for only 4% of the UK total.⁵
- **There is limited recent information on non-residential properties unprotected by defences for flooding and development in flood plain.** In 2019, 14,200 non-residential properties were within 'defended areas' at fluvial and tidal flood risk in Wales. The data is based on fluvial and tidal sources only as there are no pluvial defended areas.⁶ See Chapter 9 (Towns and cities) for more information on flood defences. The amount of development land granted permission for non-residential development in floodplain areas in 2018-2019 was 77 hectares, split relatively evenly across zone C1 (35.2 ha) and zone C2 (42.0 ha) (Figure 13.4).[†] This is a return to modest levels of potential development in flood risk areas, following two years which saw large amounts of development land in flood risk areas granted permission.⁷ However, due to the COVID-19 pandemic collection of data from local authorities was ceased for recent years.
- **There is limited data on non-domestic water consumption.** Data is available on consumptive water abstraction for industry/commerce/public services which is 526,694 ML/year, or 23% of total consumptive abstractions, but is from 2018.⁸ Large industrial users of water are in Milford Haven in South West Wales, in steel manufacturing in South East Wales and in Deeside industrial

There is limited data on non-domestic water consumption.

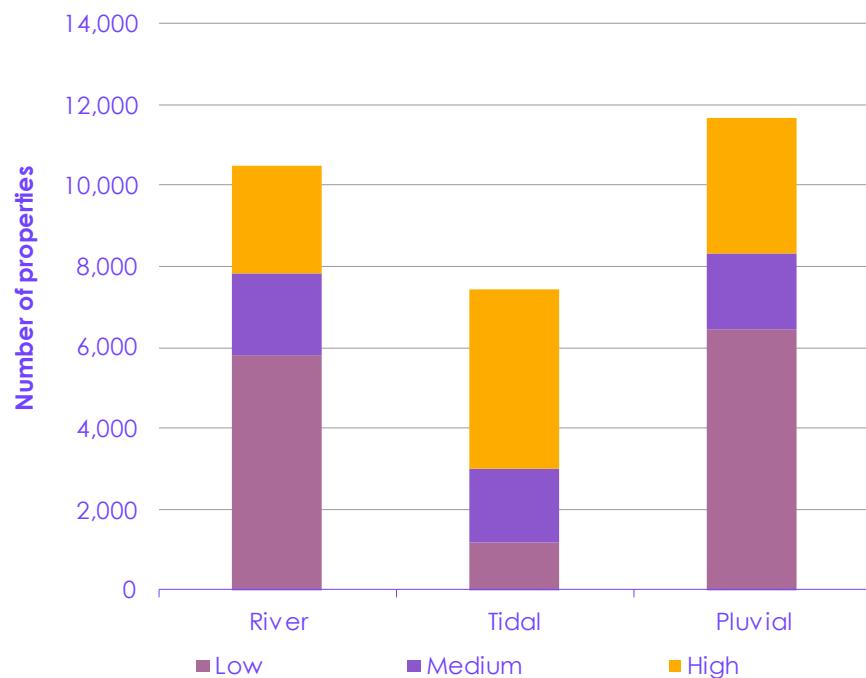
* Assumes a continuation of Current Levels of Adaptation (CLA), assuming current policies continue to be implemented and a warming scenario of a 2°C rise in Global Mean Surface Temperature (GMST) by 2100 relative to pre-industrial times.

† Zone C1 indicates areas which are developed and served by significant infrastructure, including defences. Zone C2 indicates areas without flood defence infrastructure, where development should be avoided.

complexes in North Wales. Data on water use by businesses at a national level, ideally accounting for changes in production levels, is needed to assess progress on risk mitigation.

- **Additional data would enable better progress monitoring against this outcome.** Useful indicators could include: percentage of business assets exposed to climate risks, annual financial damage from climate impacts to non-residential buildings, annual non-residential water consumption which account for production levels.

Figure 13.3 Non-Residential properties at risk of flooding

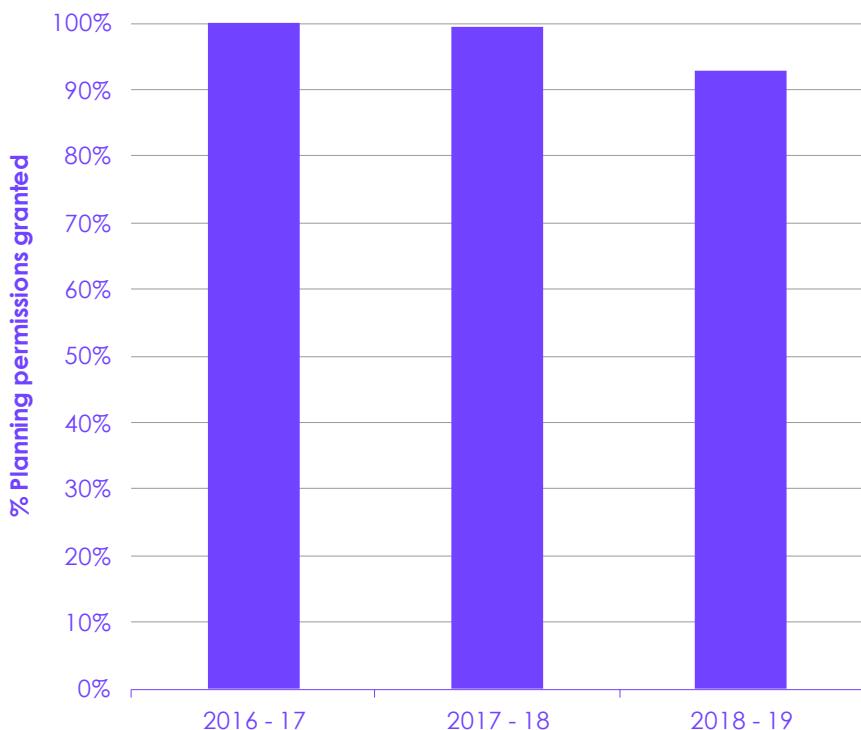


Source: Natural Resources Wales (2022) Flood risk management annual report 2021-2022.

Notes: Pluvial flooding is when an extreme rainfall event creates a flood.



Figure 13.4 Percentage of planning permissions granted for non-residential development applications in the floodplain



Source: Welsh Government (2019) *All Wales Planning Annual Performance Report 2018-19*.

Notes: There is no available data after 2018/19. Graph shows the number of permissions granted out of applications for development in the floodplain (not all applications). Zone C is floodplain area with a greater than 0.1% chance of flooding in any year.

(b) Outcome 2: Businesses have access to capital and insurance including for adaptation

It was **not possible to evaluate** this outcome due to a lack of consolidated and large-scale collected information.

- **Welsh specific estimates of adaptation investment gaps are missing.** Recent CCC research highlights the multiple barriers that currently limit investment into building climate resilience from beyond the public sector. These include market, information, bankability, policy, regulatory and behavioural barriers that can prevent business access capital and insurance for adaptation.⁹
- **There are challenges in accessing finance for small businesses across Wales.** Overall business investment across the UK decreased in Q4 2022 and remains below 2019 levels and interest rates on small business loans have increased for 16 consecutive months to February 2023.¹⁰ Firms in Wales are reporting escalating energy costs, labour shortages and ongoing supply chain issues.¹¹
- **The establishment of the Development Bank of Wales is helping to improve access to finance for some SMEs in Wales, but it is currently focused more on decarbonisation activities than adaptation.** Mid-progress report beneficiary survey evidence suggests that the Development Bank of Wales'

The establishment of the Development Bank of Wales is helping to improve access to finance for some SMEs in Wales.

'Wales Business Fund' (WBF) has improved access to finance for SMEs in Wales. Before securing WBF investment most businesses surveyed had been actively seeking finance for at least four months (53%). The most common range of time to have been seeking finance was six to 12 months.¹² Whilst the Development Bank of Wales has environmental investment goals, the current focus of projects has been mainly on decarbonisation.¹³

(c) Outcome 3: Productivity losses due to physical climate risks are minimised

It was **not possible to evaluate** this outcome due to lack of quantified and comparable data on productivity losses in Wales due to climate risks.

- **CCRA3 identified risks to employee productivity in businesses due to higher temperatures as an area requiring further investigation in Wales.** Only a limited number of studies have considered the impacts of higher temperatures on productivity in the UK, and there is no regional breakdown.
- **The majority of surveyed Welsh businesses do not currently identify increased working temperatures as a risk to productivity.**¹⁴ For those that did, the most common reasons were staff ability to work (38%) and impacts on equipment/materials (11%).¹⁵
- **Data on non-residential overheating is not available.** There is no available data on overheating in business locations in Wales. See Chapter 10 (Buildings) for more information.
- **Recent flood events have brought disruption to businesses in Wales.** February 2020 brought devastating flooding to Wales with successive storms and record rainfall levels. More than 2,000 homes and 600 businesses suffered internal flooding, affecting areas that had not seen flooding for decades.¹⁶

Recent flood events have brought disruption to businesses in Wales.

(d) Outcome 4: Supply chain risks are identified and managed

It was **not possible to evaluate** this outcome due to a lack of assessment of climate risk exposure of Welsh supply chains.

- **There are no current analyses of exposure of major import sectors to climate risks.** Wales's largest import partners* are United States (machinery and transport), China (machinery and transport equipment) and Germany (machinery and transport equipment). The biggest food imports are from Ireland and Belgium.¹⁷ There is very limited data on exposure of these supply chains to climate risk. Food supply chains are covered in detail in Chapter 4.
- **A large proportion of surveyed manufacturing firms have reported supply chain difficulties, but the reason for these was unclear.** A survey commissioned by Welsh Government through its Industry Wales organisation ahead of the Welsh government's refreshed 'Manufacturing Plan for Wales' found that 79% of respondents said they had faced supply chain difficulties, but no further information was provided on the causes of disruption.¹⁸

* Excluding imported energy products.

(e) Outcome 5: Risks and actions are disclosed and managed by businesses

Available indicators demonstrate **mixed progress** for this outcome, with disclosure coverage growing but gaps found in relation to reporting on adaptation action and risk management.

- **UK-wide reporting schemes are stimulating climate-risk reporting by large businesses, but disclosures on risk management and adaptation remain a key gap.** For example, large Welsh businesses can align with the UK-wide Task Force on Climate-related Financial Disclosures (TCFD) reporting scheme, which currently would cover the c.95 businesses with over 500 employees.¹⁹ There is no central data collection or oversight on the level of uptake or quality of responses.
- **Some businesses with operations in Wales responded to the latest Adaptation Reporting Power round of submissions.** These included Wales and West Utilities Limited, Network Rail, Cardiff International Airport, and Severn Trent Water Ltd. For more detailed analysis of submissions please see Chapter 8 (Transport), Chapter 5 (Water Supply) and Chapter 6 (Energy).
- **A baseline survey for food and drink companies has been completed, but with limited information on adaptation actions.** A Sustainability Self-Assessment online questionnaire has been developed and tested on a sample of 78 businesses (representing just under 10% of businesses). The survey provides baseline information on the strengths and areas for improvement for the industry.
- **SMEs currently remain out of scope for the mandatory disclosure schemes** with little consolidated information available to assess their management of climate risk.

(f) Progress on enablers

To achieve these outcomes for well-adapted businesses, multiple enabling factors must be in place. There is limited data available to assess progress in achieving enablers.

- **Engagement and education.**
 - ‘Business Wales’ website provides information, advice, guidance and support for businesses in Wales, but there is little information on business climate adaptation. It provides expert sessions and information on ‘green ambition’ but this is currently focused on decarbonisation and circular economy. The ‘Business Wales’ website does provide some guidance on water efficiency.
 - Flood Awareness Wales helps volunteers from communities to develop and maintain their own Community Flood Plans. Flood Awareness Wales has helped over 1000 communities, schools and businesses across Wales develop flood plans and has been commended through an independent review.²⁰
 - Welsh Government have provided a guide for creating business cases for action on climate for the private sector which includes information

Flood Awareness Wales has helped over 1000 communities, schools and businesses across Wales develop flood plans.

on potential sectoral impacts of climate change for businesses in Wales and information on potential ways to ‘future-proof’ businesses.²¹

- **Data and monitoring.** More progress is needed to establish the data and monitoring needed, such as tracking businesses adaptation actions and impacts, along with available data on adaptation costs and benefits.
- **Governance.** Monitoring of coverage of business continuity plans is not in place. Business Wales provides limited information on how to create a business continuity and briefly lists ‘extreme weather conditions’ as a potential risk to consider.²²
- **Funding and investment.** There is a lack of data to assess this.

3. Policy and planning progress

This section documents key policy developments relevant to each of the climate resilience outcomes identified within our monitoring map and the extent to which the key policy and planning milestones are in place.

(a) Outcome 1: Public and private adaptation measures are implemented to minimise risks to business sites

The policy score for this outcome is **limited**. There are credible and partial flood and coastal risk management schemes in place that can provide some protection to businesses, but no water reduction target or sufficient information for businesses to adapt to climate change.

There is a Flood and Coastal Risk Management programme in place in Wales that also offers protection to non-residential buildings.

- **There are credible and partial policies and plans in place to protect areas of Wales from river, coastal and surface water flooding and coastal erosion.** There is a Flood and Coastal Risk Management programme in place in Wales that also offers protection to non-residential buildings. Businesses and public buildings can also benefit from flood alleviation schemes, in particular those schemes which reduce risk to a mix of development types such as homes and shops along a high street or local district centre.²³ See Chapter 9 (Towns and Cities) for more detail on flood prevention policies.
- **There is no current water reduction target in place for businesses.** The Water Strategy for Wales mentions the need to 'encourage a reduction in domestic and business water use' but no specific delivery plan and it has not been updated since 2015.²⁴
- **Natural Resources Wales offer a flood plan template and flood warning system for businesses.** The business flood planning guidance provides details on steps to take to plan for and prepare for a flood and a template for establishing a response plan.²⁵

(b) Outcome 2: Businesses have access to insurance and capital including for adaptation

The key policy milestones required for this outcome are partially in place. The policy score for this outcome is **partial**.

Private businesses are responsible for investing in the resilience of their specific commercial sites and their supply chains. This requires a range of incentives that allow businesses to raise capital to invest in resilience and well-designed regulation to enable investment in all regulated sectors.

There is a missed opportunity to integrate adaptation goods and services in regional deals and innovation strategy.

Whilst there are some examples of grants or loans targeted to business adaptation, they are not long-term commitments at a scale necessary. There is a missed opportunity to integrate adaptation goods and services in regional deals and innovation strategy.

- **The Development Bank of Wales has a Green Business Loan scheme in place and covers some limited form of adaptation actions.** Loans are available for water usage improvements and building fabric improvements which could deliver adaptation benefits.²⁶ The scheme has had a strong

uptake since launching in Jan 2023, but current focus of projects has been mainly on solar development with little uptake so far for adaptation actions.

- **Welsh Government's 'A Manufacturing Future for Wales' strategic plan embeds climate resilience into economic contracts, but the plan is lacking on specific details.** The stated objective is to 'Embed low carbon and climate resilience within the Economic Contract (in place for any business receiving Welsh Government support) and expand consideration into all other aspects of Welsh Government spend including grants and procurement.'²⁷ However, there are no further specifics in the strategy for how climate resilience will be embedded or considered alongside decarbonisation.
- **Welsh Government have reactively provided business grants to recover from flooding, but there is a lack of consistent schemes for businesses.** In 2021, the Welsh Government launched a time-bound Flood Relief Fund for Welsh SMEs to recover from storm damage. A grant of up to £2,500 was available to cover costs that cannot be recovered from insurance.²⁸ Since then there has been no commitment to further flood recovery funding for business. Flood Re is active in Wales but remains only for households.
- **Recent major national development and business strategies do not currently give specific action plans that include adaptation.** There was no evident consideration of climate risk and adaptation in the four major regional deals across Wales which represent over £2 billion of investment.^{29,30} The 2023 Innovation strategy for Wales sets out a 'climate and nature' mission and indicates strategic innovation in land use management to deliver resilient ecosystems. It also sets a progress goal for 'How resilient communities are to climate change (tackling the climate emergency)' but no further specific actions. It is too early to assess the delivery of this plan.³¹

(c) Outcome 3: Productivity losses due to physical climate risks are minimised

There are **insufficient policies and plans** in place to ensure productivity losses due to physical climate risks are minimised.

- **Guidance for businesses on working in hot temperatures is linked from the Business Wales website.** Employers must stick to health and safety at work law, including keeping the temperature at a comfortable level and providing clean and fresh air.
- **There are limited policies and plans in place to ensure buildings do not overheat during heatwaves.** See Chapter 10 (Buildings) for further information.
- **Health and social care is a larger proportion of private sector turnover in Wales compared to other parts of the UK.** But adaptation planning for the healthcare sector is very high level and actions are not scheduled until 2026. See Chapter 11 (Health) for more information.

(d) Outcome 4: Productivity losses due to physical climate risks are minimised

There are **limited policies and plans** in place to ensure supply chain risks are identified and managed. Recent developments place resilience to climate change within public procurement duties, but there is a current lack of understanding on climate risk exposure, and therefore how to address it for Welsh supply chains.

A socially responsible procurement duty is in place that includes a consideration of 'resilience to the impact of climate change'.

- **A socially responsible procurement duty is in place that includes a consideration of 'resilience to the impact of climate change'.** The public sector in Wales spend around £94.4 million on food per year.³² The Social Partnership and Public Procurement (Wales) Bill was passed in 2023 and places a statutory duty on certain public bodies to consider socially responsible public procurement when carrying out procurement, to set objectives in relation to well-being goals and to publish a procurement strategy.³³ Encouragingly 'resilience to the impact of climate change' is included within the 'Environment' category.³⁴ It is too early to assess the quality of the procurement strategies in relation to adaptation.
- **A supply chain mapping exercise is underway as part of Welsh Government's 'A Manufacturing Future for Wales' strategic plan, but there is a lack of focus on assessing climate risk exposure.** Its purpose is to better understand the existing capability and capacity across sectors including Renewable Energy, Housing, Healthcare & Life Sciences, Construction, Food & Drink, Transport and public procurement to identify opportunities to re-shore existing supply chains. This is a positive exercise and should be expanded to also include climate resilience.
- **A 'Resilient Food & Drink Supply Chains' pilot project was initiated with funding from the Welsh Government Covid Recovery Challenge Fund but focus is on economic disruption rather than climate risks.**³⁵ This is a pilot procurement platform solution aimed at supporting producers to develop more efficient and robust supply chains.
- **Welsh Government have set an ambition of 'increasing exports and attracting inward investment, creating new jobs and opportunities for people in Wales'.**³⁶ There is an opportunity to consider climate risks and opportunities for adaptation goods and services.

(e) Outcome 5: Risks and actions are disclosed and managed by businesses

The key policy milestones within Welsh Government's control for this outcome are partly in place. The policy score for this outcome is **limited**.

- **The UK Government announced its intention to make TCFD-aligned disclosures mandatory by 2025.** This will also apply to Welsh businesses which will help to drive understanding and management of climate risks.
- **SMEs are currently not covered by major disclosure schemes.** More guidance could be provided to support SME businesses with climate risk assessments and adaptation action planning.
- **The majority of responding businesses with operations in Wales that fell under the third round of Adaptation Reporting Power requests (ARP3) are**

robustly assessing climate risks, but are lacking on managing these with a comprehensive programme (Table 13.2).³⁷ See Chapter 5 (Water supply) Chapter 6 (Energy) and Chapter 8 (Transport) for more information. Extending the scope of ARP to include other key value chains, such as food, would increase the value of ARP in providing a picture of the current resilience of goods and services.

Table 13.2

High-level summary of quality of Adaptation Reporting Power Third round responses

| | Robust assessment of current and future risks to the organisation? | Comprehensive programme of measures presented, both current and future? |
|--------------------------------------|---|--|
| Cardiff International Airport | Yes | Yes |
| Wales and West Utilities | Yes | Yes |
| Severn Trent Water | Partial | Partial |
| Network Rail | Yes | Yes |
| SP Energy Networks | Yes | No |
| National Grid (electricity) | Yes | No |
| National Grid (gas) | Yes | Yes |

Source: CCC analysis; CCC (2022) *Understanding climate risks to UK infrastructure: Evaluation of the third round of the Adaptation Reporting Power*.

- **There is an extensive provision of climate risk information available for Welsh businesses, but guidance on adaptation planning and response needs to be strengthened.** Recent efforts to centralise and make publicly available climate risk information through DataMapWales could help businesses access information e.g. on flood risk scenarios.³⁸ Plans for 2023-24 include to develop and roll out a training course and handbook on Climate Adaptation and Resilience Training tailored to the Food & Drink Industry. The training will equip businesses with the knowledge and skills to develop practical actions and systems to prepare for the risks and opportunities of climate change. This could be widened to other business sectors across Wales.

(f) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps (Table 13.3). Primary responsibilities are assigned to ministerial portfolios, unless stated otherwise.

Table 13.3

Recommendations – Business

| Primary responsibility | Recommendation | Timing |
|---------------------------------------|---|--------|
| Economy | Consider climate risk and adaptation in the four major regional deals across Wales at planning stage. | 2025 |
| Economy, Finance and Local Government | Provide financial support for smaller businesses to recover and adapt after extreme weather events. | 2024 |
| Economy | Carry out stress testing exercises to understand the resilience of essential goods supply chains. | 2024 |
| Business Wales | Develop more adaptation dedicated resources on 'Business Wales' website. Find good case studies and establish business champion programmes to provide clear examples, practical actions and engagement. | 2024 |
| Climate Change | Update the Water Strategy and include consideration of business water use efficiency. | 2024 |
| Economy | Engage with UK Government to strengthen adaptation reporting requirements across the UK Sustainability Disclosure Requirements. | 2023 |

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Chapter 14

Finance

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Introduction

Table 14.1

Progress summary – Finance

| | Delivery and implementation | Policies and plans | Summary |
|--|-----------------------------|----------------------------|---|
| Outcome 1: All financial institutions incorporate physical risks into financial decision-making | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> • Data on risks being incorporated into financial decision-making in Wales were largely not available. • For the UK, the latest CCC 2023 adaptation progress report to Parliament scored this outcome as limited policies and plans. There is progress to embed adaptation in financial regulators' activity, although it is still nascent. There is a lack of reliable indicators on how risk information is used in financial decisions. |
| Outcome 2: UK financial services are a global leader in adaptation | Unable to evaluate | Mostly reserved | <ul style="list-style-type: none"> • Financial indices data on adaptation are not publicly accessible to assess exports of adaptation goods and services. • For the UK, the latest CCC 2023 adaptation progress report to Parliament scored this outcome as insufficient policies and plans. There is a lack of consolidated information on size of the market for adaptation goods and services. Taxonomy for adaptation is still under development. |
| Outcome 3: No viable adaptation project fails for lack of finance | Unable to evaluate | Limited policies and plans | <ul style="list-style-type: none"> • There is a lack of aggregate estimates of the costs of adaptation for Wales and reliable estimates of potential remaining adaptation financing gaps. • A number of government grants have been put in place to provide financial support to implement adaptation actions. However, there is a lack of central coordination. • The establishment of the Development Bank of Wales is helping to improve access to finance for some SMEs in Wales, but it is currently focused more on decarbonisation activities than adaptation. |
| Outcome 4: Risks and actions are disclosed and managed by financial institutions | Mixed progress | Mostly reserved | <ul style="list-style-type: none"> • Large companies engaged in Financial Conduct Authority (FCA) regulated activities have a high degree of alignment with the Task Force for Climate-Related Financial Disclosures (TCFD). • For the UK, the latest CCC 2023 adaptation progress report to Parliament scored this outcome as limited policies and plans. While work has progressed on Net Zero transition plans, it is only just beginning on adaptation plans. There is a lack of agreed methodology for measuring the positive or negative contribution an investment portfolio is making or has made to adaptation outcomes. |
| <p>Relevant risks from CCRA3: B4: Risks to finance, investment and insurance including access to capital for businesses. ID8: Risks to the UK financial sector from climate change risks overseas.</p> | | | |

This chapter covers adaptation to climate change for the financial system. The financial system is a highly connected network of financial institutions – such as insurance companies, stock exchanges, and investment banks – that work together to exchange and transfer capital from one place to another.

Through the financial system, investors receive capital to fund projects and receive a return on their investments. There are approximately 55,000 people employed in the financial and related professional services in Wales. The sector contributes to 7% of total economic output in Wales.¹

The functioning and stability of this sector needs to be maintained despite climate shocks (Box 14.1). Physical climate risks can impact across the different risk categories that financial institutions face (such as credit risk, liability risk, and operational risk), and ultimately macro-financial risks.² Additionally, the financial sector in Wales needs to enable households, infrastructure providers and businesses to adapt to climate change by facilitating access to financial products and services. Significant investment will be needed over the next decade in several key areas to adapt to physical climate risks in the UK across flood protection, public water systems, housing, nature restoration, and infrastructure.

Box 14.1

Climate change hazards and the Welsh financial sector

The financial sector in Wales is exposed to climate impacts directly through loans and investments that have exposure to physical impacts, and indirectly from its interaction with all parts of the economy, both in the UK and overseas. Such as:

- Availability and affordability of insurance. There is emerging evidence of increased insurance costs after floods and heatwave events in the UK. In some high-risk areas businesses are reportedly experiencing difficulties accessing insurance cover for flood risk.
- Increased costs of capital. Evidence suggests that future impacts from extreme weather events are expected to increase capital costs due to impairment of fixed assets, inventory write-downs, costs of repair, retrofitting and acquisition of new sites.

Over the long-term, global exposure of the UK finance sector is deemed to be significant as it is highly networked and exposed to risk overseas for example through coastal flooding scenarios.

Source: Netherwood, A (2021) *Evidence for the third UK Climate Change Risk Assessment (CCRA3) Summary for Wales.*

Financial services firms in Wales follow the same legal and regulatory system as the rest of the UK.

The UK single market for financial services means financial services firms in Wales follow the same legal and regulatory system as the rest of the UK. The Bank of England is responsible for maintaining overall financial stability by monitoring and responding to risks including climate change. Other important roles are served by the regulatory bodies: the Financial Conduct Authority (regulates financial services firms and financial markets in the UK to ensure fair outcomes for consumers); the Financial Reporting Council (regulates auditors, accountants, and actuaries, and sets the UK's Corporate Governance and Stewardship Codes); the Prudential Regulation Authority (regulates and supervises financial services firms) and The Pensions Regulator (regulates workplace pension schemes).

Key financial institutions mainly serving only Wales include Development Bank of Wales (DBW) (owned by Welsh Government), and three main Welsh building societies (Monmouthshire, Principality, and Swansea). The only registered headquartered bank in Wales is Hodge. The Welsh Government's Programme for Prosperity for All: A Climate Conscious Wales (PfACCW) identified indicators and actions across key priority areas. Finance is a cross-cutting area, but there were no specific actions or indicators identified within the plan that monitor progress on the resilience of the financial sector in Wales to climate change.

1. Monitoring progress towards a well-adapted financial system

Successful adaptation means ensuring that the functioning of the UK's and Wales's financial system remains stable despite climate change and enables adaptation in the real economy. Building a well-adapted financial system is also necessary for the provision of capital for effective adaptation and to secure availability and affordability of insurance over time. The focus of this report is on the management of physical climate risks, rather than responses to broader sets of risks, such as transition risks. Whilst these often go hand-in-hand, this assessment is focused on actions taken in response to physical climate hazards.

We have identified key outcomes to deliver a well-adapted finance system (Figure 14.1):

To deliver a well-adapted financial system, several required outcomes need to be achieved.

- **All financial institutions incorporate physical risks into financial decision-making.** Understanding and integrating into decision-making the potential physical risks can help to steer capital towards activities that are adapted to a changing climate, as well as avoid investment in activities that increase climate risks (maladaptation).
- **UK financial services are a global leader in adaptation.** The UK has one of the largest financial sectors globally, that could be mobilised to deliver high quality adaptation financial services and products to enable wide-spread action in the UK and abroad.
- **No viable adaptation project fails for lack of finance.*** Increasing the UK's climate resilience requires investment at many scales. Lack of available and appropriately priced finance can limit the projects which go ahead. Financial institutions' contribution to providing insurance, lending and investment is key to enable implementation of adaptation measures by businesses and households.
- **Risks and actions are disclosed and managed by financial institutions.** Undertaking robust climate risk assessments enables financial institutions to identify the necessary adaptation actions. Creating a transparent information disclosure regime can provide a foundation that creates accountability and drives effective adaptation action, particularly by investors.

Enabling factors that need to be in place to deliver these outcomes are wide-ranging and include a mixture of action at both UK-level and at a Welsh level.

- **Governance** measures such as assigning institutionally responsible owners and internal committees to oversee climate risks and establishing ways to verify adaptation plans in place are needed.
 - **UK level action** to embed consideration of climate-related risks into financial conduct, macroprudential, microprudential, and monetary policy decision-making. Enforcement of high-quality climate-related reporting by financial regulators is needed.

* We use the term 'viable' to mean adaptation projects with benefits exceeding costs.

- **Engagement and education** to build skills across financial institutions in risk assessment scenario analysis, awareness of adaptation by corporates and households, how to successfully raise finance for adaptation and awareness of insurance options. This can be supported by modelling tools to assess physical risks.
- **Funding and investment** such as adaptation-linked financial products or government funding for pilots and supporting new markets.
 - **UK level action** to develop financial instruments that monetise adaptation and insurance products designed for adaptation.
- **Data and monitoring** covering corporate assets and monitoring of financial flows to adaptation, and establishing ways to verify adaptation plans, quantify effectiveness of adaptation and its return on investment.
- **Research** to support development of mechanisms to direct finance towards adaptation and identify opportunities for new adaptation goods and services.

Key policy milestones will be a mixture of devolved and reserved powers.

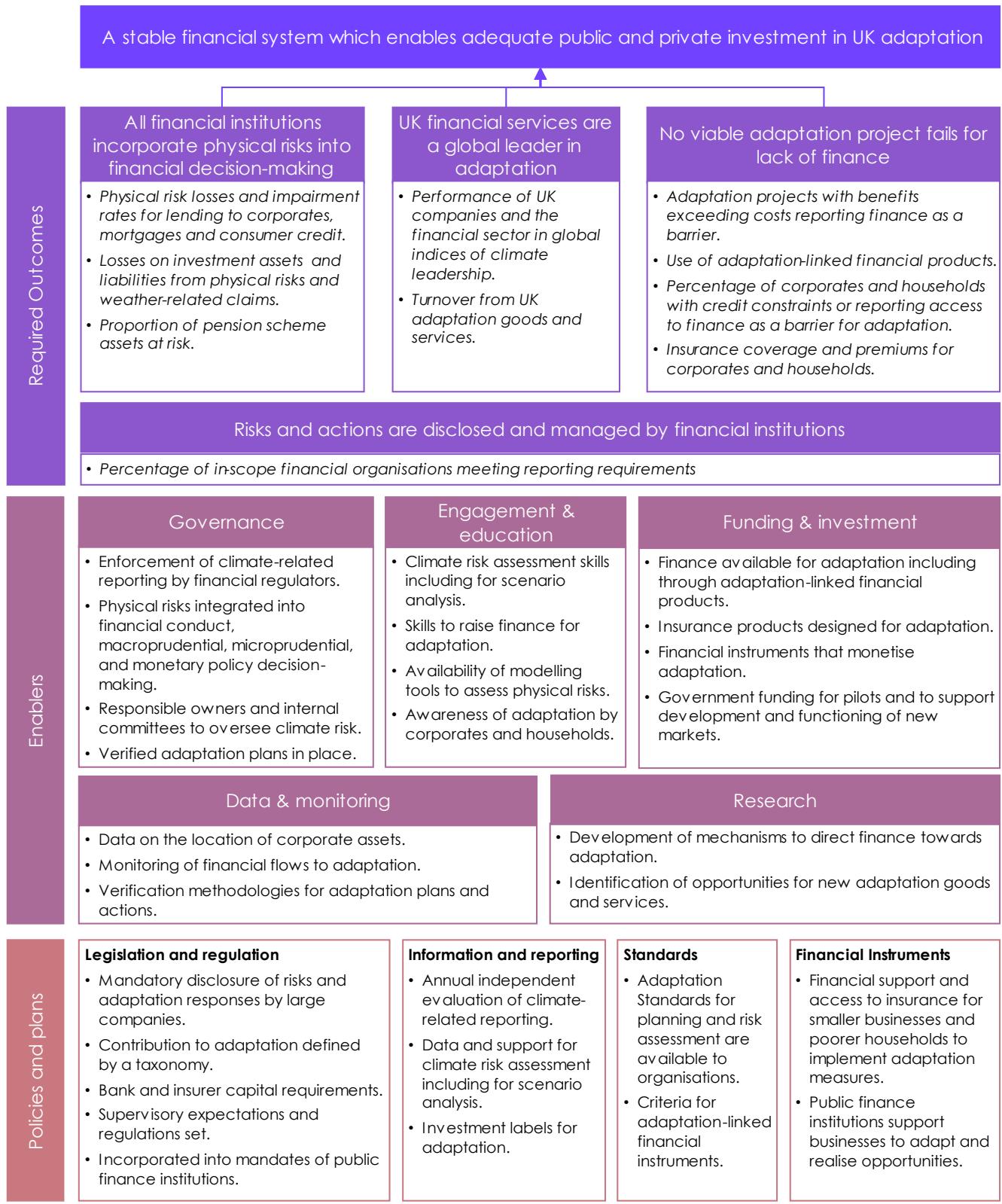
To deliver the identified outcomes consistent with a well-adapted financial system, we have identified a number of key policy milestones. For our assessment we focus on policy levers in the control of Welsh Government but consider reserved policy where relevant for adaptation implementation.

- **Legislation and regulation.**
 - **UK level.** Adaptation needs to be incorporated into the mandates of public finance institutions with supervisory expectations and regulations set, including over bank and insurer capital requirements. This should be supported by a sustainable finance taxonomy that considers adaptation and a mandatory disclosure regime of climate risks and adaptation responses.
- **Information and reporting.**
 - **UK wide.** Annual progress reviews of climate-related reporting (such as through TCFD) of institutions with Welsh operations could contribute to high levels of transparency and identification of areas for action. A robust data ecosystem is needed for climate risk assessments, independent evaluation, and for creating investment labels for adaptation.
- **Standards.**
 - **Welsh scope.** Consistent standards and criteria for adaptation planning and risk assessments.
 - **UK wide.** Develop standardised adaptation-linked financial instruments.
- **Financial instruments.**
 - **Welsh scope.** Funding provided for adaptation directly from national or local government or its agencies. This could be in the form of funding for ongoing operational expenditures or capital funding (e.g. grants) for upfront investment. This could also include targeted

financial support and access to insurance for smaller businesses and poorer households to implement adaptation measures and also to realise opportunities, such as reduced insurance or mortgage premiums.

- **UK wide.** UK public finance institutions providing funding that supports adaptation action.

Figure 14.1 Monitoring map for finance



Source: CCC analysis

Notes: Italicised text indicates suggested measures for each outcome.

2. Delivery and implementation progress

This section documents available evidence on progress towards delivery and implementation of each of the climate resilience outcomes identified in the previous section. We have provided an assessment of progress for each outcome to reflect the situation in Wales, whilst recognising that many of the policy levers are reserved to UK Government.

(a) Outcome 1: All financial institutions incorporate physical risks into financial decision-making

A lack of available information makes progress on this outcome **unable to evaluate**.

- **There is a lack of available quantitative assessment of assets at high-risk from climate change.**
- **The Welsh Pension Partnership (WPP) investment strategy has a climate risk policy.** The partnership strategy pools assets from eight local government pension schemes and has a climate risk policy that includes physical risks such as damage to property from flooding or lower precipitation giving rise to crop failure.³ The WPP's Constituent Authorities have total assets of circa £23.1 billion (as at 31 March 2022).⁴ The WPP expects its investment manager to ensure that all underlying active managers integrate the consideration of climate-related risks into their investment process and to regularly challenge underlying managers to evidence their approach.

(b) Outcome 2: UK financial services are a global leader in adaptation

Lack of available indicators for Wales makes progress on this outcome **unable to evaluate**.

- **Financial indices data on adaptation are not publicly accessible to assess exports of adaptation goods and services.** Whilst the financial services sector in Wales is increasingly contributing the UK-wide output, growing by 46% between 2010-2020, there is a lack of data on the level of adaptation finance.⁵

(c) Outcome 3: No viable adaptation project fails for lack of finance

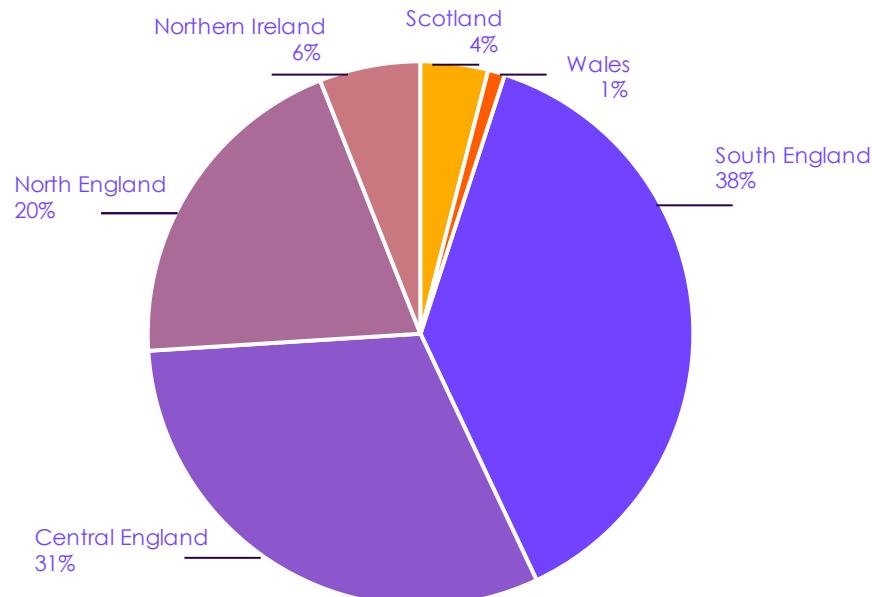
Lack of aggregate estimate of the costs to adaptation for Wales and reliable planning on potential remaining adaptation financing gaps make progress on this outcome **unable to evaluate**.

- **Data on proportion of households or businesses reporting access to finance barriers to adaptation and level of insurance coverage, or premiums, is not currently available.** Overview on barriers to accessing adaptation finance more broadly is also very limited.

Recent finance schemes cover some limited form of adaptation actions.

- **There are some financing schemes in place such as through the Welsh Government Health and Social Care Programme.** Local authorities in collaboration with social care providers are eligible for the Welsh Government £2.4 million Health and Social Care (H&SC) programme.⁶ Each local authority can receive funding of up to £30,000 for projects aligned to their strategy on Decarbonising Social Care in Wales.⁷ Outcomes covered within this scheme are two-fold: delivery of actions towards Net Zero by 2030, and/or actions towards strengthened adaptation planning to ensure resilience to people's wellbeing and service delivery risks from climate change. There is scope for greater transparency in the uptake of this fund for adaptation projects undertaken by local authorities.
- **The Development Bank of Wales has a Green Business Loan scheme and Green Homes Incentive in place and covers some limited form of adaptation actions.** Loans are available for water usage improvements and building fabric improvements which could deliver adaptation benefits.⁸ These schemes have had a strong uptake since launching, but current focus of projects has been mainly on decarbonisation with little uptake so far for adaptation actions.
- **Only 1% of companies benefitting from UK Export Finance (UKEF) trade finance or insurance in 2020-21 were located in Wales (Figure 14.2), which is lower than the regional export split in 2022 (6% for Wales).⁹** The proportion of these that were part of the allocation for clean growth projects is not available. Eligibility for this additional direct lending capacity is based upon the use of proceeds criteria and core indicators of the ICMA Green Bond Principles and supports a broad range of sectors including, amongst others, renewables, water management, clean transport, green buildings, climate adaptation, energy efficiency and pollution prevention and control.¹⁰

Figure 14.2 Proportion of companies benefiting from UKEF trade finance or insurance by region in 2020-21



Source: UK Export Finance (2021) Annual Report and Accounts 2020-21.

(d) Outcome 4: Risks and actions are disclosed and managed by financial institutions

There is **mixed progress** on disclosure and management of risks by financial institutions. Disclosure coverage is growing but there are gaps remaining in reporting of adaptation actions and risk management strategies.

Disclosure coverage is growing but data on adaptation remains weak.

- **Financial institutions active in Wales will be covered by the UK's Sustainable Disclosure Requirements.** Monmouthshire Building Society, Swansea Building Society and Hodge Bank all included climate risk management information in their latest disclosures for 'Pillar 3'.^{*11,12,13} Principality Building Society produced a report aligned to the Task Force on Climate-related Financial Disclosures (TCFD) in 2022.¹⁴ Yet in general, TCFD and other reporting schemes are currently weak on adaptation disclosures and data regarding actions taken. There is a need for more guidance and comparable reporting schemes that focus on adaptation action, rather than solely risk disclosure.

(e) Progress on enablers

Available information on enablers highlights key action needed across adaptation monitoring and tracking.

- **Data and monitoring.** More progress is needed to establish data and monitoring requirements, such as location of corporate assets and monitoring of financial flows into adaptation action. Financial disclosures need to move beyond physical risk identification and focus more on adaptation actions taken.
- **Governance.** The Welsh Government carries out a Strategic Integrated Impact Assessment (SIIA) of the Welsh Government Budget as part of the annual Budget cycle. This process also gives consideration to non-statutory requirements that includes biodiversity and environmental assessment.¹⁵

* Pillar 3' of the UK Capital Requirements Regulation (CRR) specifies disclosures in regard to risk management policies, procedures, and performance.

3. Policy and planning progress

Key policy milestones for a well-adapted financial system relate to a mixture of devolved and reserved powers. We focus on policy levers in the control of Welsh Government as they relate to **Outcome 3: No viable adaptation project fails for lack of finance**, while presenting the current progress at a UK-level for more reserved areas.

(a) Outcome 1: All financial institutions incorporate physical risks into financial decision-making

Key policy milestones for this outcome are largely outside of the Welsh Government's direct control. This outcome is therefore **not scored**.

For the UK, the latest CCC 2023 adaptation progress report to Parliament score is 'limited policies and plans'. There is progress to embed adaptation in financial regulators' activity, although it is still nascent. There is a lack of reliable indicators on how risk information is used in financial decisions.¹⁶

(b) Outcome 2: UK financial services are a global leader in adaptation

Key policy milestones for this outcome are largely outside of the Welsh Government's direct control. This outcome is therefore **not scored**.

For the UK, the latest CCC 2023 adaptation progress report to Parliament score is 'insufficient policies and plans'. There is a lack of consolidated information on size of the market for adaptation goods and services. There are general plans for seizing opportunities in the Green Finance Strategy, but taxonomy for adaptation is still under development.

(c) Outcome 3: No viable adaptation project fails for lack of finance

There are **limited policies and plans** in place to ensure no viable adaptation project fails for lack of finance.

(i) Financial instruments

Some Welsh Government grants have been established to support adaptation.

- **A number of government grants have been put in place to provide financial support to implement adaptation actions.** However, there is a lack of central coordination. Examples include:
 - In 2021, the Welsh Government launched a time-bound Flood Relief Fund for Welsh SMEs to recover from storm damage. A grant of up to £2,500 was available to cover costs that cannot be recovered from insurance.¹⁷ Since then there has been no commitment to further flood recovery funding for business.
 - The Health and Social Care Climate Emergency National Programme has started a grant programme of £2.4 million (grants up to £30,000 per local authority) for actions that drive decarbonisation and/or increase

resilience to the impacts of climate change.¹⁸ The balance of spending between decarbonisation and adaptation is not clear.

- **The establishment of the Development Bank of Wales (DBW) is helping to improve access to finance for some SMEs in Wales, but it is currently focused more on decarbonisation activities than adaptation.** Whilst the Development Bank of Wales has environmental investment goals, their most recent annual report is only focused on decarbonisation projects and management.¹⁹ Work is commencing to develop an adaptation plan for the Bank.
- **Welsh Government has set an objective for the Development Bank of Wales to support adaptation.** The 2021 Term of Government remit letter sets the expectation that DBW will “demonstrate how it will embed ‘Net Zero’ and adaptation credentials within its existing suite of funds as appropriate”.²⁰
- **Addressing the climate and nature emergency is included within the overarching ambition of the Welsh Governments’ 10-year Infrastructure Investment strategy.** It is good progress that there is a statement within the strategy that “...spending departments must consider the long-term nature of the development, undertake an assessment of their sustainability in light of future trends and, when considering the appropriateness of development, they must recognise the implications of climate change including flooding risk”.²¹
- **There is no consistent policy to help finance Property Flood Resilience (PFR) installation, but more households at risk of flooding can now access multiple insurance quotes.** There are no Welsh Government grants for post-flooding repairs or PFR installation for building owners. Flood Re's Build Back Better scheme enables homeowners to install PFR measures up to the value of £10,000 when repairing properties after a flood.²² It is too early to evaluate the uptake and delivery of this scheme. The proportion of at-risk households in the UK with recent flood claims (in the last five years) able to obtain more than 10 different quotes for insurance has steadily increased since the introduction of Flood Re. See Chapter 10 (Buildings) for more information.
- **Limited evidence of climate risk and adaptation integration in regional growth deals indicates a missed opportunity.** There are four regional growth deals in progress in Wales. These are medium-term regional portfolios of programmes and projects to stimulate growth and jobs through delivery of infrastructure for transport, energy, economic growth, and provision of skills and training. They are funded through UK, Welsh Government, public and private sector investment. There is no devolution of financial levers and the deals so far agreed have been purely economic stimulus packages for the areas involved.²³ Each deal is underpinned by an overarching Heads of Terms agreement between the local authorities in the region, the Welsh Government and the UK Government. Research by Cardiff University to review the growth deals found that despite a major focus on climate change through decarbonisation there was a lack of evidence in available documentation that climate risk and adaptation had been sufficiently considered in programme development or the individual projects supported through the deals.²⁴ Further information for two deals is given below.
 - ‘Cardiff Capital Region’; The Cardiff Capital Region Investment Framework includes ‘energy and environment’ as a key sector of

The Welsh Government’s Infrastructure Investment strategy recognises climate risk.

Limited evidence of climate risk and adaptation integration in regional growth deals indicates a missed opportunity.

interest and has a focus on infrastructure but currently makes little reference to consideration of climate risks across the length of the 20-year programme.²⁵

- **'Swansea Bay City Deal'**: The Deal focuses on the benefits of digital infrastructure, the energy sector, smart manufacturing and innovation in life science for both urban and rural areas across the region.²⁶ There are projects for carbon reduction but currently little information on how climate risks or adaptation are included.
- **Wales is in scope of UK Public Finance institutions, but the extent to which adaptation is integrated into their mandate is currently low.** The British Business Bank is set to launch a £130 million Investment Fund for Wales in autumn 2023 aimed at driving the growth of small and medium-sized businesses in Wales.²⁷ It is unclear how adaptation actions may be considered within this fund. The UK Infrastructure bank offers financing to local and mayoral authorities and can support nature-based solution projects that could deliver mitigation and adaptation, but there was a lack of information for activities in Wales specifically.²⁸

(ii) Information and reporting

- **Progress reviews of climate-related reporting are not widely conducted centrally.** The Development Bank of Wales has responsible investment goals and in their most recent annual report climate related goals have been mainly focused on decarbonisation projects and management. Work is underway to develop a sustainability strategy for the Bank, within which adaptation is a consideration.

(iii) Legislation and regulation

UK financial regulations are currently not strong on adaptation.

- Welsh financial institutions must comply with UK financial regulations, but these are currently not strong on adaptation. Several policy updates are relevant for adaptation in Wales, such as risk disclosures and definition and enforcement of sustainable finance taxonomies. See the CCC's '[Progress in adapting to climate change 2023: Report to Parliament](#)' for further details.²⁹

(d) Outcome 4: Risks and actions are disclosed and managed by financial institutions

Key policy milestones for this outcome are largely outside of the Welsh Government's direct control. This outcome is therefore **not scored**.

For the UK, the latest CCC 2023 adaptation progress report to Parliament score is 'limited policies and plans'. While work has progressed on Net Zero transition plans, it is only just beginning on adaptation plans and adaptation plan-related disclosures. There is a lack of agreed methodology for measuring the positive or negative contribution an investment portfolio is making or has made to adaptation outcomes. Work to establish adaptation as part of the UK's green finance taxonomy is underway and expected to have a positive impact.

(e) Recommendations

Based on the assessment of policy and planning progress, we have identified recommendations to close key policy gaps for finance (Table 14.2). Primary responsibilities are assigned to ministerial portfolios, unless stated otherwise.

Table 14.2

Recommendations – Finance

| Primary responsibility | Recommendation | Timing |
|---------------------------|---|---------|
| Climate Change | Include finance more centrally in the next national adaptation plan and engage with financial institutions in its development. | 2024 |
| Development Bank of Wales | Development Bank of Wales should promote adaptation business actions within its Green Business Loan Scheme. | 2024 |
| Economy | Include adaptation in investment frameworks utilised for major development strategies including city growth deals. | Ongoing |
| Economy | Engage with UK public financial institutions (such as the UK Infrastructure Bank, British Business Bank, UK Export Finance, and British International Investment) to create adaptation finance strategies, setting out how they will independently and collectively ensure that no viable UK climate adaptation project fails for lack of finance or insurance. | 2023 |
| Economy | Engage with UK Government to strengthen adaptation reporting requirements across the Sustainability Disclosure Requirements. | 2023 |

Endnotes

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- ¹³ Hodge Bank (2021) *Pillar 3 Disclosures*, <https://hodgebank.co.uk/wp-content/uploads/2022/03/Hodge-Pillar-3-Document-2020-2021.pdf>.
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- ¹⁶ Climate Change Committee (2023) *Progress in Adapting to Climate Change 2023: Report to Parliament*, <https://www.theccc.org.uk/wp-content/uploads/2023/03/WEB-Progress-in-adapting-to-climate-change-2023-Report-to-Parliament.pdf>.
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