

Carmarthenshire and Ceredigion Public Service Board's Joint Climate Change Risk Assessment Miller Research

Dom Oliver, Susannah Lynn, Katie Lloyd, Alessandra La Tour
/ Miller Research (UK) Ltd.

For further information please contact: susannah@miller-research.co.uk



Moorland fire on Mynydd Llanllwni (Copyright: Rob Marsh)

Aberystwyth seafront storm (Copyright: NRW)

Table of Contents

Glossary.....	4
Executive Summary	5
Introduction	5
Purpose of the CCRA	5
Headline Climate Risks Across Both Counties	5
Systems thinking and cascading risks	6
Understanding vulnerabilities	6
Key gaps identified.....	7
Priority collaboration opportunities	7
Immediate next steps for Carmarthenshire and Ceredigion	8
Key messages	8
1. Introduction and context.....	9
Why climate matters for Carmarthenshire and Ceredigion	9
Key climate-related challenges.....	10
Legislative and policy context.....	11
Relationship to well-being assessments & plans	12
Understanding climate risk as a systemic challenge.....	13
2. Methodology.....	15
Overview of approach	15
Alignment with NRW PSB CCRA Framework	15
Risk identification process	15
Timeframes used	17
Stakeholder engagement	17
Limitations and Assumptions.....	18
3. Climate risk overview	20
Summary of identified climate hazards.....	20
Risk interdependencies and cascading impacts	21
Understanding vulnerability in Carmarthenshire and Ceredigion	23
Cross-county risk comparison	26
Priority climate risk summary	27
Priority risk assessment	28
Synthesis	34
4. County-specific considerations	35
Carmarthenshire Public Service Board – Key risk profile	35
Ceredigion Public Service Board – Key Risk Profile	41
5. Gaps, capacity and collaboration.....	47
Existing responses and current foundations	47
Organisational and collective gaps	49
Joint working opportunities.....	51
Skills and capacity considerations.....	52

Best practice approaches	53
Collective strengths	53
Areas requiring strengthening	53
Funding opportunities	54
6. Recommendations and next steps	56
Overview	56
Strategic adaptation priorities	56
Practical next steps for Carmarthenshire and Ceredigion	58
Monitoring and review	62
Annex.....	68
Annex A - Shared documents reviewed	68
Annex B - Partners represented within the PSB partnership and invited to contribute to the assessment	70
Annex C - List of organisations within both Ceredigion and Carmarthenshire Public Services Board	71
Annex D - List of interviewed individuals	72
Annex E - List of organisations that participated in the project	73
Annex F - Carmarthenshire and Ceredigion Mapping	74
Annex G - UK CCRA3 Risks	79
7. Reference List	80

Glossary

Adaptation: Adjusting processes, systems, and communities to minimise risks and impacts from climate change, such as flood defences, resilient infrastructure, and nature-based solutions.

Mitigation: Reducing greenhouse gas emissions to prevent further climate change, including renewable energy adoption, energy efficiency, and sustainable transport.

Climate Change Risk Assessment (CCRA): A structured process used to identify, analyse, and prioritise risks arising from climate change. In the UK, the national CCRA provides the evidence base for adaptation planning, while local CCRA assess place-specific risks affecting communities, infrastructure, and ecosystems.

Hazard-Exposure-Vulnerability-Response (HEVR) Framework: A structured approach used to assess climate risk by considering:

- **Hazard:** the climate event or trend.
- **Exposure:** the people, assets, or systems that may be affected.
- **Vulnerability:** the sensitivity or capacity to cope with impacts.
- **Response:** existing measures that reduce risk.

Nature based solutions: approaches that use natural processes and ecosystems to address challenges such as climate change, biodiversity loss, and disaster risk reduction.

Cascading risk: a situation where initial climate impact triggers a sequence of secondary effects across interconnected systems. For example, flooding may disrupt transport networks, which in turn affects access to healthcare, supply chains, and emergency services.

Systemic risk: risks that arise from interconnections between systems such as infrastructure, ecosystems, institutions and communities. Climate change can create systemic risks where impacts propagate across multiple sectors simultaneously.

Catchment-scale management: an approach to environmental management that considers the entire river catchment or watershed. Catchment-based approaches recognise the connections between land-use, water systems, ecosystems, and downstream communities.

Climate projections: scientific estimates of how climate conditions such as temperature, rainfall, and sea level may change in the future under different greenhouse gas emissions scenarios.

Infrastructure interdependency: the relationship between infrastructure systems such as electricity, transport, water, and telecommunications. Failure in one system can disrupt others due to these connections.

Extreme weather event: a severe weather event such as intense rainfall, storms, heatwaves, or flooding that falls outside typical historical patterns that may cause significant disruption or damage.

Climate resilience: the ability of communities, infrastructure systems and ecosystems to prepare for, respond to and recover from climate impact while maintaining essential functions.

Infrastructure redundancy: the deliberate strategic duplication of critical components or systems within infrastructure networks to ensure continued operation when primary systems fail.

Executive Summary

Introduction

Climate change represents an immediate and escalating strategic risk to the well-being of communities, the resilience of public services, and the functioning of natural systems across Carmarthenshire and Ceredigion. Increasingly intense rainfall, flooding, coastal change, severe storms, drought and rising temperatures are already affecting infrastructure, ecosystems and communities across both counties. These risks are projected to intensify significantly over the coming decades.

This report presents a joint Climate Change Risk Assessment (CCRA) for the Carmarthenshire and Ceredigion Public Services Boards (PSBs), commissioned by Natural Resources Wales and undertaken by Miller Research. The assessment aligns with the Natural Resources Wales Climate Change Risk Assessment Framework for PSBs (2023) and with the UK Climate Change Risk Assessment (CCRA3).

The CCRA provides a shared evidence base to support future Well-being Assessments and Well-being Plans. It identifies the most significant climate risks facing both counties, assesses exposure and vulnerability across communities and infrastructure systems, and highlights opportunities for collaboration between public services, communities and partner organisations.

The assessment highlights that climate risks are increasingly systemic, with cascading and interconnected impacts across infrastructure networks, ecosystems, public services and communities.

Purpose of the CCRA

The purpose of this Climate Change Risk Assessment is to support Carmarthenshire and Ceredigion PSBs in understanding, prioritising and responding to climate risks that may affect communities, public services and local economies.

The assessment aims to:

- Identify the most significant climate hazards affecting both counties;
- Understand how exposure and vulnerability shape local climate risks;
- Assess risks using the Hazard-Exposure-Vulnerability-Response (HEVR) framework;
- Identify existing adaptation responses and areas of resilience;
- Highlight gaps in capacity, coordination and evidence;
- Inform clear, coordinated, and preventative action across PSB partners.

PSBs have a critical leadership role in coordinating cross-sector responses to climate risks that cannot be addressed by individual organisations alone.

Headline Climate Risks Across Both Counties

The assessment identified seven priority climate risks with the greatest potential to affect communities, infrastructure systems, ecosystems and public services across Carmarthenshire and Ceredigion.

These risks fall broadly into three interconnected themes.

Flooding and coastal risks

Flooding represents the most immediate and significant climate risk across both PSB areas.

Increasingly intense rainfall, rising river flows and coastal erosion are expected to increase the frequency and severity of flooding events. Flood risk affects homes, businesses, transport

networks and critical infrastructure, particularly in river valleys, coastal settlements and low-lying communities.

In addition to direct damage to buildings and infrastructure, flooding generates **significant cascading impacts** across public services by disrupting transport networks, electricity supply and access to healthcare and emergency services.

Coastal communities in Ceredigion and parts of Carmarthenshire also face long-term risks associated with sea-level rise and coastal erosion, raising questions about the long-term resilience of some settlements and infrastructure.

Infrastructure and service disruption

Climate hazards are increasingly disrupting essential infrastructure and public service delivery.

Climate hazards such as storms, flooding, and temperature extremes are already causing disruption to electricity networks, transport routes, and communication infrastructure. These systems are highly interconnected, meaning disruption in one area can trigger system wide failures.

This includes risks such as:

- Power outages affecting homes and services;
- Disruption to transport networks and access routes;
- Impacts on water supply systems during drought conditions;
- Potential food and health system disruption linked to supply chain impacts and infrastructure failure.

Rural geography further amplifies these risks, with limited alternative routes and infrastructure redundancy increasing the likelihood of community isolation during extreme events.

Environmental and ecosystem pressures

Ecosystem resilience is a critical but currently underdeveloped component of climate adaptation.

Changing rainfall patterns, higher temperatures and altered hydrological regimes are affecting river systems, peatlands, coastal habitats and terrestrial ecosystems.

These environmental systems play a critical role in climate resilience by providing ecosystem services such as flood regulation, water purification and carbon storage. Degradation of these systems may therefore increase climate risks while reducing natural resilience.

Strengthening ecosystem resilience, including through Local Nature Partnerships and catchment-based approaches, will be critical for long-term adaptation.

Systems thinking and cascading risks

Climate risks rarely occur in isolation. Flooding, storms, drought and heat can interact with infrastructure systems, ecosystems and social vulnerabilities to produce cascading impacts across public services and communities. For example, transport disruption caused by flooding may limit access to healthcare, interrupt supply chains and increase demand for emergency services simultaneously.

Understanding these systemic interactions is essential for effective climate adaptation.

Effectively addressing climate risks requires coordinated responses that consider the interdependencies between infrastructure systems, environmental processes and community resilience.

Understanding vulnerabilities

Climate risks are not evenly distributed and disproportionately affect vulnerable communities.

Key vulnerability factors include:

- Rural isolation and limited infrastructure redundancy;
- Ageing populations and those requiring care;
- Communities in flood-prone or coastal locations;
- Areas of socio-economic disadvantage.

These vulnerabilities mean that climate impacts can be more severe, longer lasting and harder to recover from without targeted intervention.

Key gaps identified

The assessment identified several cross-cutting gaps that currently limit the effectiveness of climate adaptation efforts.

Identified gap	Description
Reactive rather than preventative approaches	Much of the current system remains focused on responding to extreme weather events once they occur. While emergency response arrangements are well developed, greater investment in preventative and long-term resilience measures will be required to reduce future impacts .
Capacity constraints	Public sector organisations face increasing resource pressures , with limited staffing and technical capacity available to support long-term climate adaptation planning. These constraints affect both strategic planning and operational response, particularly during periods of repeated extreme weather events.
Limited integration of climate risk evidence	Stakeholders highlighted challenges in accessing and sharing climate risk data across organisations. Improved coordination of datasets and evidence could help identify vulnerable communities more effectively and support targeted adaptation interventions .
Engagement and communication gaps	Engagement indicated that awareness of existing flood management plans and long-term adaptation strategies is not always widespread among stakeholders and communities. Improving communication around climate risks and planned responses could support more proactive action by organisations, businesses and residents.

Priority collaboration opportunities

Despite these challenges, the assessment identified significant opportunities for collaboration across the PSB partnership.

Opportunity	Description
Catchment-scale climate adaptation	Flood risk, water quality and ecosystem resilience are closely interconnected across river catchments. Coordinated land management approaches involving farmers, landowners, public bodies and environmental organisations could deliver significant benefits for flood mitigation, biodiversity and water management .
Community-centred resilience	Communities possess valuable local knowledge and social networks that support resilience during extreme weather events. Strengthening partnerships with community organisations, voluntary groups and Town and Community Councils could enhance preparedness and response capacity.

Knowledge and research partnerships	Collaboration with universities and research institutions offers opportunities to strengthen the climate evidence base, improve monitoring and support innovation in climate adaptation.
Pilot projects and innovation	Place-based pilot projects could allow PSB partners to test new approaches to climate resilience at a community scale, including community adaptation planning, nature-based flood management and public engagement initiatives.

Immediate next steps for Carmarthenshire and Ceredigion

Actionable, coordinated delivery is now required to response to escalating climate risks.

Priority actions for the Carmarthenshire and Ceredigion PSBs include:

- Integrating climate risks identified in this assessment into future Well-being Assessments and Well-being Plans;
- Strengthening collaboration between PSB partners to address cross-sector climate risks;
- Improving communication and engagement around climate risks and adaptation planning;
- Strengthening the climate risk evidence base through improved data sharing and monitoring;
- Developing a joint Climate Adaptation Delivery Plan to coordinate adaptation actions across organisations.

Key messages

This Climate Change Risk Assessment provides an evidence base to support the integration of climate resilience within Well-being planning and broader public service strategies. **Early and coordinated adaptation action can significantly reduce the long-term costs and impacts of climate change.** Evidence from the UK Climate Change Risk Assessment and international research indicates that proactive investment in resilience is substantially more cost-effective than responding to climate impacts after they occur.

By strengthening adaptation planning now, Carmarthenshire and Ceredigion can reduce future disruption to communities, protect critical infrastructure and ensure that public services remain resilient in the face of increasingly severe climate hazards.

PSBs are uniquely positioned to coordinate the long-term response to climate change across public services, communities and ecosystems.

1. Introduction and context

Why climate matters for Carmarthenshire and Ceredigion

Climate change is no longer a distant or abstract challenge. Its impacts are already being felt across Wales and will intensify over the coming decades. Rising average temperatures, increased frequency and intensity of heavy rainfall, sea level rise, coastal erosion, more frequent storms, periods of drought, and heatwaves are projected to affect communities, infrastructure, ecosystems, and local economies through the 2030s, 2050s, and beyond.



Borth winter storm (Copyright NRW)

For Carmarthenshire and Ceredigion, these changes are significant. Both counties are characterised by:

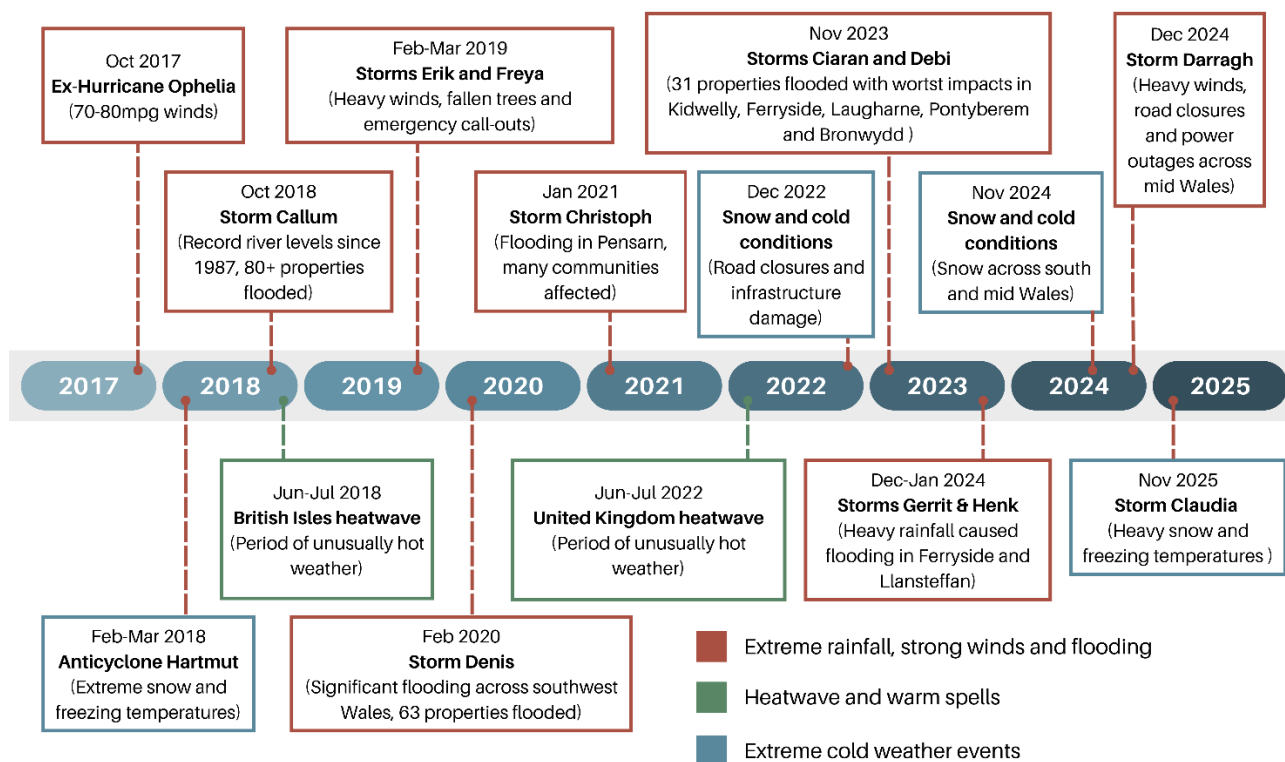
- Extensive coastlines vulnerable to erosion and tidal flooding;
- River catchments and floodplains with established flood risks;
- Rural settlements and dispersed populations;
- Significant areas of forestry coverage;
- Agricultural and food-producing landscapes;
- Nationally important habitats and designated environmental sites;
- Critical infrastructure networks connecting communities across large geographic areas.

Even under ambitious global emissions reductions, further climate change is unavoidable.

Adaptation is therefore not optional: it is essential to protect communities, safeguard public services, and sustain long-term well-being.

The timeline below illustrates key extreme weather events, including storms and periods of extreme heat affecting Carmarthenshire and Ceredigion between 2017 and 2025.

Figure 1: Recent Extreme Weather Events in Carmarthenshire and Ceredigion (2017–2025)



Source: Miller Research

Key climate-related challenges

Carmarthenshire and Ceredigion face multiple, interacting climate risks, including:

- **Flooding and coastal erosion** affecting homes, businesses, infrastructure and agricultural land, particularly in river valleys and low-lying coastal communities;
- **Risks to infrastructure networks**, including transport, water supply, wastewater systems, energy distribution and digital connectivity. These systems are highly interdependent, meaning that failure in one can trigger cascading disruption across others;
- **Extreme cold weather events**, such as snowstorms, impacting on critical water and energy infrastructure, disrupting travel networks and isolating communities from services;
- **Water resource pressures**, including drought risk, reservoir stress, and vulnerability of private water supplies in rural areas;
- **Food system risks**, including impacts on domestic agriculture, fisheries and aquaculture, and exposure to international supply chain disruption, which can drive food price volatility;
- **Impacts on health and wellbeing**, including heat-related illness, climate-sensitive disease risks, air quality impacts, and mental health pressure following extreme weather events;
- **Biodiversity loss and ecosystem stress** reducing national resilience, carbon sequestration capacity, and ecosystem services that underpin economic and community well-being;
- **Economic disruption**, particularly for agriculture, tourism, fisheries, small businesses, and sectors reliant on resilient transport and utilities;
- **Exacerbation of inequalities** where vulnerable households, including those on low incomes, in poor-quality housing, in isolated rural areas or at high flood risks, may experience disproportionate impacts.

Climate risks do not occur in isolation. They interact with demographic change, infrastructure dependency, economic transition, global market volatility, and environmental pressures. For example:

- Flooding can disrupt transport networks, limiting access to health services and affecting food distribution;
- Energy outages can interrupt water pumping for potable water and sewerage systems (with resultant pollution incidents), telecommunications, and emergency response systems;
- Overseas climate impacts can reduce food availability, contributing to local price increases and household food insecurity.

As highlighted in the UK Climate Change Risk Assessment (CCRA3), such cascading and systemic risks are increasing. **For Carmarthenshire and Ceredigion, climate change represents a strategic, cross-cutting risk to long-term well-being and service delivery.**

In recognition of this, Natural Resources Wales (NRW) commissioned Miller Research to deliver a joint Climate Change Risk Assessment (CCRA) for Carmarthenshire and Ceredigion Public Service Boards (PSBs).

This assessment:

- Identifies and evaluates the most significant climate risks affecting both counties;
- Applies a structured Hazard-Exposures-Vulnerability-Response framework;
- Reviews existing mitigation and adaptation activity across partner organisations;
- Examines gaps, interdependencies and opportunities for collaborative action;
- Considers implications for service continuity, infrastructure resilience, and community well-being;
- Explores the feasibility and scope of actions within the remit of PSB partners.

The CCRA is intended as a strategic tool to support coordinated, preventative, and long-term decision-making across public services, communities, and ecosystems.

Legislative and policy context

This assessment has been undertaken within a clear legislative and policy framework at UK and Wales levels, which establishes both a statutory requirement and a strategic imperative for climate adaptation.

Well-being of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015 places a statutory duty on Public Services Boards to improve the economic, social, environmental and cultural well-being of their areas.

Under Section 38, PSBs must take account of the risks of climate change when preparing their Well-being Assessments. This explicitly requires consideration of the most recent UK Climate Change Risk Assessment (CCRA).

This duty reflects the recognition that climate change is a long-term, cross-cutting risk affecting all seven well-being goals. Climate resilience must therefore be embedded within strategic planning, service design and partnership governance.

The sustainable development principles - long-term thinking, prevention, integration, collaboration, and involvement - underpin the methodology and approach adopted in this CCRA.

UK Climate Change Risk Assessment (CCRA3)

The UK Climate Change Risk Assessment (CCRA3) provides the national evidence base for climate risks. It identifies 61 priority risks across five thematic areas:

- Natural environment and assets;
- Infrastructure;
- Health, communities and the built environment;
- Business and industry;
- International dimensions.

CCRA3 concludes that adaptation progress across the UK is not keeping pace with increasing risk and that many risks require more urgent and coordinated action. It also highlights the importance of managing interdependencies and cascading failures across infrastructure systems.

Climate Change Risk Assessment Framework for PSBs

To support place-based implementation, Public Health Wales (PHW), Natural Resources Wales (NRW) and the Welsh Government have developed a Climate Change Risk Assessment Framework for PSBs.

This framework translates the national CCRA methodology into a structured partnership process, guiding PSBs to:

- Identify locally relevant climate risks;
- Assess risks using the Hazard-Exposure-Vulnerability-Response (HEVR) approach;
- Consider risk trajectories across multiple time horizons (present day, 2030s, 2050s, 2080s);
- Prioritise risks collaboratively;
- Integrate findings into Well-being Assessments and Plans.

The Carmarthenshire and Ceredigion CCRA has been developed in alignment with this framework.

Wider Policy Alignment

This assessment aligns with:

- The Climate Change Act 2008 and UK National Adaptation Programme;
- Welsh Government's Climate Adaptation Strategy (2024), which sets out sectoral adaptation outcomes across food, water, health, infrastructure, business and communities;
- Cymru Can – the Future Generations Commissioner's strategy;
- NRW's Corporate Plan to 2030;
- Carmarthenshire and Ceredigion Corporate Strategies;
- Local Well-being Plans and Community Risk Registers;
- NRW's Mid Wales Area Statement;
- NRW's South West Wales Area Statement;
- The Wales Resilience Framework.

Together, this policy context reinforces the need for coordinated, evidence-based and long-term adaptation planning at the local level. Details of related policies reviewed as part of this assessment can be found in Annex A.

Relationship to well-being assessments & plans

The Carmarthenshire and Ceredigion CCRA has been designed to inform subsequent PSB Well-being Assessments and Well-being Plans.

Well-being Assessments provide the statutory evidence base upon which PSBs set objectives and priorities. Climate change is not a standalone issue but a cross-cutting risk influencing all seven well-being goals.

For example:

- **A Prosperous Wales:** Infrastructure resilience, agricultural productivity, food supply chains and business continuity are affected by climate variability and extreme weather.

- **A Resilient Wales:** Biodiversity, soils, freshwater systems and ecosystem services are sensitive to changing climatic conditions.
- **A Healthier Wales:** Heat stress, flooding, air quality and service disruption affect both physical and mental health.
- **A More Equal Wales:** Climate risks disproportionately impact lower-income households and those with limited adaptive capacity.
- **Cohesive Communities:** Flooding and coastal erosion threaten housing security, community identity and cultural heritage.

This CCRA strengthens the well-being evidence base by:

- Providing a consistent and transparent assessment of priority climate risks;
- Identifying communities, assets and services most exposed to future impacts;
- Clarifying existing adaptation responses and identifying gaps;
- Highlighting interdependencies between infrastructure, health, food, water and economic systems;
- Supporting identification of shared priorities and collaborative action across the PSB partnership.

By embedding climate risk within well-being planning, PSBs can support more preventative, long-term and system-wide decision-making.

Understanding climate risk as a systemic challenge

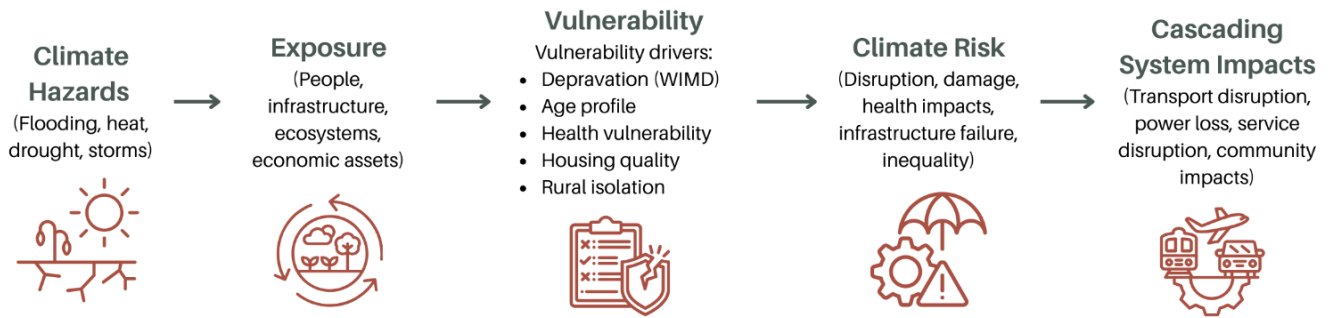
Climate risk does not manifest as isolated hazards affecting individual sectors independently. Instead, climate change increasingly produces compound, cascading and systemic risks, where impacts in one system propagate through interconnected infrastructure, ecosystems, institutions and communities.

For example, extreme rainfall may initially cause surface water flooding, but secondary impacts may include disruption to transport networks, electricity outages, impacts on health services, pressures on sewage systems and resulting impacts on pollution, and interruptions to supply chains. These cascading effects are increasingly recognised in national and international climate risk assessments.

Climate risk arises where climate hazards interact with exposed infrastructure, communities, and ecosystems and where underlying vulnerability increases the likelihood of harm. These interactions can generate cascading impacts across interconnected systems such as transport networks, utilities, public services, and local economies. Understanding climate risk in this way requires moving beyond single-sector analysis toward a systems perspective, recognising the interdependencies between infrastructure, communities, ecosystems and institutional governance.

Figure 2 shows how climate hazards combine with exposure and vulnerability to create risks that can propagate across multiple systems. For PSBs, this highlights the need to move beyond single-sector responses and instead coordinate action across infrastructure, communities, and ecosystems to manage cascading impacts and strengthen resilience.

Figure 2: Understanding Climate Risk: From Hazards to System Impacts



Source: Miller Research

This assessment therefore adopts a place-based systems approach, examining how climate hazards interact with local vulnerabilities, infrastructure networks and institutional capacity across Carmarthenshire and Ceredigion. **Effective climate adaptation requires addressing individual hazards while strengthening the resilience of systems and institutions that underpin community wellbeing and public service delivery.**

2. Methodology

Overview of approach

The methodology for the Carmarthenshire and Ceredigion Climate Change Risk Assessment (CCRA) was designed to provide a structured, evidence-based and partnership-led assessment of local climate risks.

The approach was informed by:

- Experience supporting national reviews of mitigation and adaptation planning in Wales;
- Previous climate risk prioritisation work undertaken by Carmarthenshire PSB;
- Local policy and resilience context in Carmarthenshire and Ceredigion;
- The Natural Resources Wales (NRW) Climate Change Risk Assessment Framework for Public Services Boards (2023).

The method combined:

- Structured evidence review;
- Focused bilingual stakeholder engagement;
- A practical and transparent risk assessment process;
- Capability and gap analysis;
- Clear documentation of findings to inform Well-being Assessments and Plans.

The process built on existing work rather than duplicating it. In particular, it drew directly on Carmarthenshire PSB's prior risk prioritisation exercise. This enabled early alignment with Ceredigion PSB and supported the development of a consistent joint regional baseline.

The methodology was iterative, with outputs reviewed and refined through engagement with the Joint Working Group (JWG) and wider stakeholders. The Joint Working Group comprises representation from both PSB partnerships and was formed to support the CCRA process.

Alignment with NRW PSB CCRA Framework

The assessment was undertaken in alignment with the Natural Resources Wales (NRW) Climate Change Risk Assessment Framework for Public Services Boards (2023).

The NRW Framework provided a structured methodology for assessing climate risk at local level and translating national climate risk evidence into place-based understanding. It required PSBs to:

- Identify locally relevant risks informed by the UK Climate Change Risk Assessment (CCRA3);
- Apply a structured assessment methodology;
- Consider multiple future time horizons;
- Integrate findings into Well-being Assessments and Plans;
- Support partnership-based working.

The Carmarthenshire and Ceredigion CCRA applied the Framework's recommended Hazard-Exposure-Vulnerability-Response (HEVR) model to assess the priority risks in a consistent and transparent manner.

The methodology also reflected the sustainable development principle under the Well-being of Future Generations (Wales) Act 2015 by incorporating long-term thinking, prevention, integration, collaboration and involvement within the assessment process.

Risk identification process

The risk identification process comprised four structured stages.

Evidence Review

A focused review of relevant and available strategies, datasets and risk registers was undertaken to establish a comprehensive understanding of local and regional climate-related risks.

Documents reviewed included (a full list is located in Annex A):

- Local Well-being Assessments and Plans;
- Corporate Strategies;
- Community Risk Registers;
- Sector-specific plans (e.g. flood risk management, water resource management, health resilience);
- CCRA3 risk summaries and supporting evidence;
- Relevant spatial and demographic datasets.

The review identified:

- Locally relevant climate risks;
- Existing adaptation and resilience measures;
- Evidence gaps and areas of uncertainty;
- Potential cross-sector interdependencies.

This stage established the initial evidence base for structured risk assessment and workshop discussion.

Initial risk prioritisation

Carmarthenshire PSB had previously undertaken a prioritisation exercise to identify key climate-related risks. This prioritised list was reviewed against the results of the evidence review and was presented to Ceredigion PSB Climate and Nature group as part of a facilitated calibration discussion.

The purpose of this session was to:

- Validate the relevance of identified risks within Ceredigion's local context;
- Identify any additional risks or contextual differences;
- Establish a consistent interpretation of risk categories and scoring criteria;
- Agree a shared baseline for the joint assessment.

The outcome of this stage was the development of a Joint Baseline Risk Register, which provided a consistent starting point for the joint assessment and was endorsed by the Joint Working Group. This resulted in the selection of the 7 priority risks used in the assessment.

Structured risk assessment (HEVR Framework)

Each identified risk was assessed using the HEVR framework:

- **Hazard:** The projected change in climate-related drivers (e.g. flooding, extreme rainfall, heat, drought, sea level rise), informed by UKCP18 projections, CCRA3 evidence and local datasets.
- **Exposure:** The people, assets, infrastructure, services and ecosystems potentially affected within Carmarthenshire and Ceredigion.
- **Vulnerability:** Factors influencing sensitivity and adaptive capacity, including socio-economic characteristics, geographic isolation, housing condition, health status and institutional preparedness.
- **Response:** Existing controls, adaptation measures, mitigation actions where relevant, governance arrangements and service continuity mechanisms already in place.

Risks were documented and scored within a structured risk register.

Capability, gap and collaboration analysis

Following the structured risk assessment, a focused analysis was undertaken to identify:

- Areas of established capability;
- Gaps in data, monitoring or response;
- Skills and capacity constraints;

- Opportunities for joint working across PSB partners;
- Risks requiring cross-sector coordination.

A rapid review of organisational readiness and capacity was informed by workshop discussions, partner input and documentary evidence.

Interdependencies between sectors were identified where relevant (for example: flooding affecting transport infrastructure, which in turn disrupted supply chains and access to services). This supported identification of systemic risk and highlighted areas where coordinated action would be required.

Timeframes used

Risks were assessed across four-time horizons:

- Present day (current observed and emerging risks);
- 2030s (near-term planning horizon);
- 2050s (medium-term planning horizon aligned with infrastructure lifecycles);
- 2080s (long-term climate projection horizon).

Assessing risks across multiple timeframes enabled the identification of:

- Risks that were already material;
- Risks likely to escalate without further adaptation;
- Long-term implications for infrastructure, land use and service delivery.

Confidence levels were recorded for each timeframe to reflect uncertainty within climate projections and local data.

Stakeholder engagement

Stakeholder engagement formed an integral component of the Climate Change Risk Assessment process and was primarily undertaken through the Joint Working Group (JWG). Engagement focused primarily on organisations represented within the Carmarthenshire and Ceredigion Public Services Boards (PSBs), with PSB members invited to participate in workshops and discussions supporting the assessment.

Core engagement was undertaken with the statutory PSB member organisations, including:

- Carmarthenshire County Council / Ceredigion County Council;
- Hywel Dda University Health Board;
- Mid and West Wales Fire and Rescue Service;
- Natural Resources Wales.

These organisations play a key role in managing climate-related risks affecting infrastructure, public services, environmental systems and community resilience.

Engagement also included a range of PSB partner organisations and invited participants, reflecting the wider partnership structures supporting PSB activity. These organisations contribute important expertise across areas such as community support, policing, higher education, employment services and environmental management.

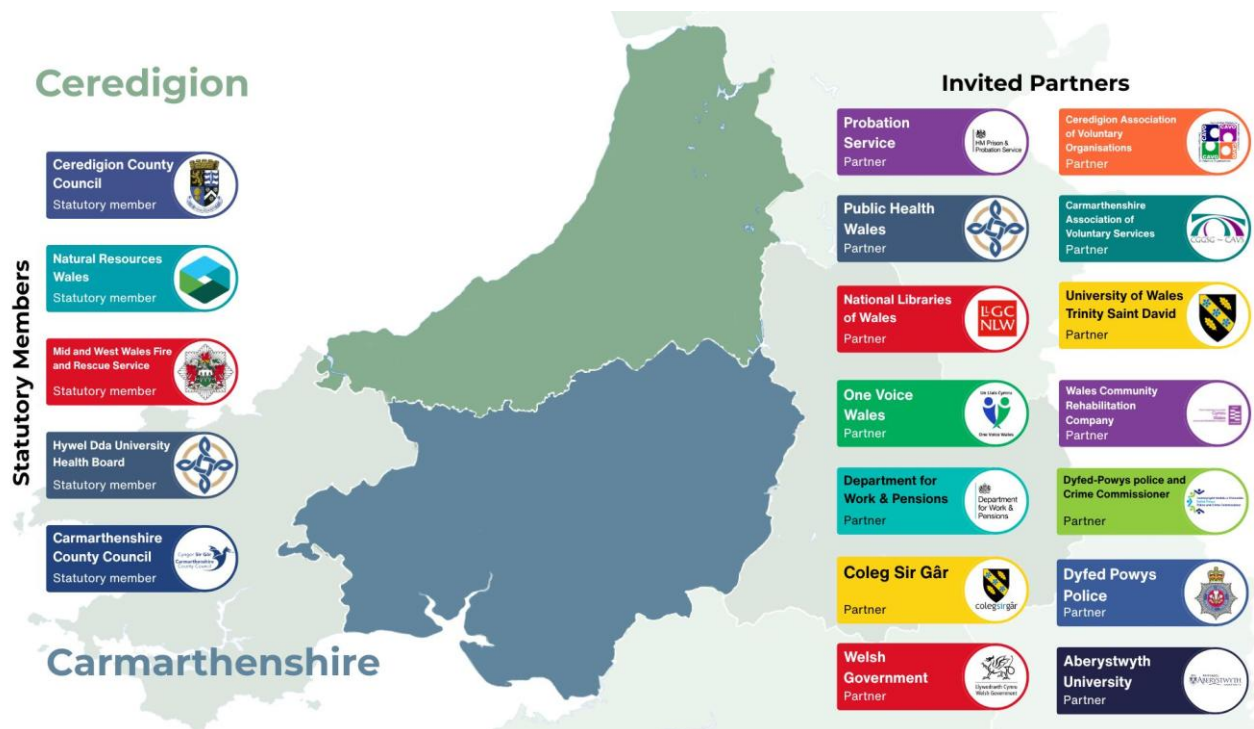
Partners represented within the PSB partnership and invited to contribute to the assessment included (see Annex B):

- Dyfed Powys Police and the Dyfed Powys Police and Crime Commissioner
- Carmarthenshire Association of Voluntary Services and Ceredigion Association of Voluntary Organisations
- Higher education and further education institutions, including the University of Wales Trinity Saint David, Aberystwyth University and local colleges
- Town and Community Councils via One Voice Wales
- Other local and regional partners contributing to the PSB partnership.

A full list of PSB member organisations can be found in Annex C.

Engagement therefore reflected the multi-agency structure of PSBs, drawing together perspectives from organisations responsible for infrastructure, emergency response, health services, environmental management, community support and local governance.

Figure 3: Ceredigion and Carmarthenshire stakeholder map



Source: Miller Research

Engagement Activities

Engagement activities supporting the assessment included:

- Ongoing engagement with the Joint Working Group (JWG), which provided project oversight and input throughout the assessment process;
- A calibration discussion with officers from Ceredigion PSB Climate and Nature group to review and contextualise Carmarthenshire PSB's previously identified priority risks;
- Two facilitated workshops with PSB members and invited partners (between 10-15 participants in each workshop) focused on:
 - o validating priority climate hazards;
 - o exploring exposure and vulnerability within local communities;
 - o identifying existing responses and resilience measures;
- Targeted follow-up interviews and written input with a small number of PSB partners, including local authority officers, emergency services representatives and education partners. A list of those interviewed can be found in Annex D.

Attendance at workshops included a mix of statutory PSB members and invited partner organisations. While participation varied across organisations, the workshops provided an opportunity to gather operational insights and sense-check the emerging risk assessment.

Engagement outputs were used to validate identified risks, refine the understanding of local exposure and vulnerability, and provide practitioner insight into how climate-related events affect public services in practice.

Limitations and Assumptions

As with all climate risk assessments, the methodology was subject to limitations and assumptions.

Data and Evidence Limitations

- Climate projection data is more limited at fine spatial scales;
- Some sector-specific datasets were incomplete or not publicly accessible;
- Private sector adaptation activity was not always publicly documented;
- Assessment of organisational response relied partly on workshop and partner input rather than an independently verified audit.

Engagement limitations

- Not all invited stakeholders were able to participate within the project timeframe (a full list of those engaged can be found in Annex E);
- Engagement was constrained by available time and resources within the project. Workshop attendance varied across partner organisations, and four targeted follow-up interviews were undertaken to supplement workshop insights where further clarification was required;
- Community participation reflected those reached through PSB networks and engagement mechanisms.

Assumptions

- Climate projections were based on UKCP18 and national CCRA evidence;
- Population and socio-economic trends were assumed to follow central projections;
- Future risk trajectories assumed no significant additional adaptation beyond currently identified plans unless explicitly documented.

This assessment provides a strategic overview of climate risks based on currently available evidence. Detailed quantitative modelling of individual hazards and infrastructure vulnerabilities has not been undertaken as part of this study.

The methodology aimed to provide a proportionate, transparent and evidence-informed assessment suitable for supporting statutory Well-being planning and PSB decision-making. The approach emphasised practical insight from practitioners responsible for managing climate-related incidents alongside evidence from national climate risk assessments and local datasets. The findings should therefore be interpreted as an evidence-informed overview designed to support strategic planning and prioritisation. Further detailed analysis and engagement is encouraged to support specific adaptation interventions or infrastructure investment decisions.

3. Climate risk overview

This chapter summarises the climate hazards and priority risks identified through the joint assessment process. It outlines how risks interact across systems (risk interdependencies) and compares the risk profile across Carmarthenshire and Ceredigion. The analysis was structured using the NRW Framework's Hazard-Exposure-Vulnerability-response (HEVR) model and was underpinned by the Joint Baseline Risk Register endorsed through the Joint Working Group (JWG).

Summary of identified climate hazards

Across both counties, the assessment identified a consistent set of climate hazards influencing risk across communities, services, infrastructure, and the natural environment. These hazards were already affecting day-to-day service delivery and were projected to intensify across future time horizons (present day, 2030s, 2050s, and 2080s).

For Ceredigion and Carmarthenshire under existing internationally agreed global policies (equivalent to global warming level of 2.0-3.7°C which is RCP 6.0), the yearly average climate change for 2070 compared with local records for the 1980s is expected to see temperatures increase by 2.75°C (2.88°C in summer) and see rainfall increase by 0.05mm/day (0.39mm/day in winter) and windiness decrease by 0.22 m/sec.¹

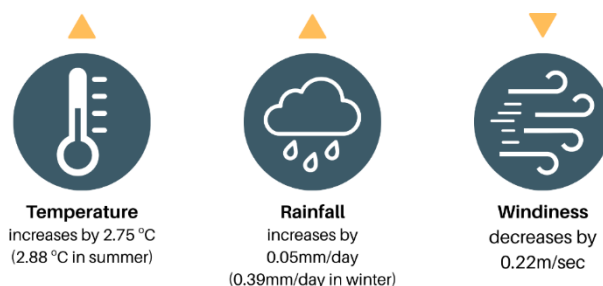
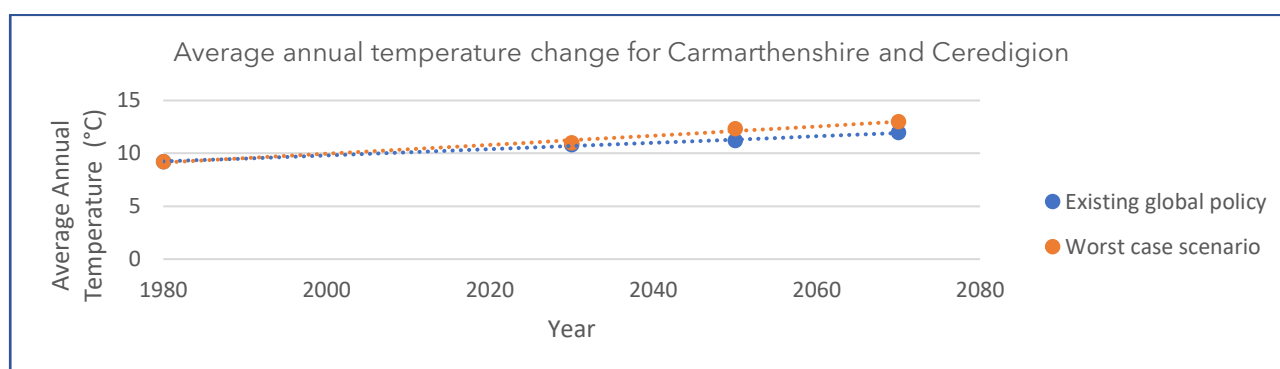


Figure 4: Temperature change in Carmarthenshire and Ceredigion by 2070 under existing internationally agreed global policies



Source: Local Climate Adaptation Tool. 2026. Carmarthenshire and Ceredigion. <https://lcat.uk/>.

The primary hazards identified through the evidence review and engagement process were:

- **Heavy rainfall and flooding.** Increased intensity and frequency of heavy rainfall contributing to fluvial flooding, surface water flooding, groundwater flooding and associated runoff impacts. In the period of April 2024 to end of March 2025, the Flood Guidance Statement (NRW) identified 40 days of heightened flood risk (significant forecast impacts and above), and 102 days of elevated flood risk (minor forecast impacts

¹ Local Climate Adaptation Tool. 2026. Carmarthenshire and Ceredigion. <https://lcat.uk/>.

and above) across Wales.² The same period also witnessed 622 flood alerts, 217 flood warnings, and 2 severe flood warnings.³

- **Storms and high winds.** Increased disruption to transport corridors, power networks, communications and access routes, including risks from fallen trees, debris, landslides, and coastal topping.⁴
- **Periods of extreme cold.** Figure 1 highlights multiple occasions of extreme cold spells, with significant impacts from snow and ice. These events have caused disruption to transport, water and energy infrastructure, especially impacting isolated, rural communities and their ability to access services.
- **Sea level rise and coastal change.** Increasing tidal flood risk, erosion and longer-term risks to the viability of low-lying coastal communities, infrastructure, and culturally significant places.
- **Higher summer temperatures and heat extremes.** Increasing risks to health, building performance, and infrastructure (particularly energy networks), alongside indirect impacts on water quality and ecosystems.
- **Drought and reduced summer rainfall.** Lower river flows and reduced soil moisture increasing stress on ecosystems, elevating water quality risks, and amplifying wildfire risk where habitats dry out.
- **Changing seasonal patterns.** Shifting winter temperatures, altered rainfall distribution, and increased variability, creating compounding pressures on agriculture, ecosystems, and infrastructure maintenance cycles.



Roads flooding near Llangadog, Carmarthenshire
2018 (Copyright NRW)

While hazards were broadly shared, local exposure and vulnerability patterns influenced the distribution of impacts across the two counties.

Risk interdependencies and cascading impacts

A consistent finding across workshops and evidence review was that climate risks were systemic and frequently generated cascading impacts across sectors. The assessment identified the following interdependency themes as particularly relevant across Carmarthenshire and Ceredigion:

Infrastructure interdependencies (cascading failure pathways)

- Disruption in one network (e.g. electricity, transport, digital communications) created knock-on effects across other services (e.g. water and wastewater operations, access to healthcare, emergency response times, supply chains);
- Rural geographies increased reliance on a limited number of transport corridors and constrained diversion routes, increasing the severity of disruptions when roads or bridges were closed;
- Impacts on rail corridors had downstream effects on freight movement, access to services, and (in some cases) increased reliance on road transport.

² Natural Resources Wales. Spring/Summer 2025. Flood risk management annual report 2024 to 2025. <https://naturalresources.wales/evidence-and-data/research-and-reports/flooding-reports-evidence-and-data/flood-risk-management-annual-report-2024-to-2025/?lang=en>.

³ Natural Resources Wales. Spring/Summer 2025. Flood risk management annual report 2024 to 2025. <https://naturalresources.wales/evidence-and-data/research-and-reports/flooding-reports-evidence-and-data/flood-risk-management-annual-report-2024-to-2025/?lang=en>.

⁴ Natural Resources Wales. 2023. Flood risk management annual report 2021 to 2022. <https://naturalresources.wales/evidence-and-data/research-and-reports/flooding-reports-evidence-and-data/flood-risk-management-annual-report-2021-2022/?lang=en>.

Flooding-water quality-public health linkages

- Increased heavy rainfall and runoff pressures contributed to increased stress on wastewater networks and water quality outcomes (including storm overflow events);
- Reduced summer river flows concentrated pollutants, which compounded water quality risks and affected ecosystem health and, potentially, tourism and recreation.

Nature-flooding-resilience feedbacks

- Habitat condition (e.g., peatlands, woodlands, wetlands, riparian corridors) influenced flood attenuation, water temperature regulation and catchment function;
- Ecosystem degradation increased vulnerability to further impacts (e.g. drying peatlands increasing wildfire risk and reducing carbon storage capacity).

Land use change effects (including “urban creep”)

- Increased impermeable surfaces reduced infiltration, increasing surface water flood risk and contributing to runoff-related impacts;
- Local development pressures interacted with water quality constraints (including nutrient-related planning constraints in some catchments), reinforcing the need for whole-catchment approaches.

Social and service interdependencies

- Disruption to transport and access routes affected staffing and service continuity (healthcare, social care, education, emergency response);
- Repeated events increased fatigue among communities and responder organisations and affected recovery time between storms and flood episodes.

These interdependencies were treated as a core part of risk characterisation in the HEVR analysis and informed later consideration of capacity, gaps and collaboration opportunities.

Understanding vulnerability in Carmarthenshire and Ceredigion

Climate risks do not affect all communities equally. The severity of climate impacts is shaped not only by physical exposure to hazards such as flooding, but also by underlying social, economic and geographic vulnerability.

To better understand this interaction, spatial analysis was undertaken comparing areas of high flood risk with areas identified as having higher levels of socio-economic deprivation according to the Welsh Index of Multiple Deprivation (WIMD).

The analysis indicates a notable spatial overlap between communities exposed to flood risk and communities experiencing higher levels of deprivation. This suggests that climate risks may disproportionately affect communities with reduced capacity to absorb and recover from climate impacts.

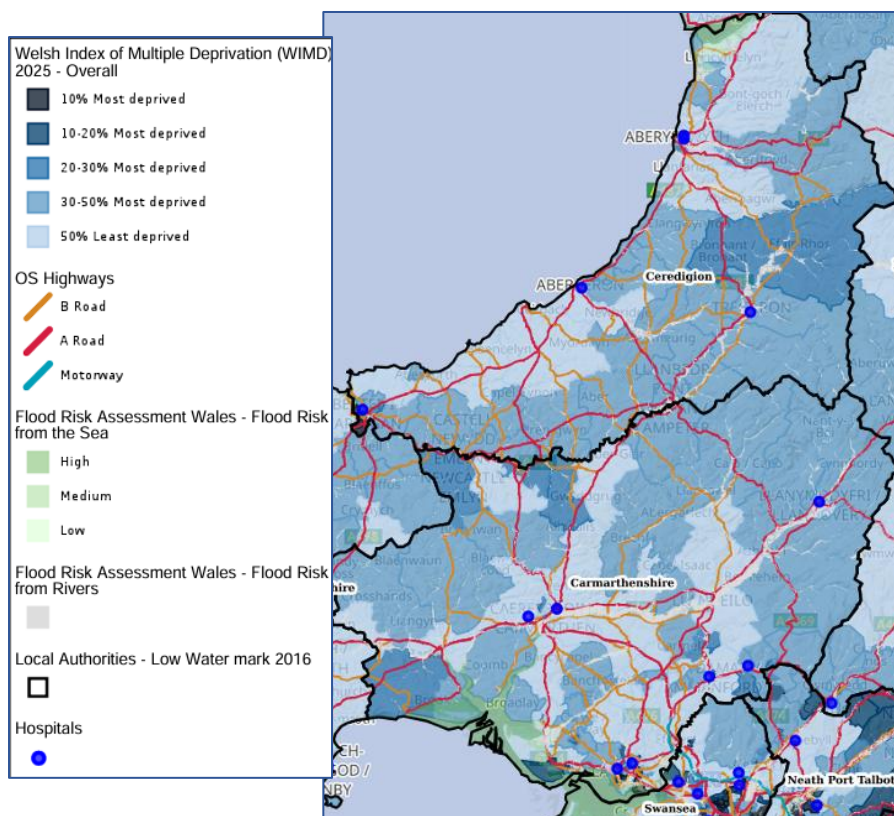
Areas experiencing both high physical exposure and high social vulnerability⁵ may face compounded risks, including disruption to livelihoods, increased pressure on public services, and longer recovery times following extreme weather events.

It is important to note that WIMD indicators may not fully capture all dimensions of vulnerability, particularly within rural areas where geographic isolation, infrastructure limitations and access to services also shape resilience.

In rural contexts, vulnerability may also be shaped by factors such as limited transport connectivity, digital infrastructure gaps, and longer response times for emergency services. These characteristics mean that relatively small disruptions to infrastructure or services can have wider impacts across communities.

Maps illustrating the spatial relationship between flood exposure and socio-economic vulnerability, transport links, and flood defence schemes are provided in Annex F.

Rural and geographic vulnerability



Flood risk from rivers and sea, Welsh Index of Multiple Deprivation, Hospital and Highways locations. Source: DataMapsWales

⁵ Cardigan in Ceredigion ranks highly in the WIMD, placing in the 10% most deprived areas in Wales and experiencing relatively frequent flooding due to the River Teifi and surface water flooding and coastal exposure to high winds.

Coastal areas of Pembrey and Llwynhendy in Llanelli also face coastal flooding, high winds, and are placed in the 10-20% most deprived areas in Wales.

Rurality is a defining characteristic of both Carmarthenshire and Ceredigion and significantly shapes climate vulnerability.

Communities located in remote or sparsely populated areas often experience longer travel times to essential services such as healthcare, emergency response and social care. During extreme weather events such as flooding or snow, disruptions to transport routes can further isolate these communities and delay emergency response.

Infrastructure redundancy is also more limited in rural areas. Loss of electricity, telecommunications or transport access may therefore result in wider service disruption than in more connected urban areas.

Digital connectivity also plays an increasingly important role in community resilience. Loss of electricity or telecommunications during extreme weather events can disrupt access to information, emergency warnings, and essential services, particularly in areas where mobile coverage or broadband connectivity is already limited.

While rural communities often possess strong social cohesion and local knowledge that supports resilience, geographic isolation and limited infrastructure can create conditions where relatively small disruptions escalate into wider community and service impacts.

Social vulnerability and demographic factors

Certain population groups may experience disproportionate impacts from climate-related hazards due to social, economic or demographic characteristics.

Stakeholder engagement highlighted several factors that may increase vulnerability, including:

- Older populations, particularly in rural areas where ageing demographics are more pronounced;
- Disabled people where adapted housing or evacuation support may be limited
- Socially isolated individuals with reduced access to support networks during emergencies;
- Low-income households who may lack resources for property-level flood resilience or recovery;
- Residents in flats, HMOs or high-density housing located in flood-prone areas.

Flood risk may also influence housing markets by affecting insurance availability, property values and mortgage eligibility, potentially limiting the ability of lower-income households to relocate away from flood-prone areas.

Where properties experience repeated flooding, homes may become increasingly difficult to insure or sell. This can create situations where households are effectively unable to relocate away from areas of high flood risk, further reinforcing patterns of vulnerability.

Infrastructure and service vulnerability

Climate-related disruption to infrastructure networks can generate cascading impacts across communities and public services.

Transport disruption during extreme weather events may restrict access to healthcare, employment and essential services. In rural areas with limited alternative routes, road closures can rapidly isolate communities.



Cors Caron Bog (Copyright NRW)

Extreme weather events can also place additional pressure on healthcare services. For example, flooding or snow may increase accident rates while simultaneously preventing staff or patients from reaching hospital sites.

Increasing reliance on digital infrastructure for communication, finance and service delivery represents a further vulnerability. Power outages or connectivity loss may disrupt access to services where contingency arrangements are limited.

Stakeholder engagement indicated that climate-related incidents can place sustained operational pressure on particular local authority services. Highways teams, housing services and adult social care services may experience prolonged disruption during periods of extreme weather, with routine service delivery sometimes suspended while resources are redirected to emergency response activities.

Many public services also depend on interconnected infrastructure systems such as electricity, digital networks, and transport access. Disruption to these systems can therefore have cascading effects across services delivery, particularly where facilities rely on digital systems or remote working arrangements.

Economic vulnerability and sector dependence

Local economies in Carmarthenshire and Ceredigion are strongly influenced by sectors sensitive to climate conditions, particularly agriculture and tourism.

Agricultural systems are exposed to flooding, drought and seasonal weather variability. As agriculture underpins many rural economies, climate impacts affecting farms may generate wider economic consequences for rural communities and supply chains.

Tourism-related pressures may also interact with climate risk. Coastal communities experience seasonal population increases which can place additional pressure on water supply, wastewater infrastructure and local services during periods of extreme weather.

Ecosystem vulnerability

Ecosystems provide important natural protection against climate hazards through services such as flood attenuation, water regulation and carbon storage.

However, these ecosystem services are themselves vulnerable to climate change. Degraded peatlands may become more susceptible to drought and wildfire, while changes in hydrology may affect freshwater ecosystems.

Peatlands have huge potential to contribute to Wales' land-based carbon storage. Only 10% of Welsh peatlands are in good condition, with emissions from degraded peatlands estimated to equal 10% of Wales' transport emissions.⁶ If these ecosystems degrade, their ability to regulate climate impacts and store carbon may be significantly reduced.

In this context, ecosystems can be understood as a form of natural infrastructure that supports flood attenuation, water regulation and climate mitigation alongside built systems. Protecting



Storm Darragh Windblow (Copyright NRW)

⁶ Natural Resources Wales. 2021. Peatland: How carbon sinks can turn into carbon emitters.

<https://cdn.cyfoethnaturiol.cymru/694124/information-note-peatland-how-carbon-sinks-can-turn-into-carbon-emitters.pdf>.

and restoring ecosystems therefore represents both an environmental priority and an important component of long-term climate resilience.

Cumulative and systemic vulnerability

Climate vulnerability often arises through the interaction of multiple pressures rather than a single factor. Communities may experience repeated flooding events, infrastructure disruption, economic pressures and reduced access to services simultaneously. Over time these cumulative impacts can place sustained pressure on both communities and public service providers.



Coastal flooding in Aberystwyth 2014 (Copyright NRW)

Repeated disruptions may also lead to secondary social impacts, including increased stress within communities, reduced confidence in warning systems, and additional pressure on emergency services and local authorities responding to repeat events.

Understanding these cumulative pressures is essential for developing effective long-term adaptation strategies and strengthening resilience across interconnected systems. Climate risks have

important equity implications. Communities experiencing higher levels of deprivation, limited housing mobility, or restricted access to services may face greater difficulty preparing for and recovering from climate impacts. Ensuring that adaptation measures support vulnerable communities therefore represents an important element of a fair and inclusive transition to climate resilience. These patterns of vulnerability provide important context for the climate risks identified in the following sections.

Cross-county risk comparison

The joint assessment identified a shared risk profile across both counties, with differences primarily driven by:

- Settlement patterns (dispersed rural communities vs. regional service hubs);
- The configuration of key transport corridors and supply chains;
- Localised coastal and estuarine exposure;
- Catchment-specific water quality pressures;
- The distribution of critical assets (hospitals, schools, care settings) in flood-risk areas.

Shared characteristics across both counties

- High exposure to flooding-related disruption affecting homes, businesses, roads, bridges and essential services;
- Rurality and dispersed settlement patterns increasing vulnerability due to limited redundancy in infrastructure and longer emergency response times;
- High dependence on the condition of the natural environment for resilience (e.g., catchment function, peatlands, riparian habitats) and increasing sensitivity to ecological stress;
- Coastal exposure increasing over time, including impacts on communities, infrastructure and cultural assets.

Distinguishing features in Carmarthenshire

- Greater exposure associated with specific river corridors and floodplains affecting communities, transport routes and critical services;

- Known vulnerabilities relating to recurring flooding impacts on particular settlements and associated recovery and insurance challenges;
- Agricultural land and catchment pressures shaping runoff and water quality issues, with implications for downstream communities and ecosystems.

Distinguishing features in Ceredigion

- Concentrated exposure in regional service hubs and transport corridors that supported connectivity, access to services and the local economy. Workshop participants identified potential impacts from severe weather on transport infrastructure, with limited diversion options in a rural network and specific sensitivity on the Cambrian line (north Ceredigion, estuary-adjacent sections);
- Coastal and estuarine exposure affecting communities and infrastructure, including locations with dual exposure to fluvial and coastal flooding;
- Noted vulnerability associated with being “at the end of the supply line” for certain goods, increasing sensitivity to disruption.

Detailed county-specific exposure and place-based considerations are set out in chapter 4.

Priority climate risk summary

Based on the evidence review, stakeholder engagement and Hazard, Exposure, Vulnerability, Response analysis, seven priority climate risks were identified as having the greatest potential to affect communities, infrastructure, ecosystems, and public services across Carmarthenshire and Ceredigion.

These risks are summarised in the table below. Scores range from 1 (low) to 5 (very high) reflecting the relative severity of hazard magnitude, exposure, vulnerability and adequacy of response. The scoring process drew on:

- evidence review
- stakeholder engagement
- national risk evidence (CCRA3)
- local datasets and policy documents.

The scores provide a comparative indication of risk severity rather than a precise quantitative measure.

Table 1: HEVR analysis summary

Risk ID	Risk Title	2030 - Carmarthenshire				2080 - Carmarthenshire				2030 - Ceredigion				2080 - Ceredigion			
		H	E	V	R	H	E	V	R	H	E	V	R	H	E	V	R
I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	3	4	4	3	4	5	5	3	4	4	4	3	5	5	5	3
I2	Risks to infrastructure services from river, surface water and groundwater flooding	3	4	4	3	4	5	5	3	3	4	4	3	4	5	5	3
I12	Risks to transport from high and low temperatures, high winds, lightning	3	4	4	4	4	5	5	3	3	4	4	4	4	5	5	3

N1	Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology	3	3	3	3	5	4	4	3	3	3	3	3	5	4	4	3
H3	Risks to people, communities and buildings from coastal and surface flooding	3	4	4	3	5	5	5	3	3	4	3	3	5	5	5	3
H4	Risks to people, communities and buildings from sea level rise	3	3	3	3	4	4	4	3	3	4	4	4	4	4	5	4
H10	Risks to health from water quality and household water supply	3	3	3	3	4	3	4	3	3	3	3	3	4	3	4	3

Flood-related risks (H3 and I2) were consistently identified as high priority due to their current frequency, widespread exposure across communities and infrastructure, and potential to generate cascading impacts across public services. Infrastructure interdependency risks (I1) were also highlighted as a growing concern, particularly where disruption to transport, electricity, or communications could affect health services, emergency response, and supply chains.

Priority risk assessment

For the joint CCRA, seven priority risks were assessed in detail using the HEVR model. These risks aligned with the national UK CCRA framing and reflected the risks most consistently prioritised through evidence base and partner engagement. An overview of the 61 risks identified in the CCRA3 is located in Annex G.

The sections below summarised the joint HEVR assessment for each priority risk.

I1: Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures

Hazard

Cascading failures were driven by extreme weather events (heavy rainfall, flooding, snowstorms, and heat) and the interaction between hazards and infrastructure system dependencies. Heat stress and storm impacts were identified as relevant drivers of service interruption, including indirect impacts on water and wastewater operations. There have been observed changes in wind strength, storminess, summer

Exposure

Exposure was heightened where critical services depended on limited transport corridors, constrained diversion routes, and single points of failure (e.g., bridges, substations, communications infrastructure). Rural areas were particularly exposed due to lower redundancy and limited alternative connectivity. The age and condition of telecommunication and other infrastructure has also been highlighted as impacting the exposure.⁸ Across Wales there are currently 51 GP surgeries, 16 hospitals, 48 care homes, and 81 emergency

⁸ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

temperatures and extreme heat events, the intensity of rainfall events, and soil erosion.⁷

services that are currently at risk of flooding, with increases projected by 2050 and 2080, especially for care homes.⁹ Annex F presents hospital locations in Ceredigion and Carmarthenshire alongside flood risk.

Vulnerability

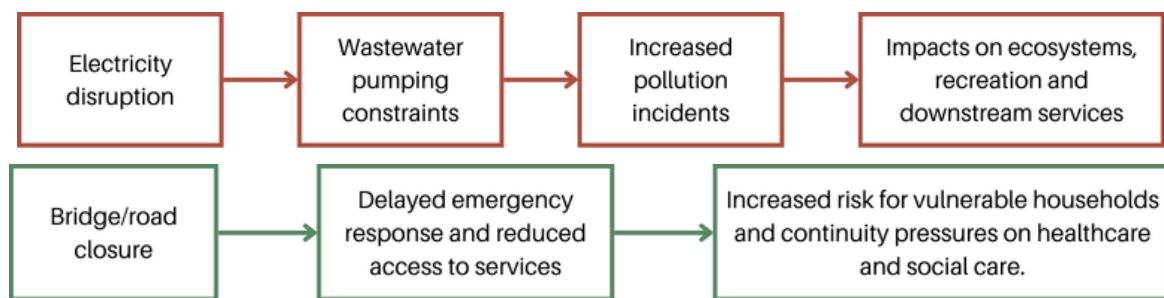
Vulnerability is influenced by:

- Rural isolation and limited digital/mobile coverage in some areas;
- Age and condition of infrastructure assets;
- Existing pressures on public service capacity and maintenance budgets;
- Growing dependence on digital infrastructure;¹⁰
- Reduced resilience when multiple events occurred in close succession.

Response

Existing responses included emergency response coordination, infrastructure maintenance programmes, and local resilience arrangements. However, the level of shared understanding of cross-system dependencies was not consistently complete, and interdependency mapping was identified as an ongoing area for strengthening. The Climate Change Committee also identified the adaptation shortfall in managing the risk of cascading failures.¹¹

Illustrative cascading pathways noted through engagement



12: Risks to infrastructure services from river, surface water and groundwater flooding

Hazard

Increased heavy rainfall and persistent wet periods were associated with increased fluvial, pluvial and groundwater flooding pressures, with a growing likelihood of infrastructure exposure over time, such as the increased risk of flood for Welsh electricity substations.¹² Between 2016 and 2019 there

Exposure

Exposure included:

- Roads, bridges and transport corridors (Road closures were a key exposure concern where diversion options were limited);
- Water supply and wastewater assets;
- Utilities and communications;
- Settlements and critical services located in flood-prone areas.

Stakeholders highlighted that recent extreme rainfall events have resulted in flooding in areas previously considered to be at relatively low risk, with some events exceeding the

⁷ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales.

<https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

⁹ Public Health Wales & World Health Organization Collaborating Centre on Investment for Health and Wellbeing. July 2023. D5.3/P6.2 Flooding. <https://phwwhocc.co.uk/wp-content/uploads/2023/07/D5.3P6.2-Flooding-Eng-final.pdf>.

¹⁰ UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

¹¹ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales.

<https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

¹² Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales.

<https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

were over 1100 incidents of infrastructure flooding in Wales.¹³

design capacity of existing flood defences. This suggests that historical risk assumptions may increasingly underestimate future climate hazards.

Vulnerability

Vulnerability was shaped by:

- Limited route redundancy, particularly in rural areas;
- Recurrent flood impacts reducing household and business recovery capacity over time;
- Constraints on maintenance and capital budgets; and
- Interactions with runoff and catchment management pressures.

Response

Responses included local flood risk management functions, flood defence and coastal protection teams, flood warning services, and community resilience arrangements in some locations. The assessment identified an ongoing need for more integrated, catchment-scale approaches where flooding interacted with land use, runoff, water quality and nature-based measures.

112: Risks to transport from high and low temperatures, high winds, lightning

Hazard

Transport disruption was driven by storms and high winds (fallen trees, debris, landslides), extreme rainfall (washouts, saturated ground, slope instability), and temperature extremes (damage to surfaces and assets, overheating constraints). The 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 2006/7 and 2018/19.¹⁴ In 2021, 34% of the rail network was at risk of flooding, with projections indicating that this could increase to 53% by 2050 under a 2°C scenario.¹⁵

Extreme rainfall events can also trigger localised land slips and slope instability adjacent to transport corridors, particularly in rural or upland areas. Even relatively minor land movements can disrupt transport routes and require temporary road closures.

Exposure

Exposure included:

- Strategic road networks and local access roads;
- Rail corridors and associated structures;
- Emergency service access routes;
- Age and condition of transport infrastructure;¹⁶
- Capacity of highest traffic infrastructure;¹⁷ and
- Routes serving regional service hubs and supply chains.

Results from CCRA3 indicate that all rail track assets in Wales will face an increased exposure to surface water risk.¹⁸ CCRA3 also indicates that heat pressure will increase exposure. Under a 4°C scenario the number of days per year over 26°C, which poses a risk to transport networks, will increase by approximately seven times.¹⁹

¹³ Public Health Wales & World Health Organization Collaborating Centre on Investment for Health and Wellbeing. July 2023. D5.3/P6.2 Flooding. <https://phwwhocc.co.uk/wp-content/uploads/2023/07/D5.3P6.2-Flooding-Eng-final.pdf>.

¹⁴ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

¹⁵ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

¹⁶ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

¹⁷ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

¹⁸ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

¹⁹ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

Vulnerability

Key vulnerability factors included:

- Constrained maintenance capacity and increasing repair requirements;
- High dependence on specific corridors for access to services, particularly healthcare;
- Population growth by region;²⁰
- Potential for compounded impacts during prolonged storm sequences; and
- Localised vulnerabilities in communities with limited alternatives for travel.

Response

Transport resilience relied on multi-agency roles and distributed responsibilities. Engagement highlighted the importance of clarifying roles across asset owners and responders, and of planning for the cumulative maintenance and budget implications as disruption frequency increased.

N1: Risks to terrestrial, freshwater, and coastal species and habitats from changing climatic conditions and extreme events

Hazard

Changing temperature and rainfall patterns created stress on habitats, particularly through reduced summer rainfall, altered hydrology, warmer waters, and increased frequency of extreme events such as floods and droughts. These hazards also increased wildfire risk where peatlands and other habitats dried out.

Although considered together within this priority risk, the pathways of impact differ across terrestrial, freshwater and coastal habitats. Freshwater systems are particularly sensitive to changes in river flow, water temperature and water quality; terrestrial habitats are affected by drought, wildfire risk, invasive species and changing climatic suitability; and coastal habitats are additionally exposed to sea-level rise and coastal squeeze.

Exposure

Exposure included peatlands, woodlands, freshwater systems, and connected ecological networks. Species with limited mobility and specialist habitat requirements were particularly exposed.²¹

Workshop discussions placed particular emphasis on freshwater and river corridor systems, while risks to coastal habitats are also closely linked to sea-level rise and coastal change and should be read alongside H4.

Vulnerability

Vulnerability is driven by ongoing declines in biodiversity and was influenced by:²²

- Fragmented habitats and limited ecological connectivity;
- Existing pressures on catchments (e.g., nutrient loading, runoff);
- Increased susceptibility to pests and invasive species under warmer conditions; and
- The feedback loop between ecosystem degradation and reduced natural resilience

Response

Responses included ongoing habitat restoration and nature-based initiatives in some catchments. Engagement highlighted the role of nature not only as a risk area but as a key component of resilience solutions (e.g., temperature regulation, flood attenuation, ecosystem services).

²⁰ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

²¹ The assessment identified risks associated with terrestrial species (N1), freshwater species and habitats (N11) as well as coastal species and habitats (N17).

²² UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

(including loss of flood attenuation and carbon storage functions).

H3: Risks to people, communities and buildings from coastal and surface flooding

Hazard

Flooding-related impacts on people and buildings were driven primarily by increased heavy rainfall and river flooding, surface water flooding, and coastal flooding (where relevant). In Wales, approximately one in seven properties (275,000 properties), are at risk of flooding.²³ Recurrent flooding was identified as a key concern due to cumulative impacts. Impacts have also been noted on mental health, with the risk of having probable depression, anxiety, or post-traumatic stress disorder (PTSD) being six times higher in peoples whose homes have been flooded than those unaffected.²⁴

Exposure

Exposure included:

- Homes and businesses in floodplains and low-lying areas;
- Location of care homes, schools and community facilities;
- Critical service sites and access routes;
- Levels of resilience in homes and health and social care buildings;²⁵
- Communities with long travel distances to services;
- Across Wales it is estimated that 148,000 people live in areas of significant flood risk from rivers, the sea, and surface water.²⁶ In 2025, 2,985 properties were at risk from surface water flooding in Ceredigion, and 8,620 in Carmarthenshire.²⁷

Vulnerability

Vulnerability was shaped by:

- Housing quality and limited availability of adapted housing (including for disabled residents);
- Age of population;²⁸
- Ability to adapt one's own behaviour or environment;²⁹
- Insurance affordability and the risk of uninsurability/unmortgageability over time;
- Social isolation and the ability to access support during and after events;
- Rurality;³⁰
- Recovery fatigue where events occurred repeatedly or back-to-back;
- Wider socio-economic pressures, such as deprivation level,³¹ affecting capacity to prepare and recover.

²³ Natural Resources Wales. 2025. Flood risk management annual report 2024 to 2025.

<https://naturalresources.wales/evidence-and-data/research-and-reports/flooding-reports-evidence-and-data/flood-risk-management-annual-report-2024-to-2025/?lang=en>.

²⁴ Public Health Wales & World Health Organization Collaborating Centre on Investment for Health and Wellbeing. July 2023. D5.3/P6.2 Flooding. <https://phwwhocc.co.uk/wp-content/uploads/2023/07/D5.3P6.2-Flooding-Eng-final.pdf>.

²⁵ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales.

<https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

²⁶ UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

²⁷ Welsh Government. 2026. StatsWales: Properties at risk of flooding in Wales. https://stats.gov.wales/en-GB/44557520-6234-4a77-9263-cabfc00f4d72/filtered/37lk0xulq3b0?page_size=100.

²⁸ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales.

<https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

²⁹ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales.

<https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

³⁰ Public Health Wales & World Health Organization Collaborating Centre on Investment for Health and Wellbeing. July 2023. D5.3/P6.2 Flooding. <https://phwwhocc.co.uk/wp-content/uploads/2023/07/D5.3P6.2-Flooding-Eng-final.pdf>.

³¹ UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

Spatial analysis undertaken for this assessment indicates that flood-prone areas in parts of both Ceredigion and Carmarthenshire overlap with communities experiencing higher levels of socio-economic deprivation. Communities with higher levels of deprivation may have fewer resources to prepare for, respond to, and recover from climate impacts. This overlap suggests that flooding may generate disproportionate social impacts, including greater disruption to households with limited financial resilience, increased demand for support services, and longer recovery periods following flood events. This interaction between environmental exposure and social vulnerability reinforces the importance of place-based adaptation strategies that prioritise communities facing compound climate risks.

Response

Responses included emergency planning and recovery support mechanisms (including local hardship funds in some instances), flood warning services, and community response groups in certain areas. Engagement also highlighted challenges around warning uptake over time, and the need for clearer communication and preparedness support. The Welsh Government is currently developing a 'Planning Policy for Wales Technical Advice Note 15: Development Flooding and Coastal; Erosion' that will guide regeneration, development and support risk management authorities on strategic flood consequence assessments.³²

H4: Risks to people, communities and buildings from sea level rise

<i>Hazard</i>	<i>Exposure</i>
Sea level rise and associated coastal change increased risks of tidal flooding, erosion, and longer-term viability challenges for some low-lying coastal settlements and infrastructure.	Exposure included: - Coastal communities, transport routes and utilities near shorelines and estuaries; - Areas with limited space for coastal adaptation due to geography and existing development patterns; - Natural habitats that provided coastal protection and wider benefits.
<i>Vulnerability</i>	<i>Response</i>
Vulnerability was shaped by: - Long-term affordability and feasibility of maintaining defences in certain locations; - Risks associated with mortgages, insurance and declining property confidence; - Cultural and community impacts associated with place-based identity and potential long-term relocation pressures; - Constraints on local capacity to plan and implement long-term coastal adaptation pathways.	Responses included shoreline management planning and local coastal risk management activity. Engagement highlighted the need for long-term planning clarity, realistic adaptation pathways, and stronger integration of social and cultural impacts within coastal resilience planning.

H10: Risks to health from water quality and household water supply

<i>Hazard</i>	<i>Exposure</i>
Water quality risks were shaped by: - Heavy rainfall increasing runoff and storm overflow pressures; - Warmer temperatures increasing risks associated with waterborne pathogens and ecosystem stress;	Exposure included: - Catchments affected by nutrient and runoff pressures; - Communities reliant on household supplies and local water treatment performance;

³² UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

- Summer rainfall and intensity of rainfall;³³
- Shrink-swell and soil erosion;³⁴
- Drought and reduced summer flows concentrating pollutants and raising temperature-related ecological risks.

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 if additional adaptation measures are not put in place.³⁵ Further, in Wales, water scarcity will become more prevalent, with summer rainfall expected to decrease by approximately 15% by the 2050s, and between 18% to 26% by the 2080s.³⁶

- Age and condition of supply infrastructure;³⁷
- Health and social care settings where water quality issues had service implications;
- Economic sectors sensitive to water quality outcomes (e.g., tourism and recreation).

Both counties have moderate exposure; rural areas in Ceredigion face infrastructure challenges, while Carmarthenshire's larger populations increase overall risk.

Synthesis

Taken together, the risks identified through the HEVR assessment indicate that flooding, infrastructure disruptions, and ecosystem degradation represent the most immediate climate challenges for both counties. These risks are already affecting operational service delivery and are expected to intensify significantly over the coming decades if adaptation measures are not strengthened.

While the priority risks identified through the HEVR assessment are broadly shared across Carmarthenshire and Ceredigion, the spatial distribution of exposure and vulnerability varies between the two counties. The following chapter therefore examines how these risks manifest in each county's specific geographic, infrastructure, and socio-economic context. This place-based analysis helps identify where climate impacts are most likely to affect communities, services, and ecosystems.

³³ UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

³⁴ UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

³⁵ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

³⁶ Public Health Wales & World Health Organization Collaborating Centre on Investment for Health and Wellbeing. July 2023. D5.5 Water Supply and Quality. <https://phwwhocc.co.uk/wp-content/uploads/2023/07/D5.5-Water-Supply-and-Quality-Eng-final.pdf>.

³⁷ Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

4. County-specific considerations

Carmarthenshire and Ceredigion share a range of climate hazards and systemic risks. However, the nature and distribution of exposure and vulnerability differs across the two counties, reflecting their geography, settlement patterns, infrastructure networks, economic structures and environmental assets.

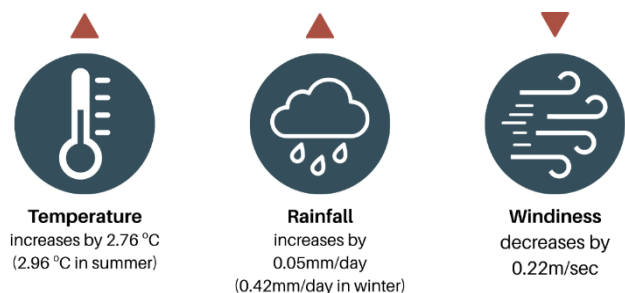
This chapter examines the distinctive risk profiles of Carmarthenshire and Ceredigion, highlighting the key locations, sectors and communities where climate risks are most pronounced. The analysis does not introduce new risk categories but instead considers how the priority risks identified in Chapter 3 manifest spatially within each county.

The purpose of the chapter is to identify place-specific concentrations of climate exposure and vulnerability, to highlight local infrastructure, environmental or socio-economic factors that shape risk outcomes, and inform the subsequent analysis of adaptation gaps, capacity constraints, and opportunities for collaboration.

Carmarthenshire Public Service Board – Key risk profile

Distinctive exposure

In Carmarthenshire, under current agreed global climate policies (equivalent to global warming level of 2.0-3.7°C which is RCP 6.0³⁸), the yearly average climate for 2070 (compared with local records for the 1980s) is expected to see temperatures increase by 2.76°C (2.96°C in summer), annual average rainfall increase by 0.05mm/day (0.42mm/day increase in winter and a 0.39mm/day decrease in summer) and annual windiness decrease by 0.22 m/sec.³⁹ Under the same existing global policies, average annual temperature in 2030 is expected to be 11.07°C, 11.46°C in 2050, and 12.21°C in 2070 (compared to 9.45°C in 1980).⁴⁰ Crucially, average annual projected climatic changes also result in more extreme and volatile weather.



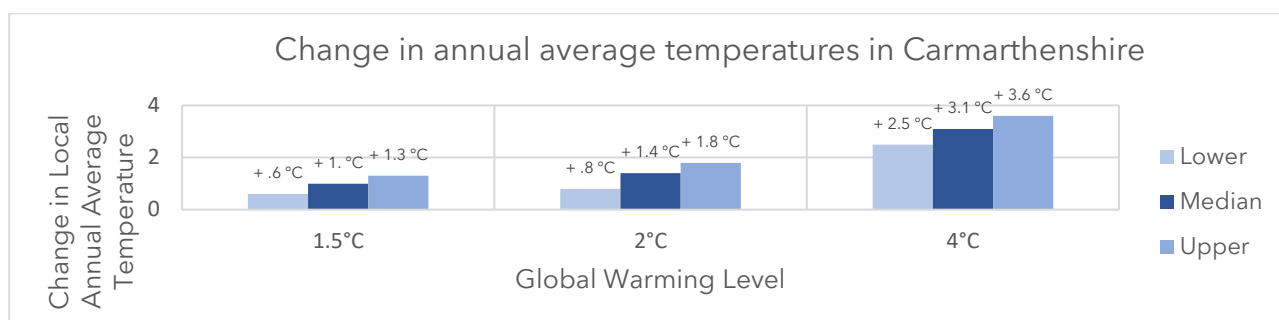
The chart below shows the increase in local average temperatures, relative to 1981-2000 when the local annual average temperature was 9.3°C. Projected temperature increases in Carmarthenshire closely follow global warming trajectories, with relatively moderate changes at 1.5-2°C but sharply higher increases under a 4°C scenario. This illustrates how global emissions pathways directly shape local climate conditions, with higher warming levels leading to more extreme and potentially disruptive impacts for communities, infrastructure, and ecosystems.⁴¹

³⁸ RCP (Representative Concentration Pathway) 6.0 is one of the four IPCC scenarios representing higher-medium emissions. Unlike the high-emissions RCP 8.5 or low-emissions RCP 2.6, RCP 6.0 assumes stabilising green house gas concentrations shortly after 2100 through technological and mitigation strategies.

³⁹ Local Climate Adaptation Tool. 2026. Carmarthenshire. <https://lcat.uk/>.

⁴⁰ Local Climate Adaptation Tool. 2026. Carmarthenshire. <https://lcat.uk/>.

⁴¹ Met Office. 2026. Local Authority Climate Explorer [Beta, v2.01] Carmarthenshire. <https://www.arcgis.com/apps/dashboards/506ff7d53c884badb0d8fd36d6280a91>.



Source: Miller Research, <https://www.arcgis.com/apps/dashboards/506ff7d53c884badb0d8fd36d6280a91>.

Carmarthenshire exhibits a diverse climate risk profile shaped by its large rural geography, river catchments, coastal settlements, and dispersed infrastructure networks. The county includes major river systems such as the Tywi, Taf and Teifi catchments, extensive agricultural land, and low-lying coastal areas around Carmarthen Bay and the Loughor Estuary. These characteristics create a combination of fluvial, surface water and coastal exposure, alongside risks to transport networks and critical infrastructure.

Flooding represents the most significant climate hazard affecting Carmarthenshire.⁴²⁴³ The potential for more intense rainfall events, rising sea levels and increased storm frequency is expected to increase pressure on river systems, drainage infrastructure and coastal defences. Climate change is therefore projected to increase the frequency and severity of flooding and associated impacts on communities, infrastructure and ecosystems.

The county's transport and energy networks are particularly exposed due to their location along river valleys and coastal corridors, meaning that flooding or severe weather can trigger cascading disruptions across multiple systems, including electricity supply, health services, road networks and rail services.

Carmarthenshire is also home to sensitive ecological landscapes, including river catchments, floodplain habitats and coastal ecosystems. These systems face increasing pressure from changing climatic conditions, including altered rainfall patterns, higher temperatures and coastal change. Climate impacts therefore have the potential to affect both environmental assets and the ecosystem services they provide, such as flood regulation and water quality.



Snowstorm in Brechfa 2025 (Copyright NRW)

In Carmarthenshire, ecological risks are shaped by the interaction between river catchments, floodplain habitats, peatland and woodland systems, and coastal habitats along estuarine and coastal zones. Recent climate-related events have highlighted the compound nature of these risks. Severe storms can combine heavy rainfall, high winds, and tidal conditions, amplifying impacts across communities and infrastructure systems. Evidence collected by NRW emphasises that flooding across the region is increasingly driven by interconnected hazards rather than single events, underlining the importance of integrated risk management approaches.

High-priority local risks

⁴² Natural Resources Wales. 2023. Appendix J: South West Local Measures. <https://cdn.cyfoethnaturiol.cymru/b3rpvlph/appendix-j-south-west-wales.pdf>.

⁴³ Carmarthenshire County Council. February 2024. Carmarthenshire County Council's Local Flood Risk Management Strategy 2024-2030. <https://www.carmarthenshire.gov.wales/media/53cl50yc/carmarthenshire-county-council-s-local-flood-risk-management-strategy.pdf>.

11: Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures

Carmarthenshire's infrastructure networks are vulnerable to interconnected failures triggered by extreme weather events, particularly flooding and storms.

Local examples illustrate how climate hazards can disrupt critical services:

- Abergwili has experienced repeated flooding affecting electrical infrastructure, including a substation that has flooded on multiple occasions. Disruption to this asset has had knock-on impacts for nearby health services, including the operation of the hospital and local medical facilities. This has been responded to with a planned change in the electricity network⁴⁴, with Green GEN Cymru proposing a new 132 kV connection to a new National Grid substation at Llandyfaelog, introducing additional infrastructure and interdependencies.
- Ammanford, located within a flood-risk corridor, faces threats to transport and rail infrastructure from river flooding and surface water accumulation. Disruption to the rail corridor or road network can affect regional connectivity and emergency access.
- Across the county, high winds and extreme weather pose risks to bridges, road networks and overhead power infrastructure. Tree falls during storms can damage transport routes and energy infrastructure causing service interruptions and limiting emergency response capability.

These cascading failures demonstrate how climate hazards can affect multiple critical systems simultaneously, particularly where infrastructure is co-located within river valleys or floodplains.

12: Risks to infrastructure services from river, surface water and groundwater flooding

Flooding from rivers and intense rainfall represents a major risk to infrastructure services.

Several locations have been identified as particularly vulnerable:

- Carmarthen has been identified as a priority area for surface water flooding, where intense rainfall can overwhelm drainage systems and block roads. Surface water flooding is particularly disruptive in urban areas where drainage capacity is limited. The council estimates over 12,600 addresses are at risk of flooding in Carmarthenshire,⁴⁵ indicating significant exposure of communities and associated service assets.
- The Heart of Wales railway line runs alongside river systems through parts of the county and is vulnerable to flooding during periods of sustained rainfall. Flooding can cause track damage, landslips and service interruptions.
- Flooding of roads and local infrastructure during extreme rainfall events can disrupt access to rural communities, businesses and emergency services.

Carmarthenshire is relatively rural with low population density, and key towns



Flooding and debris blocking bridge in Brownnydd, Carmarthen

⁴⁴ Natural Resources Wales. 2023. Improvements made to Abergwili flood defence gates to alleviate secondary flooding. <https://naturalresourceswales.gov.uk/about-us/news-and-blogs/news/improvements-made-to-abergwili-flood-defence-gates-to-alleviate-secondary-flooding/>.

⁴⁵ Carmarthenshire County Council. February 2024. Carmarthenshire County Council's Local Flood Risk Management Strategy 2024-2030: A strategy for the management of flood risk across Carmarthenshire. <https://www.carmarthenshire.gov.wales/media/53cl50yc/carmarthenshire-county-council-s-local-flood-risk-management-strategy.pdf>.

(Carmarthen, Ammanford, Llanelli) serve wider areas, so disruptions to main corridors can have wide impacts on access and services.⁴⁶

- Carmarthenshire County Council's Local Flood Risk Management Strategy 2024-2030 identifies surface water flooding, groundwater flooding and flooding from ordinary watercourses as key local sources of risk, alongside the interactions between drainage capacity, infrastructure vulnerability and climate change. This provides an important local framework for understanding flood risk beyond main rivers and the coast, and reinforces the need for coordinated management by the local authority and partner organisations..

112: Risks to transport from high and low temperatures, high winds, lightning

Transport infrastructure in Carmarthenshire is exposed to a range of weather-related hazards.

Key vulnerabilities include:

- Storm damage and high winds, which can cause fallen trees and debris to block roads and damage transport infrastructure;
- Flooding of key transport routes, particularly those running through river valleys or low-lying areas;
- Transport related disruption from snow and ice;
- Heat-related stresses on infrastructure such as rail lines and road surfaces, which may become more significant as temperatures rise.

Given the county's rural geography, transport disruptions can have disproportionate impacts on access to services, employment and emergency response, particularly in more remote communities.

N1: Risks to terrestrial, freshwater, and coastal species and habitats from changing climatic conditions and extreme events

Climate change is expected to affect terrestrial ecosystems across Carmarthenshire. Evidence from NRW,⁴⁷ ⁴⁸ Mid Wales and local flood risk management plans indicates rising climate pressures.

Potential impacts include:

- Shifts in species distributions;
- Changes in habitat suitability;
- Increased pressure on freshwater and floodplain ecosystems.

Freshwater and floodplain habitats may be affected by altered flow regimes, sediment transport and water quality changes during heavy rainfall events, while coastal habitats such as saltmarshes and mudflats face additional pressures linked to sea-level rise, erosion and coastal squeeze.

These changes have implications for biodiversity conservation as well as ecosystem services such as flood regulation, carbon storage and water purification.



Saltmarsh Teifi Estuary (Copyright NRW)

H3: Risks to people, communities and buildings from coastal and surface flooding

⁴⁶ Carmarthenshire County Council. 2017. Revised Carmarthenshire Local Development Plan 2018-2033. <https://www.carmarthenshire.gov.wales/media/1216121/ldp-summary-introduction-english-final.pdf>.

⁴⁷ Interview's undertaken by NRW between August 2025 - January 2026.

⁴⁸ Natural Resources Wales. 2025. State of Natural Resources Report 2025. <https://cdn.cyfoethnaturiol.cymru/f45ehjei/sonarr2025-final-report.pdf>.

Flooding represents the most significant climate risk affecting communities in Carmarthenshire.

Several communities have experienced recent flooding events:

- Abergwili has experienced repeated flooding affecting homes and community spaces. In the first few months of 2026, houses on the flood plain have flooded multiple times and the recreation field has flooded during recent events, affecting local activities and community cohesion.
- Floodplains in the area are also associated with historic mining contamination, meaning that floodwaters may mobilise heavy metals such as lead. This raises additional environmental and public health concerns.
- Whitland has experienced significant flooding, including an incident in November 2025 where a retirement housing complex had to be evacuated and 48 residents rescued.⁴⁹ The vulnerability of older residents increases the potential health and social impacts of flooding.
- Cynwyl Elfed has experienced heavy rainfall and flooding affecting homes, farms and local businesses.
- Rhandirmwyn has recurring flood exposure linked to catchment pressures and river flows.
- Llansteffan and areas around Carmarthen also face ongoing flood risk due to their location near rivers and coastal systems.

Flood risk is therefore not only an infrastructure issue but also a social vulnerability challenge, particularly where ageing populations, rural isolation and housing location increase exposure.

H4: Risks to people, communities and buildings from sea level rise

Sea-level rise presents a long-term risk to coastal communities and infrastructure along Carmarthenshire's coastline.

Scientific projections suggest that sea levels around the Welsh coast could rise by between approximately 0.97 and 1.47 meters by 2120, increasing flood risk and accelerating coastal change.

The UKCP18 calculates a mean sea level rise (meters) by 2100 of 0.83 to 1.09 meters (from the 1981-2000 baseline) and 1.08 to 1.45 meters sea level rise in Carmarthenshire by 2120.⁵⁰ Coastal adaptation in Carmarthenshire is guided by the West of Wales Shoreline Management Plan (SMP2), which divides the coastline into a series of short 'policy units'. For each unit, a preferred policy approach is identified across three epochs: 0-20 years, 20-50 years, and 50-100 years. The four policy options are: No Active Intervention, where no investment is made in new or existing defences; Hold the Line, where defences are maintained or upgraded broadly along the current alignment; Managed Realignment, where defences are allowed to move landward to create a more sustainable long-term response; and Advance the Line, where new defences are constructed further seaward. These policies provide an important strategic framework for long-term coastal planning, although they do not specify the precise design or standard of protection of individual schemes.

In practice, this means that coastal risk management in Carmarthenshire needs to be understood not only in terms of current exposure, but also in relation to the changing management approach proposed for different stretches of coastline over time.

Climate change is expected to lead to:

- Increased coastal flooding;

⁴⁹ Ellie Gosley. November 2025. Major incident declared as retirement home evacuated due to flooding. <https://www.walesonline.co.uk/news/wales-news/major-incident-declared-retirement-home-32815288>.

⁵⁰ Natural Resources Wales on behalf of the Welsh Government. August 2022. Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales. https://www.gov.wales/sites/default/files/publications/2022-11/guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales_0.pdf.

- Pressure on coastal defence infrastructure;
- Loss of coastal habitats through coastal squeeze.

Within Carmarthenshire:

- Bynea, a low-lying coastal settlement, faces increasing exposure to flooding and coastal change. These pressures could affect housing, local services and economic activity.
- With around 90km of coastline, Carmarthenshire faces increasing coastal flooding and erosion pressures and storm surges. This combined with fluvial flooding through tide-locking at river mouths increases the coastal/estuarine community exposure risk.⁵¹
- NRW can provide local estimates of predicted future habitat loss due to coastal squeeze on request.

Coastal ecosystems such as saltmarsh and intertidal habitats may also be affected by sea-level rise and coastal squeeze, which occurs when habitats are unable to migrate inland due to existing development or infrastructure.

H10: Risks to health from water quality and household water supply

Changes in rainfall patterns and river flows pose risks to water quality and water supply.

The River Tywi catchment is particularly sensitive to climatic changes. Reduced river flows during dry periods can increase pollutant concentrations and reduce water quality, while heavy rainfall events can overwhelm treatment systems and transport contaminants into waterways. Water quality and algae levels are also already affected by temperature changes and sunlight.⁵²

These pressures can affect:

- Drinking water supply;
- Agricultural water use;
- River ecosystem health.

Maintaining water quality will therefore require integrated catchment management and adaptation planning, particularly in recognition of Carmarthenshire's larger population.

Specific gaps in evidence

While significant evidence exists regarding flood hazards and coastal change, several gaps remain in understanding the full impacts of climate change in Carmarthenshire. Key gaps include:

- Limited understanding of community-level lived experience of climate impacts, particularly repeated flooding events;
- Insufficient evidence on interdependencies between hazards, such as storms combining heavy rainfall, wind and tidal flooding;
- Limited data on social vulnerability and unequal impacts across communities, including the effects on older populations and rural areas;
- Need for improved understanding of ecosystem resilience and nature-based solutions, including how habitat restoration may support climate adaptation.

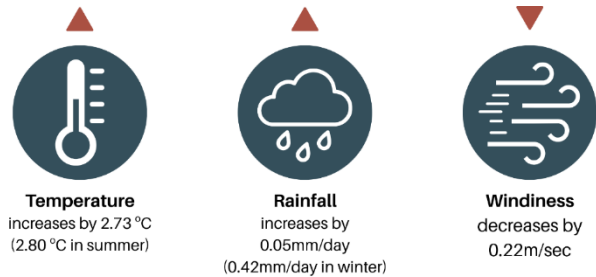
Addressing these gaps will support more targeted adaptation planning and strengthen the evidence base for future Public Services Board climate strategies.

⁵¹ Carmarthenshire County Council. August 2024. Carmarthenshire County Council Flood Risk Management and Coastal Adaption Local Strategy 2024-2030. <https://www.carmarthenshire.gov.wales/media/pv0bdgys/ccf-flood-risk-management-and-coastal-adaption-local-strategy-2024-2030.pdf>.

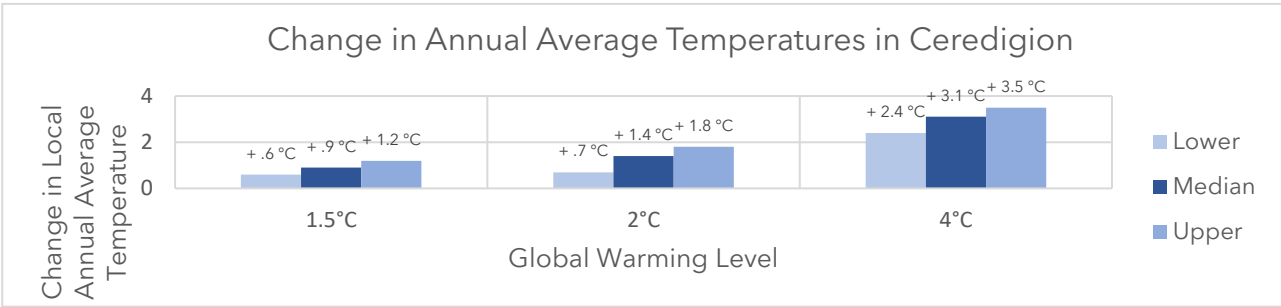
⁵² Elkanah Evans. June 2023. Carmarthenshire Council keen to re-open North Dock, Llanelli. <https://www.carmarthenshirenewsonline.com/carmarthenshire-county-council/carmarthenshire-council-keen-to-re-open-north-dock-llanelli/www.carmarthenshirenewsonline.com/carmarthenshire-news/carmarthenshire-council-keen-to-re-open-north-dock-llanelli/>.

Distinctive exposure

In Ceredigion, under current agreed global climate policies (equivalent to global warming level of 2.0-3.7°C which is RCP 6.0), the yearly average climate for 2070 (compared with local records for the 1980s) is expected to see temperatures increase by 2.73°C (2.80°C in summer), annual average rainfall increase by 0.05mm/day (0.42mm/day increase in winter and a 0.29mm/day decrease in summer) and annual windiness decrease by 0.22 m/sec.⁵³ Under the same existing global policies, average annual temperature in 2030 is expected to be 10.55°C, 10.95°C in 2050, and 11.68°C in 2070 (compared to 8.95°C in 1980).



The chart below shows the increase in local average temperatures, relative to 1981-2000 when the local annual average temperature was 8.8°C. Projected temperature increases in Ceredigion closely follow global warming trajectories, with relatively moderate changes at 1.5-2°C but sharply higher increases under a 4°C scenario. This illustrates how global emissions pathways directly shape local climate conditions, with higher warming levels leading to more extreme and potentially disruptive impacts for communities, infrastructure, and ecosystems.⁵⁴



Source: Miller Research, <https://www.arcgis.com/apps/dashboards/506ff7d53c884badb0d8fd36d6280a91>.

Ceredigion has a distinctive climate risk profile shaped by its coastal geography, river catchments, rural infrastructure and ecologically sensitive landscapes. The county extends across approximate 1,900 km², with a predominantly rural landscape consisting of agricultural land, uplands and moorland, alongside more than 90 km of coastline along Cardigan Bay. The area contains several important river systems, including the Teifi, Rheidol, Ystwyth, Aeron and Clarach, many of which drain upland catchments before reaching the coast through estuaries and low-lying settlements.

This geography creates a number of distinctive climate exposures. Coastal settlements such as Aberystwyth, Borth and Cardigan face combined risks from sea level rise, storm surges and tidal flooding, while inland and river corridor communities such as Llandysul, Newcastle Emlyn (specifically the Adpar region, which falls within Ceredigion), Tregaron, and Lampeter are more exposed to fluvial flooding, surface water flooding and hydrological variability. Some communities are particularly vulnerable where rivers meet the coast, where transport and settlement patterns follow narrow valley corridors, or where settlements are located on narrow coastal strips or estuarine floodplains.

Ceredigion’s infrastructure networks are relatively limited and spatially concentrated, which increases vulnerability to disruption. Transport connectivity relies heavily on a small number of road corridors and the Cambrian railway line, which provides the primary east-west rail link

⁵³ Local Climate Adaptation Tool. 2026. Carmarthenshire. <https://lcat.uk/>.
⁵⁴ Met Office. 2026. Local Authority Climate Explorer [Beta, v2.01].
<https://www.arcgis.com/apps/dashboards/506ff7d53c884badb0d8fd36d6280a91>.

connecting the county to the wider UK network. Disruption to these networks during extreme weather events can have cascading effects across communities and services. For example, in recent years Ceredigion has experienced several cold spells, bringing snow and ice. These conditions have impacted the ability of isolated communities and individuals to access support as a result of transport and communications infrastructure disruption.

The county also contains a high concentration of environmentally designated landscapes and habitats, including Special Areas of Conservation, Sites of Special Scientific Interest and National Nature Reserves. Sensitive ecosystems such as peatlands, coastal wetlands and river habitats are particularly exposed to changing temperatures, altered rainfall patterns and hydrological change.

Workshop discussions emphasised the importance of river corridor systems, particularly along the Teifi, where hydrological change, flooding, runoff and water quality pressures interact to affect both ecosystems and communities. This was a recurring theme across discussion of Cardigan, Llandysul, and other settlements influenced by the Teifi system.

Together, these factors mean that climate risks in Ceredigion often arise through the interaction between coastal change, river systems, infrastructure vulnerability and ecological sensitivity, rather than from a single hazard alone.

High-priority local risks

11: Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures

Ceredigion's infrastructure networks are spatially concentrated and constrained meaning that disruptions caused by extreme weather can lead to cascading impacts across transport, services, and communities.

Aberystwyth illustrates this risk particularly clearly. The town is located between Cardigan Bay and the confluence of the rivers Rheidol and Ystwyth, creating combined coastal and fluvial flood exposure which can affect roads, utilities and public services within the town. As a major regional service centre, including the location of Bronglais Hospital, disruptions to transport infrastructure can have wider social consequences. For example, road closures or flooding may prevent people from accessing healthcare appointments and other essential services.

Coastal processes place pressure on infrastructure in Aberystwyth, including erosion on the spit and flooding risks along the seafront. Work is currently underway to strengthen the local evidence base and improve preparedness, including enhancements to the hydrometric monitoring network in Aberystwyth, Borth and Dol-y-Bont, improvements to flood warning services, and feasibility assessments to reduce flood risk.⁵⁵ Funding has also been allocated for the Aberystwyth Coastal Defence Business Justification Case and Detailed Design.⁵⁶

Transport infrastructure is another key source of cascading risk. The Cambrian railway line is a critical transport corridor linking Aberystwyth and Borth to Shrewsbury and the wider UK rail network.⁵⁷ Sections of the line run close to estuaries and coastal environments, increasing exposure to flooding, high winds and erosion. Some infrastructure along the line, including bridges and viaduct structures such as those near Dyfi Junction, may be vulnerable to rising water levels and storm impacts. At certain locations trains must already reduce speeds to 10mph due to environmental exposure, with potential for track to be exposed to extreme events.

Inland service centres such as Lampeter and Llandysul also experience disruption where flooding affects roads, local access, town-centre infrastructure, and essential services. Cardigan

⁵⁵ Natural Resources Wales. 2023. Natural Resources Wales Flood Risk Management Plan: Mid Wales Place. <https://cdn.cyfoethnaturiol.cymru/3hwgt4vp/frmp-cycle-2-place-section-mid.pdf>.

⁵⁶ Welsh Government. March 2025. Flood and Coastal Erosion Risk Management Programme 2025 to 2026. <https://www.gov.wales/flood-and-coastal-erosion-risk-management-programme-2025-2026.html>.

⁵⁷ Welsh Government. January 2012. Regional and Local Economic Impacts of Rail Investments. <https://www.gov.wales/sites/default/files/statistics-and-research/2018-12/120130railreporten.pdf>.

is similarly vulnerable where transport links, utilities, and access routes are influenced by Teifi flood conditions and tidal interactions.

Ceredigion has a set of key rail stations and an integrated bus-rail network, including the Cambrian Main Line and interchange at Aberystwyth, Machynlleth, and Bow Street. Disruption to the railway line or strategic road network would have significant implications for regional connectivity, tourism and freight movement. As Ceredigion lies towards the end of major supply routes, disruptions can also affect the movement of goods, including food supply chains.

More widely, local infrastructure has already experienced disruption during severe weather events. For example, Storm Darragh caused widespread impacts across the county, including temporary electricity disruption to Ysgol Rhos Helyg in Bronant and road closures on routes such as the A44, A475 and A484.⁵⁸ Flooding also regularly affects low-lying areas such as supermarket car parks in Lampeter and Llandysul, illustrating the everyday infrastructure challenges associated with increased rainfall intensity.

12: Risks to infrastructure services from river, surface water and groundwater flooding

Flooding represents one of the most significant climate risks affecting infrastructure services across Ceredigion. Both coastal and inland communities are exposed to river flooding, surface water flooding and groundwater pressures, which can disrupt transport networks, damage infrastructure and restrict access to services.

The town of Cardigan is particularly exposed due to its position on the River Teifi, where river flooding combined with tidal influences can inundate roads and bridges. These events can restrict movement within and beyond the town and disrupt essential services. The Teifi river corridor was repeatedly highlighted through stakeholder discussion as a key climate risk zone within Ceredigion. Settlements along this corridor, including Cardigan, Llandysul and the Adpar region of Newcastle Emlyn, are exposed not only to river flooding itself but to the wider effects of runoff, erosion, access disruption and water quality pressures moving through the catchment. This reinforces the importance of understanding infrastructure risk in Ceredigion through a catchment-scale lens.

Across the county more broadly, recent weather patterns have highlighted the growing pressure on infrastructure systems, with stakeholders reporting extended periods of storm activity and repeated flooding events during early 2026. These events increase pressure on drainage systems, transport networks and public infrastructure, suggesting that the severity and frequency of extreme weather events may already be increasing.

112: Risks to transport from high and low temperatures, high winds, lightning

Transport networks across Ceredigion are particularly sensitive to extreme weather due to the county's rural geography, coastal exposure and limited transport corridors.

High winds, heavy rainfall and storm events can lead to fallen trees, flooding and damage to infrastructure across the road network. These hazards have already caused disruption to both rail and road transport in recent years. For example, in December 2024 Storm Darragh brought high winds and heavy rainfall, causing roads to flood, fallen trees to block transport routes and power outages, with significant impacts on rural communities. Coastal sections of transport infrastructure are also exposed to saltwater corrosion, erosion and wave action.

Rail infrastructure along the Cambrian line is particularly exposed to weather extremes. Storm events can affect track stability and infrastructure resilience, while coastal exposure increases vulnerability to erosion and flooding. More intense storms could potentially damage or wash away sections of track, while strong winds and heat-related stresses may disrupt operations.

⁵⁸ Ceredigion County Council. December 2024. The latest on Storm Darragh in Ceredigion.
<https://www.ceredigion.gov.uk/resident/news/2024/the-latest-on-storm-darragh-in-ceredigion/>.

Workshop feedback also highlighted the vulnerability of inland road corridors serving communities such as Lampeter, Llandysul and Cardigan, where road closures, drainage exceedance, snow and ice conditions and localised landslip or debris events can reduce access to services and isolate communities. Given the limited number of major transport routes serving the county, disruptions can quickly isolate communities and affect access to employment, services and supply chains.

N1: Risks to terrestrial, freshwater, and coastal species and habitats from changing climatic conditions and extreme events

Climate change also poses significant risks to Ceredigion's terrestrial ecosystems and biodiversity, particularly within sensitive habitats that depend on stable hydrological and climatic conditions.

One of the most significant examples is Cors Fochno (Borth Bog), part of the Dyfi National Nature Reserve. This internationally important peatland supports a range of specialist species and habitat types that depend on stable groundwater levels and temperature regimes. Changes in rainfall patterns, temperature and hydrological conditions could degrade these habitats and threaten species that cannot easily relocate or adapt.

However, ecological climate risk in Ceredigion is broader than peatland alone. Freshwater habitats and river corridor systems, particularly along the Teifi, were repeatedly highlighted in workshop discussions. Changes in flow regimes, erosion, runoff, sedimentation and water quality may affect riverine and floodplain habitats, as well as species dependent on these systems. Coastal habitats, including dunes, saltmarsh and estuarine margins, also face pressures associated with coastal squeeze, erosion and sea-level rise.



Cors Fochno, Ceredigion (Copyright NRW)

Peatland ecosystems are particularly important in the context of climate change because of their role in long-term carbon storage. Globally, peatlands store extremely large quantities of carbon, approximately double that of all the world's forests combined, meaning that their degradation could release stored carbon and further exacerbate climate change.⁵⁹

H3: Risks to people, communities and buildings from coastal and surface flooding

Flooding represents a major direct risk to communities, housing and local infrastructure across Ceredigion.

Coastal communities such as Borth are particularly vulnerable due to their low-lying position along Cardigan Bay. Even with the presence of coastal defences, the community remains exposed to tidal flooding and storm surges. In regional flood risk planning, Borth and Aberystwyth are identified as the two communities most at risk of flooding in Ceredigion.⁶⁰

Flooding also affects inland communities and infrastructure, particularly during intense rainfall events that overwhelm drainage systems and increase river flows.

⁵⁹ Guy Schurgers and Kristian Bjørn-Hansen. February 2024. World Wetlands Day: Bogs hold an important key to the climate crisis. <https://science.ku.dk/english/press/news/2024/world-wetlands-day-bogs-hold-an-important-key-to-the-climate-crisis/>.

⁶⁰ Natural Resources Wales. 2023. Natural Resources Wales Flood Risk Management Plan: Mid Wales Place. <https://cdn.cyfoethnaturiol.cymru/3hwgt4vp/frmp-cycle-2-place-section-mid.pdf>.

H4: Risks to people, communities and buildings from sea level rise

Long-term sea level rise and coastal erosion pose significant risks to the future viability of some coastal communities in Ceredigion.

Future sea-level rise is expected to increase these risks. Projections from UKCP18 indicate that mean sea level around the Welsh coast could rise by approximately 0.8–1.07 meters (from the 1981–2000 baseline) by 2100, with further increases projected by the early twenty-second century.⁶¹ By the 2080s, sea level rise could reach 86cm above 1990 levels in a high-impact future scenario, or 43cm in a central future scenario.⁶² Rising sea levels will increase the frequency and severity of coastal flooding events and place greater pressure on existing coastal defences.

Low-lying settlements such as Clarach Bay are exposed to increasing tidal flooding and coastal change. More broadly, communities around the Dyfi estuary and the Borth area face long-term challenges associated with rising sea levels and coastal processes.

Over time, sea-level rise may increase the costs and complexity of maintaining coastal defences. In some locations, projections suggest that parts of the coastline may become increasingly difficult to defend, raising questions about long-term adaptation pathways. In extreme scenarios, areas such as Borth and Ynyslas could face significant challenges to long-term habitability if sea levels continue to rise and coastal processes intensify.⁶³

The existing response to this risk lies in active monitoring and funded scheme delivery. For example, the £32m Aberaeron Coastal Defence Scheme. However, long-term viability still depends on strategic planning and community-supported pathways for managed change beyond scheme-by-scheme defence.

H10: Risks to health from water quality and household water supply

Climate change is also expected to place increasing pressure on water quality and freshwater systems across Ceredigion.

The River Teifi catchment is particularly sensitive to these pressures. Increased rainfall intensity and flooding can lead to higher levels of agricultural runoff and nutrient loading, which may degrade river ecosystems and affect water quality. At the same time, extreme weather events can overwhelm wastewater infrastructure and treatment systems, increasing the risk of contamination.

These pressures may affect the availability and safety of drinking water supplies, as well as the ecological health of rivers and estuaries.

Specific gaps in evidence

While there is a substantial evidence base on flooding and coastal processes affecting Ceredigion, several gaps remain in understanding the full implications of climate change at the local level.

One gap relates to the understanding of cascading infrastructure risks. Although individual hazards such as flooding or coastal erosion are relatively well documented, less evidence exists on

⁶¹ Natural Resources Wales on behalf of the Welsh Government. August 2022. Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales.

https://www.gov.wales/sites/default/files/publications/2022-11/guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales_0.pdf.

⁶² Met Office. March 2026. Climate Report for Ceredigion. <https://www.reports.esriuk.com/view-report/b8eb3cee8f764147a2cfd69cf36238f/W06000008>.

⁶³ Felix Nobes. November 2022. Borth and Ynyslas will be lost to the sea in decades, experts fear. <https://www.cambrian-news.co.uk/news/environment/borth-and-ynyslas-will-be-lost-to-the-sea-in-decades-experts-fear-572371>.

how disruptions to transport, electricity, and communication systems may interact to affect essential services and community resilience across the county.

There are limitations in the evidence relating to the long-term viability of coastal communities, particularly in areas where sea level rise may eventually exceed the capacity of existing coastal defences. While shoreline management planning provides strategic guidance for coastal adaptation, further work is needed to better understand the social, economic, and cultural implications of long-term change for coastal settlements.

Another evidence gap concerns ecological responses to climate change, particularly within sensitive habitats such as peatlands, river systems, and estuarine environments. While individual studies exist, for example on fisheries or habitat conditions, there is limited integrated evidence on how climate change may affect ecosystem functioning and biodiversity across the county as a whole.

There is a need for improved understanding of community-level vulnerability and lived experience of climate impacts, particularly in rural and coastal communities that may experience repeated flooding or infrastructure disruption. Strengthening the evidence in this area would support more targeted adaptation planning and help ensuring that responses reflect the realities faced by local communities.

Addressing these gaps will require continued collaboration between PSB partners and voluntary members to strengthen the evidence base and support effective long-term climate adaptation planning in Ceredigion.

5. Gaps, capacity and collaboration

Existing responses and current foundations

Across Carmarthenshire and Ceredigion, a wide range of organisations are already engaged in responding to climate risks through emergency planning, environmental management, infrastructure investment, and community resilience activity. These responses form a firm foundation for strengthening adaptation and resilience across the PSB.

Key elements of the existing response include:

Emergency preparedness and response coordination

- The Mid and West Wales Fire and Rescue Service area multi-agency arrangements support coordination between emergency responders and local authorities, particularly in relation to flooding and severe weather incidents. Within the region, nearly 31,000 properties are identified as being at risk of flooding, highlighting the scale of ongoing preparedness activity.⁶⁴
- Local Resilience Forums (LRFs) bring together statutory responder organisations under the Civil Contingencies Act to coordinate emergency planning and response arrangements. These forums (Dyfed-Powys LRF) support operational responses to severe weather events and wider incidents affecting communities.⁶⁵ There is an opportunity to strengthen links between LRF structures and PSB-led adaptation planning, helping connect emergency response with longer-term resilience and prevention
- NRW has a free flood warning service that covers main rivers and the sea, but workshop attendees highlighted that it does not cover all types of flooding.
- Local authorities have established structured emergency management arrangements, including Gold and Silver command frameworks and routine multi-agency situational awareness meetings. These structures support coordination across departments and partner agencies during periods of severe weather.
- Local authorities, in their role as Lead Local Flood Authorities (LLFAs), are also central to the management of local flood risk from surface water, groundwater and ordinary watercourses, and therefore play an important role in linking emergency response, local flood investigation, and longer-term adaptation planning.
- Stakeholders also highlighted ongoing efforts to strengthen emergency response capability through multi-agency training programmes, enabling a wider range of staff to access operational, tactical and strategic command training.

Climate adaptation planning and risk assessment

- Natural Resources Wales' Climate Change Adaptation Plan (2023-2027) sets out more than 50 actions aimed at improving resilience across the organisation, the natural environment and communities. Priority themes include strengthening climate resilience in planning and communities, protecting nature sites, improving ecosystem condition, and managing climate risks across regulated sectors.⁶⁶

Flood and coastal risk management

- Local authorities and NRW jointly deliver a range of flood risk management activities, including:

⁶⁴ Mid and West Wales Fire and Rescue Service. 2026. Flooding Advice. <https://www.mawwfire.gov.uk/eng/your-safety/your-community-and-events/flooding-advice/>.

⁶⁵ Welsh Government. May 2025. Local Resilience Forums. <https://www.gov.wales/local-resilience-forums>.

⁶⁶ Natural Resources Wales (H. James, C. Walmsley, S. Waterhouse, L. Watts). 2023. Climate Change Adaptation Plan 2023-2027. <https://nrwcmsv13-a3hwekacajb3frbw.a02.azurefd.net/pvzladru/climate-change-adaptation-plan-2023-2027-2.pdf>.

- Shoreline Management Plans;
 - Flood Risk Management Plans;
 - Coastal defence schemes;
 - Catchment and watercourse management programmes;
 - Local Flood Risk Management Strategies led by local authorities in their role as Lead Local Flood Authorities.
- Both Ceredigion⁶⁷ and Carmarthenshire⁶⁸ County Councils maintains a Flood Defence and Coastal Protection Team responsible for managing flood risks from surface water and small watercourses across the county, with flood defence schemes aiming to mitigate the impacts of flooding for as many residents and businesses as possible.
 - Ceredigion County Council, as the Lead Local Flood Authority, delivers flood risk management through coastal monitoring, flood investigations, shoreline management planning and watercourse maintenance.⁶⁹
 - Ceredigion is delivering a major £32million flood defence scheme in Aberaeron, designed for a 1 in 200-year event with a 100-year design life, and protecting 135 residential and 42 non-residential properties.⁷⁰
 - Major coastal adaptation initiatives such as the Borth-Ynyshir Coastal Adaptation Project demonstrate joint working between NRW and local authorities to address long-term sea-level rise risks.
 - Within Shoreline Management Plans, different policy approaches such as Hold the Line, Managed Realignment and No Active Intervention provide an important strategic framework for considering how different sections of coastline may need to be managed over time as climate risks intensify.

Nature-based adaptation and catchment restoration

- A number of programmes are already delivering nature-based climate adaptation approaches across the region:
- The Four Rivers for LIFE project, restoring major river systems including the Teifi, Tywi, Usk and Cleddau, focuses on improving ecological condition while increasing flood resilience and catchment stability. All four rivers are Special Areas of Conservation due to their special importance for wildlife and plants, such as Atlantic salmon, lamprey, shad, otter, and water crowfoot. They also support habitats such as floodplains and bogs.⁷¹
- Peatland restoration programmes, including LIFE Welsh Raised Bogs and the National Peatland Action Programme, are restoring degraded peatlands to increase carbon storage, improve hydrology and reduce wildfire risk.
- Local Nature Partnership members also provide an important foundation for nature-based adaptation activity, supporting habitat restoration, ecological resilience, biodiversity planning, and collaborative approaches to land and catchment management across both counties.⁷²
- Local initiatives such as community-led flood management and catchment restoration activities (e.g. tree planting, woody debris, riparian buffers) are helping slow river flows and reduce downstream flood impacts.

⁶⁷ Ceredigion County Council. 2026. Coastal Defence. <https://www.ceredigion.gov.uk/resident/coast-countryside/coast-and-flood-risk-management/coastal-defence/>

⁶⁸ Carmarthenshire County Council. 2026. Flood Defence Schemes. <https://www.carmarthenshire.gov.wales/council-services/emergencies-and-community-safety/flooding/flood-defence-schemes/>.

⁶⁹ Ceredigion County Council. 2026. Local Flood Risk Management. [https://www.ceredigion.gov.uk/resident/coast-countryside/coast-and-flood-risk-management/local-flood-risk-management/#:~:text=The%20Flood%20and%20Water%20Management%20Act%202010%20provides%20a%20definition,the%20Lead%20Local%20Flood%20Authority\).](https://www.ceredigion.gov.uk/resident/coast-countryside/coast-and-flood-risk-management/local-flood-risk-management/#:~:text=The%20Flood%20and%20Water%20Management%20Act%202010%20provides%20a%20definition,the%20Lead%20Local%20Flood%20Authority).)

⁷⁰ Ceredigion County Council. April 2024. Newsletter: Reducing flood risk in Aberaeron together. <https://www.ceredigion.gov.uk/media/zxcoendc/aberaeron-coastal-defence-scheme-newsletter-april-2024.pdf>.

⁷¹ Natural Resources Wales. May 2024. Four Rivers for LIFE. <https://naturalresources.wales/about-us/what-we-do/our-projects/our-nature-projects/4-rivers-for-life/?lang=en>.

⁷² Local Nature Partnerships Cymru. 2026. What is the LNP Cymru Scheme. <https://lnp.cymru/About-Us>.

- NRW's Marine Area Statement also offers information on improving public understanding of nature-based solutions, improving access to information and guidance, and support for Shoreline Management Plans.⁷³

Community resilience and local response networks

Local communities play an important role in responding to climate impacts:

- Community flood groups across settlements such as Borth, Talybont and Cardigan support local preparedness and response.
- Volunteer organisations, farmers, angling clubs and community hubs frequently support emergency response activities such as clearing debris, supporting vulnerable residents and monitoring environmental conditions.

Town and Community Councils, including through representation within PSB structures via One Voice Wales, were identified as important local partners for strengthening community resilience. Their close links to local communities may enable more effective communication of risks, early warning, local preparedness activity and coordination of volunteer support during extreme weather events.

Strategic planning and energy system transformation

The National Energy System Operator's Regional Energy Strategic Plans aim to support planning for energy infrastructure development aligned with net zero and climate resilience objectives by offering independent advice.⁷⁴ The South West Wales Energy Strategy aims to provide a strategic pathway identifying key interventions to deliver on the region's ambitions for decarbonising its energy system.

These plans aim to ensure communities have access to reliable, affordable and low-carbon energy systems while supporting regional growth.

Water and wastewater infrastructure resilience

Dŵr Cymru / Welsh Water also plays an important role in managing climate risks relating to wastewater systems, storm overflows, drainage infrastructure and water service resilience.

Ongoing investment, including major work in Cardigan and wider programmes across communities in Ceredigion, highlights the importance of water and wastewater infrastructure providers within the broader adaptation landscape.

These investments are particularly relevant where heavy rainfall, flooding and water quality pressures intersect, and where infrastructure resilience has implications for public health, environmental quality and community confidence.

Recovery Support

In Carmarthenshire, the council offered grants to those affected by floods. A hardship emergency fund was set up for residents and businesses affected by internal flooding.⁷⁵ Households that were internally flooded could apply for a £500 payment, and a further £1000 was available for householders without insurance.⁷⁶

Organisational and collective gaps

⁷³ Natural Resources Wales. 2026. Marine Area Statement: Nature-based solutions and adaption at the coast. <https://naturalresources.wales/about-us/what-we-do/strategies-plans-and-policies/area-statements/marine-area-statement/nature-based-solutions-and-adaptation-at-the-coast/?lang=en>.

⁷⁴ National Energy System Operator. 2026. What we do. <https://www.neso.energy/what-we-do>.

⁷⁵ Carmarthenshire County Council. December 2025. Flooding. <https://www.carmarthenshire.gov.wales/council-services/emergencies-and-community-safety/flooding/>.

⁷⁶ Carmarthenshire County Council. November 2025. Flooding recovery update. <https://carmscouncil-newsroom.prgloo.com/news/carmarthenshire-county-council-flooding-recovery-update>.

Despite the strong foundation of activity described above, stakeholders identified a range of organisational and systemic gaps that limit the region's ability to respond effectively to climate risks.

Reactive rather than proactive responses

Much of the current system remains event-driven, with resources mobilised primarily after extreme weather events occur.

While emergency funds and support mechanisms are available following incidents such as flooding, proactive investment in prevention and resilience is more limited. This can result in:

- Delayed action to address known vulnerabilities;
- Repeated impacts on communities experiencing consecutive storms;
- Insufficient time for recovery between events.

Resource constraints within the public sector

Public sector capacity has declined over the past decade due to funding pressures and workforce reductions.

Local authorities reported:

- Reduced staffing levels;
- Limited technical capacity for long-term planning;
- Competing service pressures limiting time available for climate adaptation work.

This capacity constraint affects both strategic planning and operational response, particularly during periods of multiple simultaneous incidents.

Fragmented information and data sharing

Stakeholders highlighted challenges in accessing and sharing data across organisations.

Key barriers include:

- Different data platforms and systems;
- Limited staff capacity to maintain shared datasets;
- Complexities associated with land ownership and data governance.

Engagement highlighted that awareness of existing flood risk management plans and long-term adaptation strategies remains limited among some stakeholders. Several participants noted that they were not aware of existing flood plans and suggested they would be more likely to take proactive action if they were engaged earlier in discussions around long-term flood risk and adaptation planning. This indicates a need for clearer communication and engagement with communities, private sector organisations and other partners regarding flood risk management strategies, planned interventions and future adaptation pathways.

Improved access to information, particularly regarding vulnerable populations, land ownership, infrastructure assets and environmental conditions, was seen as critical for strengthening risk management.



Damage from storm Darragh 2024 (Copyright NRW)

Coordination challenges across institutions

Although responsibilities for emergency response are relatively clear, climate risks often span organisational boundaries, leading to complexity for both agencies and communities.

Examples include:

- Flood risks involving multiple organisations (NRW, local authorities, water companies and landowners);
- Overlapping responsibilities between Local Resilience Forums and PSBs;
- Public confusion about who to contact when incidents occur.

Strengthening coordination mechanisms between partnerships, particularly between PSBs, LRF structures, LLFAs and key infrastructure providers, could help address these challenges and improve the connection between immediate response, recovery and long-term adaptation planning.

Land management and catchment governance challenges

Effective climate adaptation requires a catchment-wide perspective, particularly for flood management and water resources.

However, delivery is often constrained by:

- Fragmented land ownership;
- Limited incentives for land managers;
- Competing land uses such as agriculture, housing and renewable energy development.

Engaging farmers and landowners more systematically in adaptation approaches such as natural flood management was identified as a priority. Local Nature Partnerships, land managers, river interests, and environmental organisations all have an important role in supporting more integrated catchment-scale responses.

Joint working opportunities

Stakeholders highlighted a number of opportunities to strengthen collaboration and develop more integrated responses to climate risks. However, consideration should be given to current restraints on resources and capacity for delivering additional activities. Therefore, prioritisation of such actions/opportunities may be needed, with the ultimate decision being made collectively by the PSB and in relation to available resource. The following opportunities are ordered according to expected resource requirements.

Community-centred adaptation

Communities often hold detailed local knowledge of environmental change and historical flood patterns.

Opportunities include:

- Supporting community flood groups and preparedness networks;
- Enabling Town and Community Councils, including through One Voice Wales representation, to participate more systematically in resilience planning;
- Building stronger links between PSBs and community organisations.

Such approaches can improve awareness, preparedness and local ownership of climate resilience initiatives.

Data sharing and evidence coordination

Improving shared data platforms and information exchange could enable partners to:

- Identify vulnerable communities more effectively;
- Target interventions where they will have the greatest impact;
- Avoid duplication of effort.

Initiatives such as *DataMapWales* provide opportunities to improve interoperability between datasets.

Collaboration with research institutions

Universities and research organisations can provide valuable analytical capacity and technical expertise.

Examples include:

- Partnerships with Aberystwyth University on coastal and catchment research;
- Collaborative projects linked to river restoration and ecological monitoring.

These partnerships can support improved climate modelling, monitoring and evaluation.

Catchment-scale collaboration

Flood risk, water quality and ecosystem resilience require coordination across entire catchments.

Opportunities include:

- Natural flood management interventions across upstream landscapes;
- Coordinated river restoration projects;
- Integrated land management with farmers and landowners.

This could include stronger collaboration between PSB partners, Dŵr Cymru / Welsh Water, landowners, farmers and Local Nature Partnership members, particularly in catchments where flood risk, water quality and habitat resilience are closely linked. Catchment-wide approaches combining multiple small interventions across landscapes can deliver significant cumulative benefits for flood mitigation and drought resilience.

Community resilience pilot projects

Workshop discussions highlighted an opportunity for the PSBs to pilot place-based approaches to climate resilience within selected communities. Pilot projects could involve collaboration between public services, third-sector organisations, local residents and education providers to explore how communities can adapt to increasing climate risks such as flooding, storms and extreme weather.

Such pilots could test practical approaches including community-led resilience planning, local adaptation measures, training and awareness programmes, and improved communication between public services and residents. Engaging higher education institutions and further education providers could support community upskilling, enabling residents to develop practical knowledge on climate adaptation, emergency preparedness and nature-based solutions.

Pilot initiatives would allow PSB partners to test new approaches at a manageable scale, generate practical learning, and identify effective models that could subsequently be scaled up across Carmarthenshire and Ceredigion.

Skills and capacity considerations

Strengthening adaptation capacity across the PSB partnership will require additional capacity within specialist teams. There is likely a need for the development of several key skill areas, including:

- Climate risk analysis and scenario planning;
- Catchment-scale environmental management;
- Community engagement and behavioural change;
- Data analysis and digital mapping;
- Nature-based solutions design and delivery.

In addition, stakeholders highlighted the need for stronger cross-disciplinary expertise, combining environmental science, infrastructure planning, public health and community development. Given existing resource pressures, collaboration with universities, research institutions and third-sector organisations may provide opportunities to supplement capacity.

Education providers and higher education institutions represent a valuable resource in supporting climate resilience. Universities, colleges and training providers can contribute

research expertise, technical knowledge and training programmes that can help communities and local organisations develop the skills required to adapt to climate risks. Strengthening collaboration with the education sector could support community upskilling, student-led research projects and innovation in local adaptation approaches.

Best practice approaches

Several examples of good practice demonstrate effective approaches to climate adaptation that could inform future activity across the region.

Nature-based flood management

Nature-based solutions are increasingly being used to manage flood risks and improve ecosystem resilience.

A notable example is the £13million Pont-y-Felin wetland storm overflow scheme in Newport, where a constructed wetland treats storm overflow water before discharge into rivers. The scheme reduced construction costs significantly compared with traditional engineering solutions, saving around £40million, and avoided over 3,000 tonnes of carbon emissions.⁷⁷

Other local examples include:

- Tree planting and woody debris to slow river flows;
- Peatland restoration to store water and reduce wildfire risk;
- Riparian buffers to improve water quality and reduce runoff.

These approaches deliver multiple benefits for climate adaptation, biodiversity and water management.

Community-led resilience initiatives

Community flood groups and volunteer networks demonstrate the value of local leadership in managing climate risks.

For example, the Talybont flood group has implemented natural flood management measures such as planting over 40,000 trees to create living leaky dams to reduce local flooding.⁷⁸

Such initiatives strengthen local capacity while complementing formal emergency response systems.

Collective strengths

Despite the challenges identified, the PSB partnership and wider regional networks have significant strengths that provide a strong foundation for future adaptation efforts, including:

- Strong operational collaboration between emergency responders;
- Extensive environmental expertise within Natural Resources Wales;
- Active community organisations and volunteer networks;
- Established partnerships across public sector organisations;
- Growing use of nature-based solutions in environmental management.

These strengths create opportunities to build a more integrated and proactive approach to climate resilience.

Areas requiring strengthening

Stakeholders identified several areas where additional focus will be required to improve regional climate resilience. Key priorities include:

- Improving public awareness and preparedness for climate risks;

⁷⁷ Business News Wales. November 2025. £13 Million Nature-Based Wetland Storm Overflow Opens in Torfaen. <https://businessnewswales.com/13-million-nature-based-wetland-storm-overflow-opens-in-torfaen/>.

⁷⁸ Debbie Luxon. January 2026. Welsh flood victims don wellies planting over 40,000 trees to slow the flow. <https://nation.cymru/feature/welsh-flood-victims-don-wellies-planting-40000-trees-to-slow-the-flow/>.

- Strengthening community resilience networks;
- Developing clearer responsibilities and communication pathways between organisations;
- Scaling up nature-based solutions and catchment-wide approaches;
- Improving coordination between emergency response and long-term adaptation planning.
- Strengthening engagement with third-sector organisations, private sector partners and higher education institutions to support community resilience, knowledge exchange and collaborative adaptation initiatives.

In addition, greater attention is needed to ensure that infrastructure, housing and land use planning decisions incorporate climate risk considerations. For example, in Ceredigion, remote sensing and GIS revealed that between 2003 and 2023 there was an urban expansion of approximately 122km². This demonstrates increases in vegetation loss, changes in water availability, increases in the Urban Heat Island effect, and an increase in impermeable surfaces.⁷⁹

Funding opportunities

Several funding streams and opportunities exist to support climate adaptation and resilience activities.

These include:

- Welsh Government climate resilience and flood management programmes⁸⁰ (e.g. Natural Flood Management Grant, Flood and Coastal Erosion Risk Management Grant, Flood and Coastal Erosion Risk Management Capital Works, Revenue and Small Scale Works Grants)
- Peatland restoration and nature-based solutions funding (e.g. Welsh Government's Peatland Restoration Grant⁸¹, Natural Flood Management Fund⁸², and Integrated Natural Resources Scheme⁸³)
- Coastal adaptation and resilience programmes (Welsh Government's Flood and Coastal Erosion Risk Management Grant and Coastal Risk Management Programme⁸⁴, the Coastal Capacity Building Fund⁸⁵ and Natural Resources Wales' Coastal Adaptation Programmes⁸⁶)
- Research partnerships with universities (e.g. Aberystwyth University is currently conducting the 'Transformative Research Actions for Resilient Coastal Communities'⁸⁷ project, exploring ways to respond to coastal challenges and build resilience among affected communities.)

⁷⁹ Younis et al., August 2025. Urbanization and Its Environmental Impact in Ceredigion County, Wales: A 20-Year Remote Sensing and GIS-Based Assessment (2003-2023). doi: [10.3390/s25175332](https://doi.org/10.3390/s25175332).

⁸⁰ Welsh Government, 2025. Flooding and coastal erosion: Guidance and services. <https://www.gov.wales/flooding-coastal-erosion>

⁸¹ Natural Resources Wales, 2025. Current grant opportunities. <https://naturalresources.wales/about-us/grants-and-funding/current-grant-funding-opportunities/?lang=en>

⁸² Welsh Government, 2025. Natural Flood Management. <https://www.gov.wales/natural-flood-management-guidance-undertake-natural-flood-management-works-html>

⁸³ Welsh Government, 2026. Integrated Natural Resources Scheme. <https://www.gov.wales/integrated-natural-resources-scheme>

⁸⁴ Welsh Government, 2025. Flood and Coastal Erosion Risk Management Programme 2025 to 2026. <https://www.gov.wales/flood-and-coastal-erosion-risk-management-programme-2025-2026-html#167913>

⁸⁵ Welsh Government, 2025. Coastal Capacity Building Fund: 2025 to 2027. <https://www.gov.wales/coastal-capacity-building-fund-2025-2027>

⁸⁶ Welsh Government, 2025. Flood and Coastal Erosion Risk Management Programme 2025 to 2026. <https://www.gov.wales/flood-and-coastal-erosion-risk-management-programme-2025-2026-html#167904>

⁸⁷ Aberystwyth University, 2024. New projects to support UK coastal community communities <https://www.aber.ac.uk/en/news/archive/2024/07/title-273357-en.html>

- Grant schemes supporting community resilience and environmental restoration (e.g. The National Lottery Heritage Fund's Nature Networks Fund⁸⁸, Welsh Government's Local Places for Nature Programme Schemes⁸⁹ and the Sustainable Landscapes, Sustainable Places Landscape Fund⁹⁰)

Strengthening collaboration between partners can improve the ability to develop joint funding proposals and deliver larger landscape-scale projects.

Long-term and flexible funding will be essential to support sustained adaptation activity beyond short policy cycles.

⁸⁸ The National Lottery Heritage Fund, 2026. Nature Networks Fund. <https://www.heritagefund.org.uk/funding/nature-networks-fund-round-five>

⁸⁹ Welsh Government, 2024. Local Places for Nature Programme. <https://www.gov.wales/local-places-nature-programme#136822>

⁹⁰ Sustainable Landscapes, Sustainable Places - Landscape Fund. <https://www.gov.wales/sustainable-landscapes-sustainable-places-landscape-fund-grants-allocated-html>

6. Recommendations and next steps

Overview

This Climate Change Risk Assessment highlights that Carmarthenshire and Ceredigion are already experiencing the operational and environmental consequences of climate change. Increasingly intense rainfall events, flooding, severe storms, wildfire risk and periods of drought are affecting infrastructure systems, ecosystems, communities, and public services.

Evidence gathered through stakeholder engagement demonstrates that these risks are no longer theoretical. Flood events are occurring in areas previously considered to be relatively low risk, while extreme weather is placing growing pressure on key service areas including highways maintenance, housing, emergency response, and social care provision. In several instances, climate hazards have produced cascading impacts across public service systems, for example where flooding or landslides disrupt transport networks, limit access to care services and increase pressure on emergency response capacity.

Both Carmarthenshire and Ceredigion already have strong emergency planning arrangements and established partnership structures. However, the increasing frequency and intensity of climate hazards requires a strategic shift from primarily reactive emergency response towards anticipatory adaptation and long-term resilience planning.

PSBs are uniquely positioned to support this shift. Through their cross-sector governance role and statutory responsibility to improve the well-being of communities under the Well-being of Future Generations (Wales) Act, PSBs can provide the strategic coordination required to align public services, infrastructure planning, environmental management, and community resilience.

The recommendations below establish a framework for strengthening climate resilience across both counties. They are organised around five strategic adaptation priorities and supported by a series of practical actions that the Carmarthenshire and Ceredigion PSBs can take forward over the coming years. The recommendations are designed to complement and support existing frameworks including the Natural Resource Wales Flood Risk Management Plan, the West of Wales Shoreline Management Plan, and the corporate strategies of both local authorities. Aligning PSB adaptation activities with these frameworks will help ensure consistency between strategic planning, operational delivery, and long-term coastal and catchment management.

Strategic adaptation priorities

Priority 1: Climate-resilient infrastructure and service continuity

Infrastructure systems and public services represent some of the most exposed assets within Carmarthenshire and Ceredigion. Transport networks, drainage systems, energy infrastructure and public buildings are increasingly affected by flooding, storms and land instability.

Both PSBs should prioritise the integration of climate resilience into infrastructure planning and asset management. Maintenance and investment programmes should account for projected increases in rainfall intensity, storm events and temperature variability.

Particular **attention should be given to ensuring that critical services remain operational during extreme weather events.** Health services, care provision and emergency response functions should review service continuity arrangements to ensure resilience to transport disruption, power outages and infrastructure failures.

Where appropriate, **infrastructure resilience should increasingly incorporate nature-based solutions**, such as sustainable drainage systems and catchment restoration measures, which reduce flood risk while enhancing ecosystem resilience.

Public sector organisations across the PSBs should continuously review operational risk registers, business continuity plans, and service delivery models to ensure that climate risks are systematically considered. This could include:

- Assessing how extreme weather could disrupt staffing, transport access or digital systems;
- Ensuring critical facilities such as hospitals, care homes and emergency service hubs have contingency plans for power loss or flooding;
- Incorporating climate risk scenarios into emergency preparedness exercises;
- Identifying service dependencies on infrastructure systems such as electricity, telecommunications and transport.

Priority 2: Catchment-scale flood and water management

Flooding remains one of the most significant climate risks affecting both counties. Increasingly intense rainfall events are placing pressure on river systems, drainage networks and transport infrastructure, while coastal areas face additional pressures associated with sea-level rise and coastal erosion.

Strengthening **flood resilience will require integrated catchment-scale approaches** that recognise the interconnections between land management, river systems, drainage infrastructure and coastal processes.

PSB partners should work collaboratively with Dŵr Cymru / Welsh Water, landowners, farmers, Local Nature Partnership members and environmental organisations to expand the use of natural flood management approaches, including woodland creation, peatland restoration and wetland management. These interventions can help slow the flow of water through catchments and reduce flood peaks downstream.

Improved maintenance of drainage systems and monitoring of high-risk locations will also remain essential in reducing disruption to infrastructure and communities during extreme rainfall events.

Priority 3: Strengthening community resilience and local preparedness

Building stronger community resilience will be essential in reducing the social and operational impacts of climate change. Rural isolation, ageing populations and reliance on local infrastructure mean that some communities across Carmarthenshire and Ceredigion are particularly vulnerable to extreme weather events.

Both PSBs should prioritise greater engagement with local communities and community organisations to strengthen preparedness and response capacity. This includes working proactively with voluntary organisations, community groups and local networks that can support response efforts during extreme weather events.

Community organisations can play an important role in assisting with communication, supporting vulnerable residents and providing local coordination during emergencies. Developing stronger partnerships with these organisations will help ensure that response systems extend beyond formal emergency services.

Town and Community Councils, including through One Voice Wales representation within PSB structures, should also be engaged more systematically as key partners in resilience planning. Their knowledge of local communities and ability to mobilise local networks can support more effective responses during climate-related incidents.

In addition, both **PSBs should strengthen public education and awareness of climate risks**, helping residents better understand local hazards such as flooding, storms and wildfire risk. Increasing awareness of risk will support communities to prepare for extreme weather events and respond more effectively when they occur.

Priority 4: Strengthening cross-partner collaboration and shared response systems

Climate risks cut across organisational and sectoral boundaries. Effective adaptation therefore requires coordinated action between local authorities, Natural Resources Wales, health services, emergency responders, educational institutions and community organisations.

Both PSBs should strengthen mechanisms for collaboration between partners, ensuring that organisations have a shared understanding of climate risks and coordinated approaches to response and adaptation. This should include stronger alignment between PSB adaptation planning, Local Resilience Forum arrangements, and the work of key infrastructure and utility providers, so that **long-term resilience planning is better connected to emergency response** and recovery structures.

This may include **developing clearer shared response arrangements** between public institutions such as local authorities, health services, schools, higher education institutions and major employers. For example, coordination around decisions such as service closures during severe weather events can help reduce disruption and improve public communication.

There is also an opportunity to **strengthen collaboration around shared resources and mutual support arrangements**, enabling organisations to assist each other during climate-related incidents.

Expanding engagement with higher education institutions and research organisations could support improved evidence, training and innovation in climate resilience planning.

Priority 5: Strengthening climate risk evidence, monitoring, and learning

Climate risks are dynamic and evolving. Improving the quality and use of climate risk evidence will therefore be essential in supporting effective adaptation planning.

Both PSBs should strengthen the evidence base that informs climate resilience decision-making. This includes improving access to climate projections, mapping local vulnerability hotspots and monitoring the impacts of climate-related disruptions on services and infrastructure.

Developing shared monitoring frameworks between partner organisations will help ensure that emerging risks are identified early and that adaptation interventions can be evaluated and refined over time.

A stronger evidence base will also support more effective prioritisation of investment in adaptation measures.

Practical next steps for Carmarthenshire and Ceredigion

The strategic adaptation priorities outlined above provide a framework for strengthening resilience to climate risks across Carmarthenshire and Ceredigion. Translating these priorities into effective action will require coordinated activity across PSB partners, clear leadership, and sustained engagement with communities, infrastructure providers and environmental organisations.

Integrate climate resilience into local well-being plans and strategic planning

The findings of this Climate Change Risk Assessment should be embedded within the next cycle of PSB Well-being Assessments and Well-being Plans, ensuring that climate resilience is recognised as a cross-cutting priority influencing economic, environmental and social well-being. **Climate risks identified through this assessment should inform relevant organisational strategies across PSB partners**, including:

- local authority corporate strategies and asset management plans
- infrastructure and transport planning
- environmental management and biodiversity strategies
- health and social care service planning

- emergency preparedness and resilience frameworks

Embedding climate risk considerations into mainstream planning processes will help ensure that adaptation becomes an integral part of long-term decision-making rather than a standalone policy area.

Public sector organisations should review organisational risk registers, business continuity plans and emergency preparedness arrangements to ensure that climate-related risks are systematically considered across service delivery.

Establish clear ownership of priority climate risks

While PSBs provide strategic oversight and coordination, effective adaptation requires clear organisational leadership for specific risks. **Both PSBs should consider identifying lead organisations or thematic working groups responsible for progressing key risk areas identified in this assessment**, such as:

- flood and water management
- infrastructure resilience
- community preparedness and emergency response
- ecosystem resilience and nature-based solutions

Assigning **clear ownership will strengthen accountability**, improve coordination between organisations and help ensure that adaptation actions are progressed through existing institutional structures.

Develop a joint Climate Adaptation Delivery Plan

To support implementation of the strategic priorities identified in this assessment, the **PSBs should consider developing a joint Climate Adaptation Delivery Plan**. This plan would translate the strategic priorities outlined in this report into a set of specific, deliverable actions, supported by:

- Clear organisational responsibilities;
- Delivery timelines and milestones;
- Alignment with existing programmes and investment plans;
- Monitoring and reporting arrangements.

Where possible, the delivery plan should align with relevant existing initiatives including:

- Local Area Energy Plans;
- Flood risk management strategies;
- Biodiversity and ecosystem restoration programmes;
- Regional resilience planning arrangements.

Developing a **shared delivery plan will provide a practical mechanism for coordinating adaptation activity across partners and tracking progress** over time.

Joint working between Carmarthenshire and Ceredigion can build resilience. The two counties face similar climate pressures, depend on interconnected environmental and infrastructure systems, and bring complementary organisational strengths across planning, flood risk, health, emergency response, community resilience and nature recovery. A shared forward work programme would enable more consistent prioritisation, stronger cross-boundary resilience, more efficient use of limited capacity, and greater ability to attract external funding for landscape-scale and systems-based adaptation activity.

Strengthen community engagement and local resilience

Communities across Carmarthenshire and Ceredigion already demonstrate strong local networks and social capital, particularly in rural areas. These networks represent a critical asset in responding to climate-related disruptions. **Both PSBs should work with partners to strengthen community resilience and preparedness**, including:

- Developing stronger relationships with community organisations, voluntary groups and community hubs that are already active during extreme weather events;
- Supporting the development of community flood groups and resilience initiatives in high-risk areas;
- Working with Town and Community Councils to strengthen local communication networks, preparedness planning, and community-led resilience activity;
- Exploring opportunities to provide training, information or small-scale support for community-led resilience initiatives.

Supporting community preparedness will strengthen local response capacity and help reduce pressure on emergency services during severe weather events.

Private sector organisations can play a significant role in shaping climate resilience across the PSBs. Strengthened collaboration with the private sector could support:

- Improved resilience of energy, telecommunications, and transport infrastructure;
- Climate-resilient business continuity planning;
- Engagement with agricultural producers and land managers in catchment-scale adaptation;
- Partnerships with tourism and hospitality sectors to manage seasonal climate pressures.

PSBs should explore mechanisms to engage private sector partners more systematically in climate resilience planning, including through local business networks, infrastructure providers, and sector partnerships.

Increase public awareness of climate risks and preparedness actions

Stakeholder engagement suggests that many residents remain unaware of the specific climate risks affecting their communities, or of the practical steps they can take to reduce vulnerability.

Both **PSBs should support partners to strengthen public awareness and communication on climate risks**, including:

- Improving awareness of flood warning systems and emergency alerts;
- Providing clear guidance on household-level resilience measures, such as flood protection and drainage maintenance;
- Raising awareness of wildfire risk, storm impacts and coastal hazards;
- Supporting community-level conversations about local climate risks and adaptation measures.

Engagement with stakeholders highlighted the importance of communicating long-term flood risk management plans more effectively. Improving awareness of existing flood plans, adaptation strategies and future risk projections could help encourage businesses, institutions and communities to take proactive steps to improve resilience. Strengthening engagement with private sector organisations, higher education institutions and community groups could support wider understanding of climate risks and encourage shared responsibility for resilience.

Improving public awareness can help empower residents to take proactive steps to protect themselves, their homes and their communities.

Strengthen collaboration across public services and institutions

Climate hazards frequently affect multiple organisations simultaneously, particularly where flooding, storms or infrastructure failures disrupt transport networks and essential services. Both **PSBs should strengthen cross-partner coordination**, including:

- Improving shared understanding of climate risks across partner organisations;
- Developing clearer communication pathways during extreme weather events;
- Encouraging collaboration between public institutions such as local authorities, health services, schools, colleges and universities when responding to severe weather;
- Exploring opportunities for shared use of facilities or resources during emergency situations;

- Supporting community-based pilot projects and applied research on climate resilience;

Stronger collaboration will help ensure that responses to climate events are more coordinated and efficient across the public service system.

Strengthen collaboration with higher education and research institutions

The presence of higher education institutions within the region offers an opportunity to strengthen the evidence base for climate adaptation planning. Both **PSBs should explore opportunities to work more closely with universities, colleges and research organisations** to support:

- Climate risk research and data analysis;
- Innovation in nature-based solutions and catchment management;
- Student research projects linked to local climate challenges;
- Training and knowledge exchange for public service organisations.

Partnerships with academic institutions can help strengthen analytical capacity while supporting innovation in local adaptation approaches.

Strengthen the climate risk evidence base

Effective adaptation requires a strong and continuously evolving evidence base. **Both PSBs should support improved data sharing, monitoring and analysis across partner organisations**, including:

- Improving access to climate projections and risk mapping;
- Identifying areas of high climate vulnerability across communities and infrastructure systems;
- Monitoring the operational impacts of extreme weather events on services and infrastructure;
- Sharing data and learning across organisations to inform adaptation planning.

Improving the quality and availability of climate risk evidence will support more informed decision-making and more effective prioritisation of resilience investment.

Pilot place-based climate resilience initiatives

Both PSBs should consider developing a small number of pilot projects to test innovative approaches to climate adaptation and community resilience.

These pilots could focus on communities experiencing higher levels of climate exposure, such as areas affected by flooding or coastal change. Pilot initiatives may involve collaboration between local authorities, Natural Resources Wales, community organisations, education providers and residents.

Potential elements of pilot projects could include:

- Community resilience planning and preparedness training;
- Local adaptation measures such as natural flood management or property-level resilience;
- Awareness and education programmes delivered through schools, colleges or universities;
- Strengthened communication channels between public services and residents.

Pilot projects can enable the PSBs to explore practical approaches to adaptation, generate learning and develop scalable models for wider implementation across the region.

Monitoring and review

Climate risks will continue to evolve as climate change progresses. **Maintaining resilience therefore requires ongoing monitoring, learning and adaptation of policies and actions.**

Both Carmarthenshire and Ceredigion **PSBs should ensure that the findings and recommendations of this Climate Change Risk Assessment remain integrated within their governance and planning processes.**

Monitoring progress

Progress in strengthening climate resilience should be monitored through existing PSB governance structures where possible, ensuring that climate adaptation remains embedded within broader well-being planning processes.

This may include:

- Regular updates to the PSBs on progress against adaptation actions;
- Monitoring delivery of actions identified within any future Climate Adaptation Delivery Plan;
- Sharing learning between PSB partners on emerging risks and effective responses.

Monitoring should focus on understanding whether actions are strengthening resilience across communities, infrastructure systems and public services.

Reviewing emerging climate risks

Climate projections and local climate impacts will continue to evolve over time. **Both PSBs should therefore review the evidence base supporting climate adaptation periodically.**

This may involve:

- Reviewing climate risk evidence alongside updates to Well-being Assessments and Well-being Plans;
- Periodically assessing climate risk and vulnerabilities against the whole suite of climate risks identified in the CCRA3 and any additional evidence included in the CCRA4 when it is published;
- Incorporating lessons learned from recent extreme weather events;
- Updating risk priorities where new vulnerabilities or emerging hazards are identified.

Ensuring that climate risks are periodically reassessed will help maintain an up-to-date understanding of threats to community well-being and public services.

Though this assessment was focussed on the seven priority risks (identified through engagement with both PSBs and building on Carmarthenshire PSB's initial risk prioritisation exercise) outlined in Table 1, a number of additional risks were raised during stakeholder engagement, which the PSB should consider moving forward. These include:

- risks to local agricultural systems from changing weather patterns such as flooding and droughts;
- risks to food security as a result of reduced food availability in increasing consumer prices;
- risks to finance, investment and insurance, e.g. for developments and properties repeatedly flooded.

Supporting continuous learning and collaboration

Finally, both **PSBs should continue to use their partnership structures to support learning and collaboration between organisations.**

This includes:

- Sharing knowledge and experience across PSB partners;
- Strengthening links with regional and national adaptation initiatives;

- Learning from best practice in other local authority areas and regions.

Climate adaptation is an ongoing process rather than a one-off exercise. **Continued collaboration between organisations, communities and institutions will be essential in ensuring that Carmarthenshire and Ceredigion remain resilient in the face of a changing climate.**

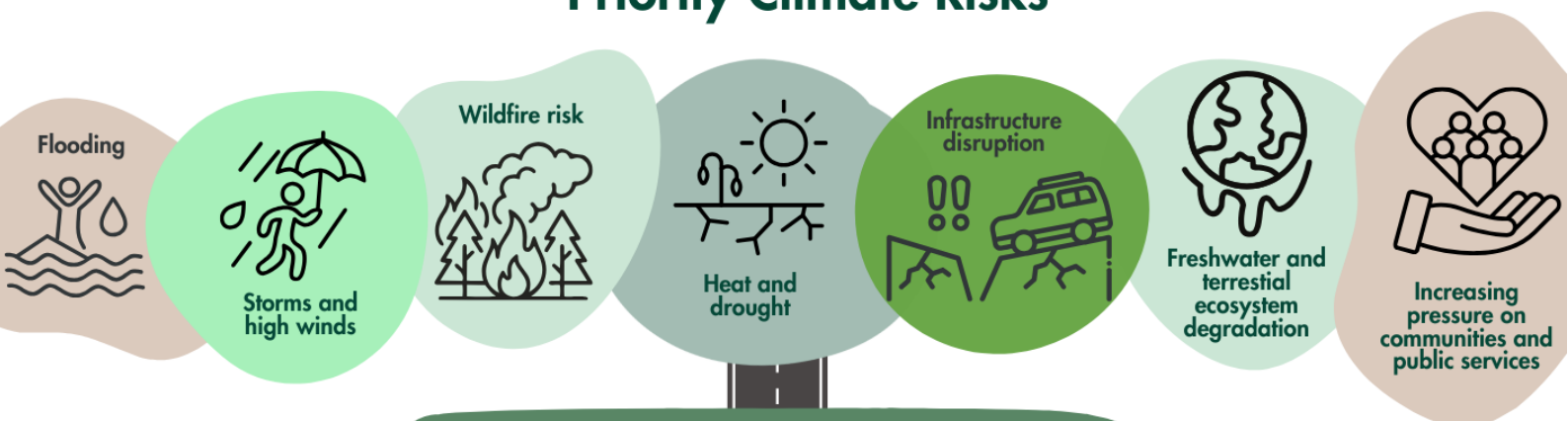
CLIMATE CHANGE RISK SUMMARY - CARMARTHENSHIRE PSB

A summary of priority risks, vulnerabilities and opportunities for action based on the Carmarthenshire and Ceredigion Climate Change Risk Assessment (2026)

Why this matters

- Climate change is **already affecting communities, infrastructure and public services** across Carmarthenshire
- Extreme weather events are **becoming more frequent, intense and prolonged**
- Key services are **increasingly disrupted**, placing pressure on resources and response capacity
- Proactive adaptation can **reduce long-term costs**, protect **vulnerable communities** and strengthen **resilience**

Priority Climate Risks



What we're already seeing

Infrastructure and services

- Flood events exceeding historic thresholds, including areas not previously identified as high risk
- Road closures and disruption caused by slips and drainage failures
- Power outages resulting from storm damage to electricity networks
- Sustained pressure on highways teams responding to prolonged weather events

Communities and services

- Evacuation of care facilities due to flooding incidents
- Disruption to social care delivery during extreme weather events
- Increased demand on emergency response and coordination functions
- Temporary suspension of business-as-usual activities across key service areas



Who and what is most vulnerable?

- Older populations and those receiving care
- Individuals reliant on consistent service provision
- Communities with limited capacity to respond



- Settlements in flood-prone areas
- Rural communities with limited access routes
- Areas with ageing or constrained infrastructure



- Transport networks (roads, drainage systems)
- Energy infrastructure and electricity distribution
- Water and drainage systems



What is already in place?

- Multi-agency emergency response structures (Gold and Silver command)
- Regular situational awareness and horizon scanning across services
- Increasing coordination across departments during incidents
- Expansion of multi-agency training and emergency preparedness

Where further action is needed

Community-level awareness and preparedness for climate risks

Stronger engagement beyond core PSB partners

Use of pilot approaches to test and scale adaptation solutions

Gaps in communication of long-term risks, particularly flooding

Coordination with private sector and higher education partners

Priority Next Steps for the PSB

1. Strengthen partner engagement

Broaden active engagement across PSB partners, ensuring consistent involvement beyond core statutory members. This should include stronger collaboration with the third sector, higher and further education institutions, and relevant private sector organisations.

2. Build community resilience

Work with Town and Community Councils, voluntary organisations and local networks to develop proactive, community-led approaches to resilience. This includes supporting communities to play a defined role in preparedness, response and recovery.

3. Pilot local adaptation approaches

Develop and test place-based pilot projects to explore how communities, services and partners can adapt to climate risks in practice. This should include collaboration with education providers to build local skills, awareness and capacity, and generate learning that can be scaled across both PSB areas.

4. Improve shared response and coordination

Strengthen coordination across public services and partners to support more integrated planning and response. This includes improving information sharing, aligning approaches to disruption, and enabling more efficient use of shared resources during incidents.

5. Increase public awareness of climate risk

Improve communication of current and future climate risks—particularly flooding and long-term environmental change—to support greater public understanding, preparedness and behaviour change. This includes engaging residents and businesses more directly in risk and response planning.

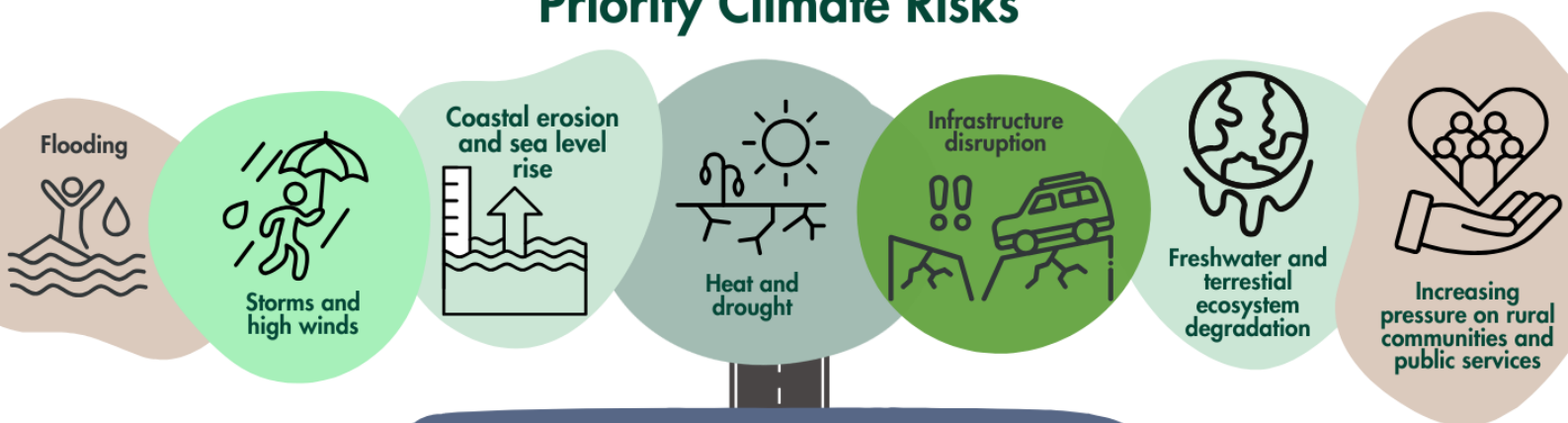
CLIMATE CHANGE RISK SUMMARY - CEREDIGION PSB

A summary of priority risks, vulnerabilities and opportunities for action based on the Carmarthenshire and Ceredigion Climate Change Risk Assessment (2026)

Why this matters

- Climate change is **already affecting communities, infrastructure** and natural systems across Ceredigion
- Risks are expected to intensify, particularly in coastal and rural areas
- Disruption to transport, services and infrastructure will increase without further adaptation
- Early, coordinated action can reduce impacts and strengthen long-term resilience

Priority Climate Risks



What we're already seeing

Infrastructure and services

- Flooding and storm events affecting transport connectivity and access
- Disruption to road networks, particularly in rural and coastal areas
- Increased pressure on infrastructure maintenance and response services
- Coastal processes contributing to long-term risk in some areas

Communities and services

- Disruption to access to services in rural and isolated communities
- Increased demand on emergency response and coordination
- Pressure on public services during prolonged weather events
- Emerging challenges linked to coastal change and long-term risk



Who and what is most vulnerable?

- Rural and isolated communities with limited access to services
- Older populations and vulnerable individuals
- Communities with limited local response capacity



- Coastal settlements exposed to erosion and sea level rise
- Rural areas with limited connectivity
- Flood-prone river catchments



- Transport networks and access routes
- Coastal infrastructure and assets
- Energy and service delivery systems in remote areas

What is already in place?

- Multi-agency emergency response structures
- Coordination through PSB and partner organisations
- Growing awareness of climate risks across services
- Existing planning and risk management frameworks

Where further action is needed

Limited community awareness of long-term risks, particularly coastal change and flooding

Need for stronger engagement with a wider range of partners

Limited piloting of innovative or place-based adaption approaches

Gaps in coordination across sectors, including private and education sectors

Need to strengthen community level resilience and preparedness

Priority Next Steps for PSB

1. Strengthen partner engagement

Broaden active engagement across PSB partners, ensuring consistent involvement beyond core statutory members. This should include stronger collaboration with the third sector, higher and further education institutions, and relevant private sector organisations.

2. Build community resilience

Work with Town and Community Councils, voluntary organisations and local networks to develop proactive, community-led approaches to resilience. This includes supporting communities to play a defined role in preparedness, response and recovery.

3. Pilot local adaptation approaches

Develop and test place-based pilot projects to explore how communities, services and partners can adapt to climate risks in practice. This should include collaboration with education providers to build skills, awareness and capacity, and generate learning that can be scaled across both PSB areas.

4. Improve shared response and coordination

Strengthen coordination across public services and partners to support more integrated planning and response. This includes improving information sharing, aligning approaches to disruption, and enabling more efficient use of shared resources during incidents.

5. Increase public awareness of climate risk

Improve communication of current and future climate risks—particularly flooding and long-term environmental change—to support greater public understanding, preparedness and behaviour change. This includes engaging residents and businesses more directly in risk and response planning.

Annex

Annex A - Shared documents reviewed

Carmarthenshire County Council. February 2020. Route towards becoming a Net Zero Carbon Local Authority by 2030. <https://www.carmarthenshire.gov.wales/media/1223704/gd6245-netzerocarbon-plan3.pdf>.

Carmarthenshire County Council. March 2025. Flood Risk Management Plan 2025-2030. <https://www.carmarthenshire.gov.wales/media/t3ub50wc/carmarthenshire-cc-draft-flood-risk-management-plan.pdf>.

Carmarthenshire County Council. 2022. Corporate Strategy 2022-2027: Developing Carmarthenshire Together: One Council, One Vision, One Voice. <https://www.carmarthenshire.gov.wales/media/1231822/corporate-strategy-2022-27.pdf>.

Carmarthenshire Public Services Board. March 2022. Carmarthenshire: Local Well-being Assessment. <https://www.thecarmarthenshirewewant.wales/media/quipyh1k/1-well-being-assessment.pdf>.

Carmarthenshire Public Services Board. May 2023. The Carmarthenshire We Want: Carmarthenshire Public Services Board: Well-being Plan. <https://www.thecarmarthenshirewewant.wales/media/x3fhtenc/well-being-plan.pdf>.

Ceredigion County Council. October 2024. Local Flood Risk Management Strategy. <https://www.ceredigion.gov.uk/media/1idkwvyo/local-flood-risk-management-strategy.pdf>.

Ceredigion County Council. 2022. Corporate Strategy 2022-27. <https://www.ceredigion.gov.uk/media/43mhuedd/corporate-strategy-2022-2027.pdf>.

Ceredigion Public Services Board. February 2025. Ceredigion PSB Local Well-Being Plan Annual Report 2024-2025. <https://www.ceredigion.gov.uk/media/tzxcg1ca3/annual-report-2024-2025-ceredigion-psb-local-well-being-plan.pdf>.

Ceredigion Public Services Board. May 2023. Ceredigion Local Well-Being Plan 2023-2028. <https://www.ceredigion.gov.uk/media/2ezdmmam/ceredigion-local-well-being-plan-2023-28.pdf>.

Ceredigion Public Services Board. 2022. Ceredigion Assessment of Local Well-Being. <https://www.ceredigion.gov.uk/media/ailh1mpt/ceredigion-assessment-of-local-well-being-2022.pdf>.

Climate Change Committee. May 2024. Proposed methodology for the Fourth Climate Change Risk Assessment – Independent Assessment (CCRA4-IA). <https://www.theccc.org.uk/publication/proposed-methodology-for-the-ccra4-advice/?chapter=3-proposed-methodological-approach-for-ccra4-ia#3-proposed-methodological-approach-for-ccra4-ia>.

Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales. <https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

Cymry Can. 2023. The strategy for the Future Generations Commissioner for Wales 2023-2030. <https://futuregenerations.wales/cym/wp-content/uploads/2025/08/Cymru-Can-strategy-1.pdf>.

Dyfed Powys Local Resilience Forum. 2024. Dyfed Powys Community Risk Register. <https://www.dyfed-powys.police.uk/SysSiteAssets/foi-media/dyfed-powys/lists-and-registers/risk-registers/dplrf-crr---english.pdf>.

HM Government. January 2022. UK Climate Change Risk Assessment 2022. <https://assets.publishing.service.gov.uk/media/61e54d8f8fa8f505985ef3c7/climate-change-risk-assessment-2022.pdf>.

HM Government. 2008. Climate Change Act 2008. <https://www.legislation.gov.uk/ukpga/2008/27/contents>.

National Infrastructure Commission Wales. October 2024. Building resilience to flooding in Wales by 2050: A report from the National Infrastructure Commission for Wales (NICW). https://nationalinfrastructurecommission.wales/wp-content/uploads/2024/10/50416_NICW-Flooding-Report-E_WEB-1.pdf.

Natural Resources Wales (H. James, C. Walmsley, S. Waterhouse, L. Watts). 2023. Climate Change Adaptation Plan 2023-2027. <https://nrwcmsv13-a3hwekacajb3frbw.a02.azurefd.net/pvzladru/climate-change-adaptation-plan-2023-2027-2.pdf>.

Natural Resources Wales. April 2023. Nature and People Thriving Together: Our corporate plan to 2030. <https://cdn.cyfoethnaturiol.cymru/aelcsmat/final-nature-and-people-thriving-together-our-corporate-plan-to-2030.pdf>.

Natural Resources Wales. 2024. Natural Resources Wales Flood Risk Management Plan: Mid Wales Place. <https://cdn.cyfoethnaturiol.cymru/3hwgt4vp/frmp-cycle-2-place-section-mid.pdf>.

Natural Resources Wales. 2024. Natural Resources Wales Flood Risk Management Plan: South West Wales Place. <https://cdn.cyfoethnaturiol.cymru/10hnbjij/frmp-cycle-2-place-section-south-west.pdf>.

South Wales Local Resilience Forum. 2022. Community Risk Register 2022/23. <https://www.southwaleslrf.co.uk/media/ktgaychh/swlrf-risk-register-2022-version-14-public.pdf>.

Welsh Government. October 2020. Strategic Environmental Assessment: Environmental Report: Flood and Coastal Erosion Risk Management: Development of a National Strategy for Wales. <https://www.gov.wales/sites/default/files/publications/2020-10/strategic-environmental-assessment-flood-and-coastal-erosion-risk-management-national-strategy-for-wales.pdf>.

Welsh Government. October 2024. Climate Adaption Strategy for Wales. <https://www.gov.wales/sites/default/files/publications/2024-10/climate-adaptation-strategy-for-wales-2024.pdf>.

Welsh Government. 2020. The Nature Recovery Action Plan for Wales 2020-21. <https://www.gov.wales/sites/default/files/publications/2020-10/nature-recovery-action-plan-wales-2020-2021.pdf>.

Welsh Government. 2025. Wales Resilience Framework 2025: Working in partnership to strengthen Wales' resilience and preparedness. <https://www.gov.wales/sites/default/files/publications/2025-05/wales-resilience-framework-2025.pdf>.

Annex B - Partners represented within the PSB partnership and invited to contribute to the assessment

The organisations listed below reflect the wider partnership structures supporting the Carmarthenshire and Ceredigion Public Services Boards (PSBs). These organisations were invited to contribute to the Climate Change Risk Assessment process through workshops, discussions, follow-up engagement and evidence sharing activities undertaken as part of the assessment.

The purpose of this engagement was to ensure that the assessment reflected a broad range of operational, strategic and community perspectives across both counties. Contributions from participating organisations helped inform the understanding of local climate risks, infrastructure interdependencies, community vulnerabilities, environmental pressures and service delivery challenges associated with climate change.

Participation varied across organisations during the course of the project and reflected the availability, capacity and relevance of climate-related issues to different partners. Engagement was therefore intended to provide proportionate insight from across the wider PSB partnership rather than represent a comprehensive audit of organisational preparedness or activity.

The organisations listed below include statutory PSB members, invited partner organisations and wider stakeholders supporting resilience, community wellbeing, environmental management, infrastructure, education and emergency response across Carmarthenshire and Ceredigion. A full list of organisations that participated in the assessment can be found in Annex E.

- Dyfed Powys Police and the Dyfed Powys Police and Crime Commissioner
- Carmarthenshire Association of Voluntary Services and Ceredigion Association of Voluntary Organisations
- Higher education and further education institutions, including the University of Wales Trinity Saint David, Aberystwyth University and local colleges

Annex C - List of organisations within both Ceredigion and Carmarthenshire Public Services Board

Statutory Members:

- Carmarthenshire County Council
- Ceredigion County Council
- Hywel Dda University Health Board
- Mid and West Wales Fire and Rescue Service
- Natural Resources Wales

Invited Participant Organisations and Other partners:

- Aberystwyth University
- Bannau Brycheiniog National Park Authority
- Carmarthenshire Association of Voluntary Services
- Ceredigion Association of Voluntary Organisations
- Coleg Ceredigion
- Coleg Sir Gâr
- Department for Work & Pensions
- Dyfed Powys Police
- Dyfed-Powys Police and Crime Commissioner
- Dyfed-Powys Probation Service
- National Library of Wales
- One Voice Wales
- Probation Service
- Public Health Wales
- University of Wales Trinity Saint David
- Wales Community Rehabilitation Company
- Welsh Government

Annex D - List of interviewed individuals

- Aled Vaughan Owen: Cabinet Member for Climate Change, Decarbonisation and Sustainability at Carmarthenshire County Council
- Carys Morgan: Chief Executive and Monitoring Officer at the Office of the Police and Crime Commissioner Dyfed Powys
- Clive Davies: Cabinet Member for Economy and Regeneration at Ceredigion County Council
- Daniel Priddy: Head of Sustainability and Environment at University of Wales Trinity Saint David

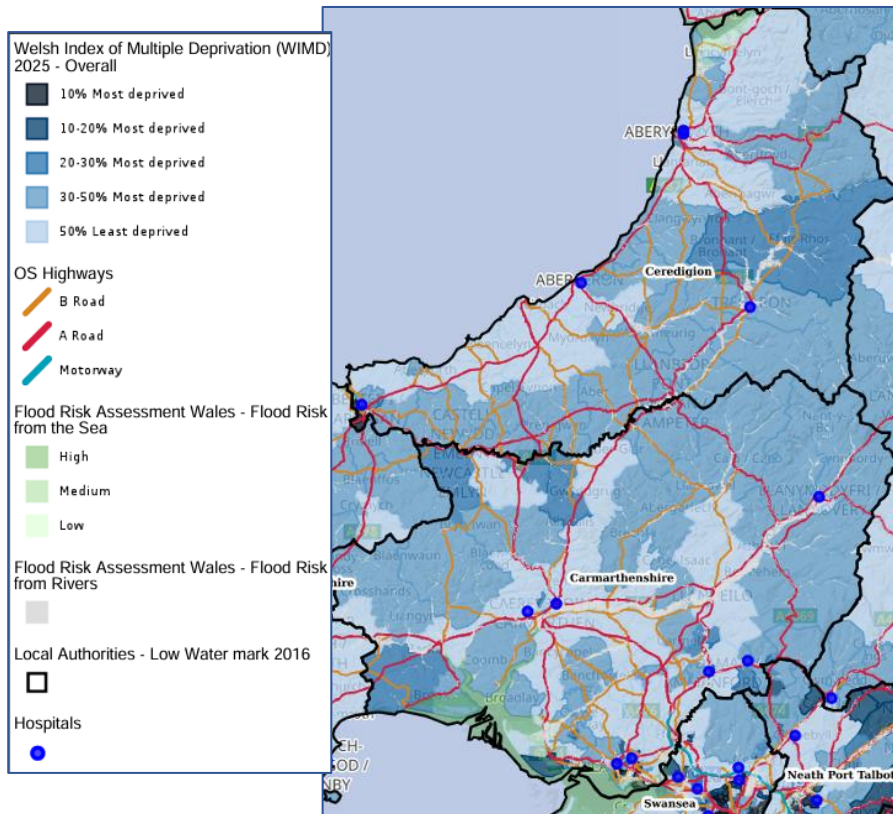
Annex E - List of organisations that participated in the project

- Carmarthenshire County Council
- Ceredigion County Council
- Dyfed-Powys Police
- Hywel Dda University Health Board
- Natural Resources Wales
- Office of the Police and Crime Commissioner Dyfed Powys
- University of Wales Trinity Saint David
- Mid and West Wales Fire and Rescue Service

Annex F - Carmarthenshire and Ceredigion Mapping

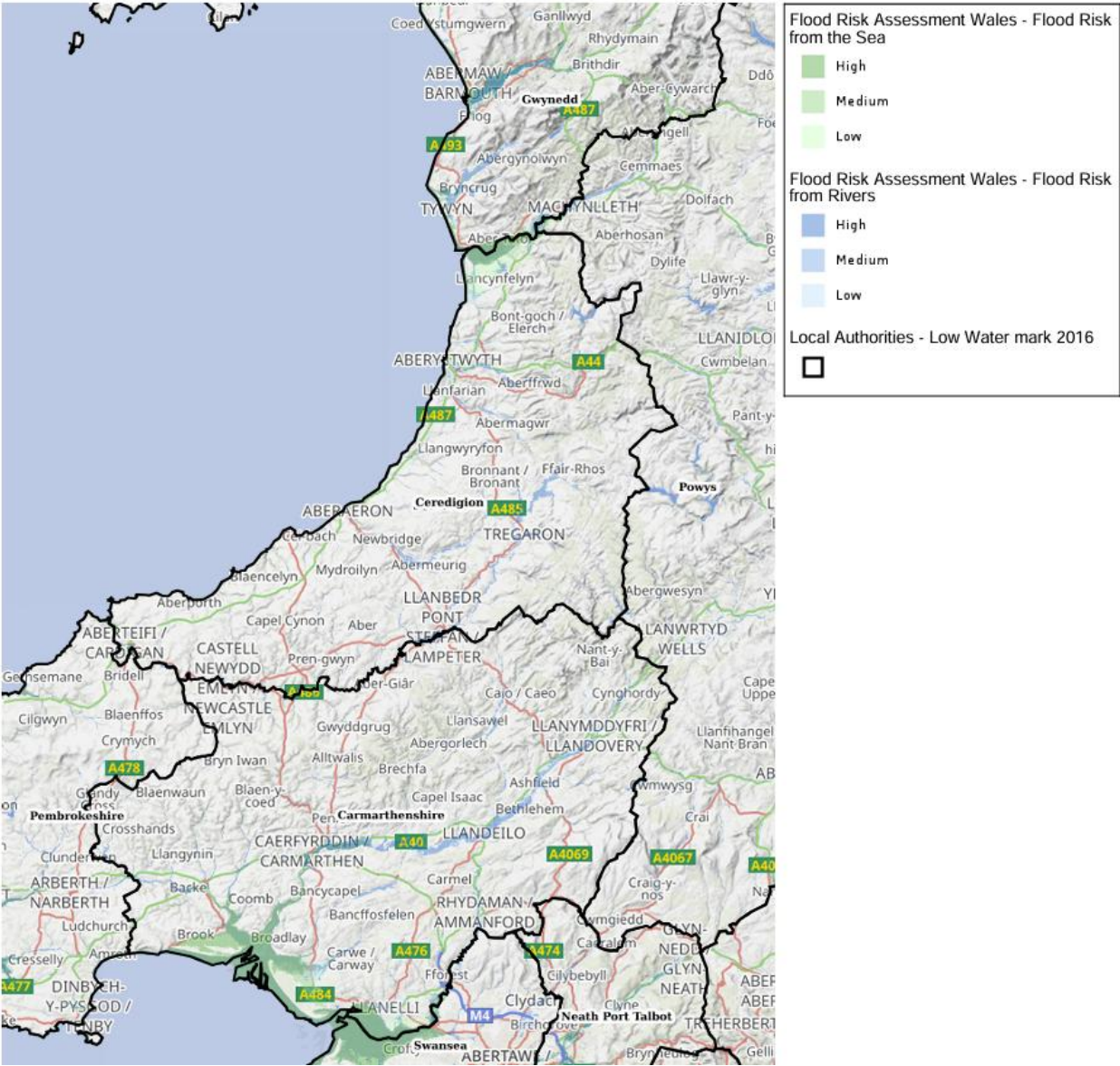
The maps provided below and the relevant data can be found through Data Maps Wales. Available at: <https://datamap.gov.wales/>

Welsh Index of Multiple Deprivation (WIMD) 2025, Highways, Flood Risk Assessment Wales - Flood Risk from the Sea, Flood Risk Assessment Wales - Flood Risk from Rivers, and Hospitals.



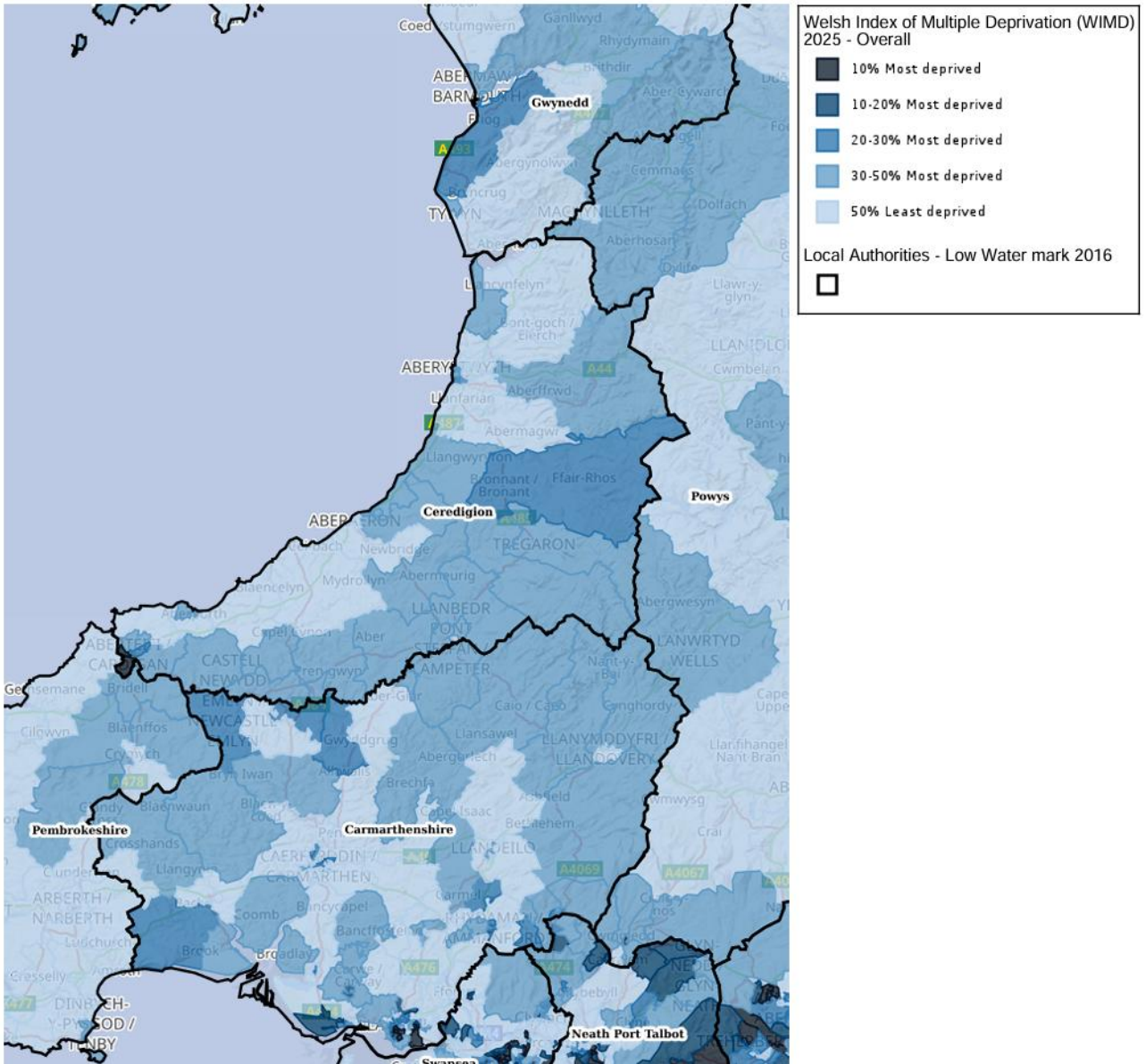
Crown copyright and database rights 2026 OS AC0000849488, via Europa: 2026 Europa Technologies Ltd.

Flood Risk Assessment Wales- Flood Risk From the Sea and Flood Risk from Rivers



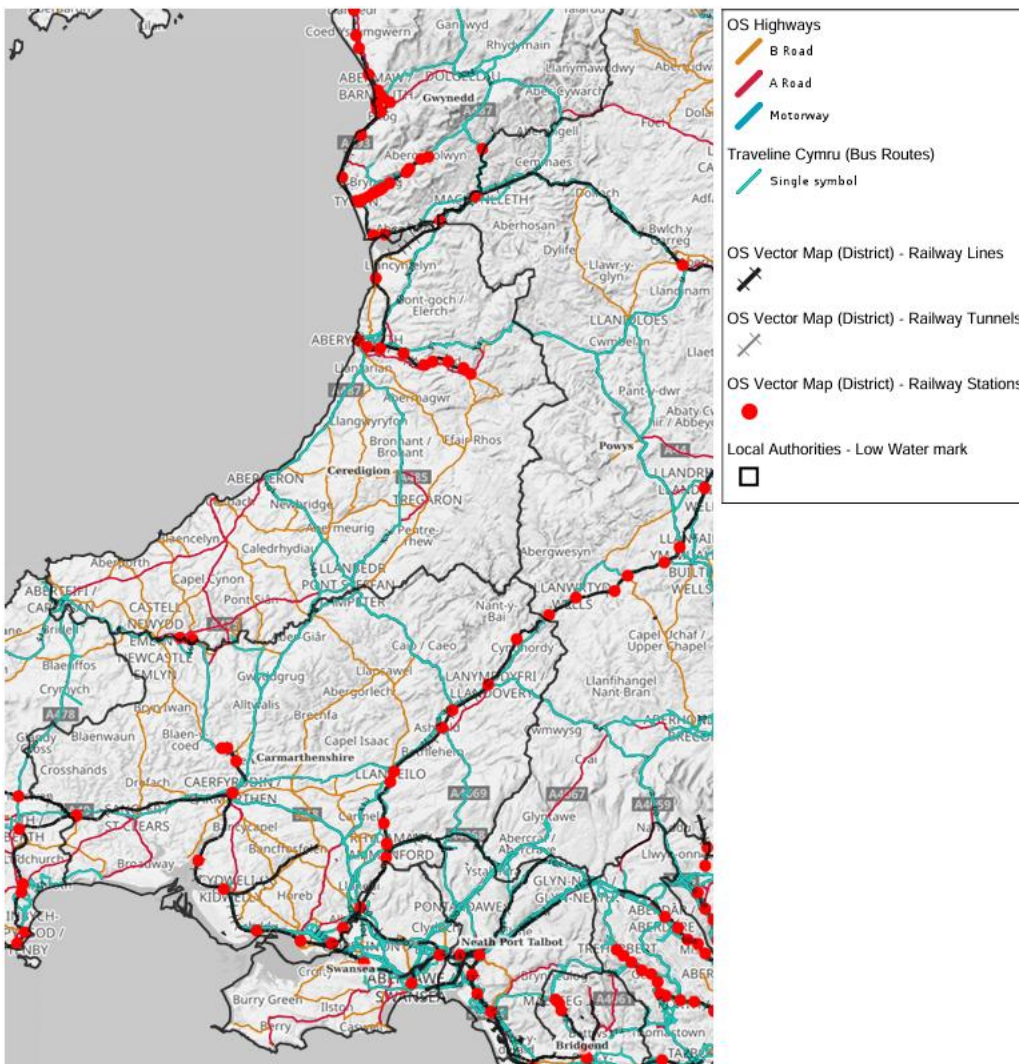
Crown copy right and database rights 2026, OS AC0000849488, viaEuropa; Europa Technologies Ltd

Welsh Index of Multiple Deprivation (WIMD) 2025 Overall



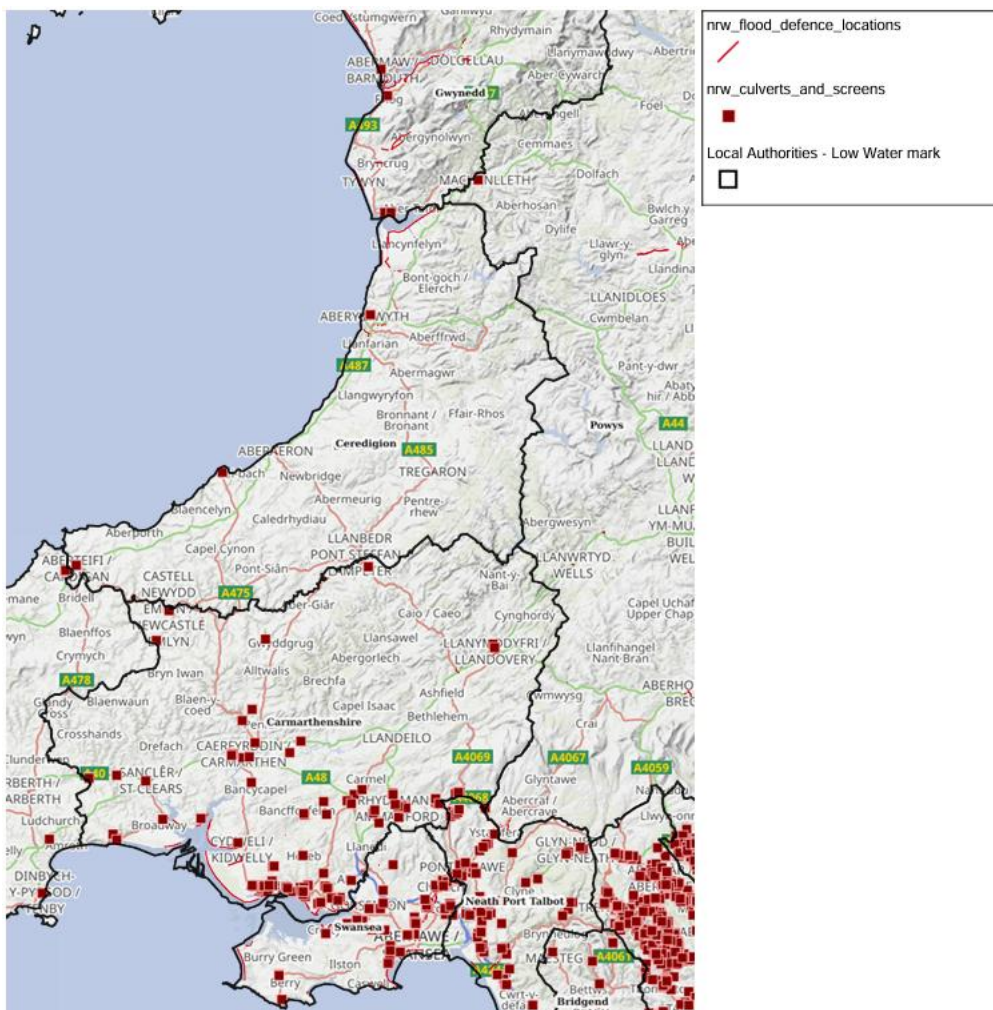
Crown copy right and database rights 2026, OS
AC0000849488, viaEuropa; Europa Technologies Ltd

Carmarthenshire and Ceredigion, OS Highways, Traveline Cymru Bus Routes, OS Railway Lines, OS Railway Tunnels, OS Railway Stations



Crown copyright and database rights 2026 OS AC0000849488, via Europa: 2026 Europa Technologies Ltd.

Carmarthenshire and Ceredigion NRW Flood defence locations and NRW Culverts and Screens



Crown copyright and database rights 2026 OS AC0000849488, via Europa: 2026 Europa Technologies Ltd.

Annex G - UK CCRA3 Risks

N1 Risks to terrestrial species and habitats	N2 Risks to terrestrial species and habitats from pests, pathogens and INNS	N4 Risk to soils from changing conditions, including seasonal aridity and wetness	N5 Risks to natural carbon stores and sequestration from changing conditions	N6 Risks to and opportunities for agricultural and forestry productivity
N7 Risks to agriculture from pests, pathogens and INNS	N8 Risks to forestry from pests, pathogens and INNS	N11 Risks to freshwater species and habitats	N12 Risks to freshwater species and habitats from pests, pathogens and INNS	N14 Risks to marine species, habitats and fisheries
N16 Risks to marine species and habitats from pests, pathogens and INNS	N17 Risks and opportunities to coastal species and habitats	I1 Risks to infrastructure networks from cascading failures	I2 Risks to infrastructure services from river and surface water flooding	I5 Risks to transport networks from slope and embankment failure
I8 Risks to public water supplies from reduced water availability	I12 Risks to transport from high and low temperatures, high winds, lightning	H1 Risks to health and wellbeing from high temperatures	H3 Risks to people, communities and buildings from flooding	H4 Risks to people, communities and buildings from sea level rise
H6 Risks and opportunities from summer and winter household energy demand	H8 Risks to health from vector-borne diseases	H11 Risks to cultural heritage	H12 Risks to health and social care delivery	H13 Risks to education and prison services
B1 Risks to business sites from flooding	B2 Risks to business locations and infrastructure from coastal change	B6 Risks to business from disruption to supply chains and distribution networks	ID1 Risks to UK food availability, safety, and quality from climate change overseas	ID5 Risks to international law and governance from climate change overseas that will impact the UK
ID4 Risks to the UK from international violent conflict resulting from climate change	ID9 Risk to UK public health from climate change overseas	ID7 Risks from climate change on international trade routes	ID10 Risk multiplication from the interactions and cascades of named risks across systems and geographies	N3 Opportunities from new species colonisations in terrestrial habitats
N9 Opportunities for agricultural and forestry productivity from new species	N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	N15 Opportunities for marine species, habitats and fisheries	N18 Risks and opportunities from climate change to landscape character	I3 - Risks to infrastructure services from coastal flooding and erosion
I4 Risks to bridges and pipelines from flooding and erosion	I6 Risks to hydroelectric generation from low or high river flows	I7 Risks to subterranean and surface infrastructure from subsidence	I9 Risks to energy generation from reduced water availability	I10 Risks to energy from high and low temperatures, high winds, lightning
I13 Risks to digital from high and low temperatures, high winds, lightning	H2 Opportunities for health and wellbeing from higher temperatures	H5 Risks to building fabric	H7 Risks to health and wellbeing from changes in air quality	H9 Risks to food safety and food security
H10 Risks to health from poor water quality and household water supply interruptions	B3 Risks to businesses from water scarcity	B5 Risks to business from reduced employee productivity – infrastructure disruption and higher temperatures	B7 Opportunities for business - changing demand for goods and services	N13 Opportunities to marine species, habitats and fisheries
I11 Risks to offshore infrastructure from storms and high waves	B4 Risks to finance, investment, insurance, access to capital	ID8 Risk to the UK finance sector from climate change overseas	ID2 Opportunities for UK food availability and exports	ID3 Risks to the UK from climate-related international human mobility
ID6 Opportunities (including Arctic ice melt) on international trade routes				

More Action Needed

Further Investigation

Sustain Current Action, Watching Brief

Source: The Third UK Climate Change Risk Assessment Technical Report [Betts, R.A., Haward, A.B. and Pearson, K.V. (eds.)]. Prepared for the Climate Change Committee, London

7. Reference List

- Business News Wales. November 2025. £13 Million Nature-Based Wetland Storm Overflow Opens in Torfaen. <https://businessnewswales.com/13-million-nature-based-wetland-storm-overflow-opens-in-torfaen/>.
- Carmarthenshire County Council. August 2024. Carmarthenshire County Council Flood Risk Management and Coastal Adaption Local Strategy 2024-2030. <https://www.carmarthenshire.gov.wales/media/pv0bdgys/ccc-flood-risk-management-and-coastal-adaption-local-strategy-2024-2030.pdf>.
- Carmarthenshire County Council. December 2025. Flooding. <https://www.carmarthenshire.gov.wales/council-services/emergencies-and-community-safety/flooding/>.
- Carmarthenshire County Council. February 2020. Route towards becoming a Net Zero Carbon Local Authority by 2030. <https://www.carmarthenshire.gov.wales/media/1223704/gd6245-netzerocarbon-plan3.pdf>.
- Carmarthenshire County Council. February 2024. Carmarthenshire County Council's Local Flood Risk Management Strategy 2024-2030: A strategy for the management of flood risk across Carmarthenshire. <https://www.carmarthenshire.gov.wales/media/53cl50yc/carmarthenshire-county-council-s-local-flood-risk-management-strategy.pdf>.
- Carmarthenshire County Council. March 2025. Flood Risk Management Plan 2025-2030. <https://www.carmarthenshire.gov.wales/media/t3ub50wc/carmarthenshire-cc-draft-flood-risk-management-plan.pdf>.
- Carmarthenshire County Council. November 2025. Flooding recovery update. <https://carmscouncil-newsroom.prgloo.com/news/carmarthenshire-county-council-flooding-recovery-update>.
- Carmarthenshire County Council. 2017. Revised Carmarthenshire Local Development Plan 2018-2033. <https://www.carmarthenshire.gov.wales/media/1216121/ldp-summary-introduction-english-final.pdf>.
- Carmarthenshire County Council. 2022. Corporate Strategy 2022-2027: Developing Carmarthenshire Together: One Council, One Vision, One Voice. <https://www.carmarthenshire.gov.wales/media/1231822/corporate-strategy-2022-27.pdf>.
- Carmarthenshire County Council. 2026. Flood Defence Schemes. <https://www.carmarthenshire.gov.wales/council-services/emergencies-and-community-safety/flooding/flood-defence-schemes/>.
- Carmarthenshire Public Services Board. March 2022. Carmarthenshire: Local Well-being Assessment. <https://www.thecarmarthenshirewewant.wales/media/quipyh1k/1-well-being-assessment.pdf>.
- Carmarthenshire Public Services Board. May 2023. The Carmarthenshire We Want: Carmarthenshire Public Services Board: Well-being Plan. <https://www.thecarmarthenshirewewant.wales/media/x3fhtenc/well-being-plan.pdf>.
- Ceredigion County Council. April 2024. Newsletter: Reducing flood risk in Aberaeron together. <https://www.ceredigion.gov.uk/media/zxcoendc/aberaeron-coastal-defence-scheme-newsletter-april-2024.pdf>.
- Ceredigion County Council. December 2024. The latest on Storm Darragh in Ceredigion. <https://www.ceredigion.gov.uk/resident/news/2024/the-latest-on-storm-darragh-in-eredigion/>.

Ceredigion County Council. October 2024. Local Flood Risk Management Strategy.
<https://www.ceredigion.gov.uk/media/1idkwvyo/local-flood-risk-management-strategy.pdf>.

Ceredigion County Council. 2026. Local Flood Risk Management.
[https://www.ceredigion.gov.uk/resident/coast-countryside/coast-and-flood-risk-management/local-flood-risk-management/#:~:text=The%20Flood%20and%20Water%20Management%20Act%202010%20provides%20a%20definition,the%20Lead%20Local%20Flood%20Authority\).](https://www.ceredigion.gov.uk/resident/coast-countryside/coast-and-flood-risk-management/local-flood-risk-management/#:~:text=The%20Flood%20and%20Water%20Management%20Act%202010%20provides%20a%20definition,the%20Lead%20Local%20Flood%20Authority).)

Ceredigion County Council. 2022. Corporate Strategy 2022-27.
<https://www.ceredigion.gov.uk/media/43mhuedd/corporate-strategy-2022-2027.pdf>.

Ceredigion Public Services Board. February 2025. Ceredigion PSB Local Well-Being Plan Annual Report 2024-2025. <https://www.ceredigion.gov.uk/media/tzxcg1ca3/annual-report-2024-2025-ceredigion-psb-local-well-being-plan.pdf>.

Ceredigion Public Services Board. May 2023. Ceredigion Local Well-Being Plan 2023-2028.
<https://www.ceredigion.gov.uk/media/2ezdmmam/ceredigion-local-well-being-plan-2023-28.pdf>.

Ceredigion Public Services Board. 2022. Ceredigion Assessment of Local Well-Being.
<https://www.ceredigion.gov.uk/media/ailh1mpt/ceredigion-assessment-of-local-well-being-2022.pdf>.

Climate Change Committee. May 2024. Proposed methodology for the Fourth Climate Change Risk Assessment – Independent Assessment (CCRA4-IA).
<https://www.theccc.org.uk/publication/proposed-methodology-for-the-ccra4-advice/?chapter=3-proposed-methodological-approach-for-ccra4-ia#3-proposed-methodological-approach-for-ccra4-ia>.

Climate Change Committee. September 2023. Adapting to Climate Change: Progress in Wales.
<https://www.theccc.org.uk/wp-content/uploads/2023/08/Adapting-to-Climate-Change-Progress-in-Wales.pdf>.

Cymry Can. 2023. The strategy for the Future Generations Commissioner for Wales 2023-2030.
<https://futuregenerations.wales/cym/wp-content/uploads/2025/08/Cymru-Can-strategy-1.pdf>.

Debbie Luxon. January 2026. Welsh flood victims don wellies planting over 40,000 trees to slow the flow. <https://nation.cymru/feature/welsh-flood-victims-don-wellies-planting-40000-trees-to-slow-the-flow/>.

Dyfed Powys Local Resilience Forum. 2024. Dyfed Powys Community Risk Register.
<https://www.dyfed-powys.police.uk/SysSiteAssets/foi-media/dyfed-powys/lists-and-registers/risk-registers/dplrf-crr---english.pdf>.

Elkanah Evans. June 2023. Carmarthenshire Council keen to re-open North Dock, Llanelli.
<https://www.carmarthenshirenewsonline.com/carmarthenshire-county-council/carmarthenshire-council-keen-to-re-open-north-dock-llanelli/www.carmarthenshirenewsonline.com/carmarthenshire-news/carmarthenshire-council-keen-to-re-open-north-dock-llanelli/>.

Ellie Gosley. November 2025. Major incident declared as retirement home evacuated due to flooding. <https://www.walesonline.co.uk/news/wales-news/major-incident-declared-retirement-home-32815288>.

Felix Nobes. November 2022. Borth and Ynyslas will be lost to the sea in decades, experts fear.
<https://www.cambrian-news.co.uk/news/environment/borth-and-ynyslas-will-be-lost-to-the-sea-in-decades-experts-fear-572371>.

Guy Schurgers and Kristian Bjørn-Hansen. February 2024. World Wetlands Day: Bogs hold an important key to the climate crisis. <https://science.ku.dk/english/press/news/2024/world-wetlands-day-bogs-hold-an-important-key-to-the-climate-crisis/>.

HM Government. January 2022. UK Climate Change Risk Assessment 2022. <https://assets.publishing.service.gov.uk/media/61e54d8f8fa8f505985ef3c77/climate-change-risk-assessment-2022.pdf>.

HM Government. 2008. Climate Change Act 2008. <https://www.legislation.gov.uk/ukpga/2008/27/contents>.

Local Climate Adaptation Tool. 2026. Carmarthenshire. <https://lcat.uk/>.

Local Climate Adaptation Tool. 2026. Carmarthenshire and Ceredigion. <https://lcat.uk/>.

Local Nature Partnerships Cymru. 2026. What is the LNP Cymru Scheme. <https://lnp.cymru/About-Us>.

Mid and West Wales Fire and Rescue Service. 2026. Flooding Advice. <https://www.mawwfire.gov.uk/eng/your-safety/your-community-and-events/flooding-advice/>.

Met Office. March 2026. Climate Report for Ceredigion. <https://www.reports.esriuk.com/view-report/b8eb3cee8f764147a2cfcd69cf36238f/W06000008>.

Met Office. 2026. Local Authority Climate Explorer [Beta, v2.01] Carmarthenshire. <https://www.arcgis.com/apps/dashboards/506ff7d53c884badb0d8fd36d6280a91>.

Met Office. 2026. Local Authority Climate Explorer [Beta, v2.01] Ceredigion. <https://www.arcgis.com/apps/dashboards/506ff7d53c884badb0d8fd36d6280a9>.

National Energy System Operator. 2026. What we do. <https://www.neso.energy/what-we-do>.

National Infrastructure Commission Wales. October 2024. Building resilience to flooding in Wales by 2050: A report from the National Infrastructure Commission for Wales (NICW). https://nationalinfrastructurecommission.wales/wp-content/uploads/2024/10/50416_NICW-Flooding-Report-E_WEB-1.pdf.

Natural Resources Wales. April 2023. Nature and People Thriving Together: Our corporate plan to 2030. <https://cdn.cyfoethnaturiol.cymru/aelcsmat/final-nature-and-people-thriving-together-our-corporate-plan-to-2030.pdf>.

Natural Resources Wales on behalf of the Welsh Government. August 2022. Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales. https://www.gov.wales/sites/default/files/publications/2022-11/guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales_0.pdf.

Natural Resources Wales. May 2024. Four Rivers for LIFE. <https://naturalresources.wales/about-us/what-we-do/our-projects/our-nature-projects/4-rivers-for-life/?lang=en>.

Natural Resources Wales (H. James, C. Walmsley, S. Waterhouse, L. Watts). 2023. Climate Change Adaptation Plan 2023-2027. <https://nrwcmsv13-a3hwekacajb3frbw.a02.azurefd.net/pvzladru/climate-change-adaptation-plan-2023-2027-2.pdf>.

Natural Resources Wales. 2021. Peatland: How carbon sinks can turn into carbon emitters, <https://cdn.cyfoethnaturiol.cymru/media/694124/information-note-peatland-how-carbon-sinkscan-turn-into-carbon-emitters.pdf>.

Natural Resources Wales. 2023. Appendix J: South West Local Measures. <https://cdn.cyfoethnaturiol.cymru/b3rpvlph/appendix-j-south-west-wales.pdf>.

Natural Resources Wales. 2023. Flood risk management annual report 2021 to 2022. <https://naturalresources.wales/evidence-and-data/research-and-reports/flooding-reports-evidence-and-data/flood-risk-management-annual-report-2021-2022/?lang=en>.

Natural Resources Wales. 2023. Improvements made to Abergwili flood defence gates to alleviate secondary flooding. <https://naturalresourceswales.gov.uk/about-us/news-and-blogs/news/improvements-made-to-abergwili-flood-defence-gates-to-alleviate-secondary-flooding/>.

Natural Resources Wales. 2023. Natural Resources Wales Flood Risk Management Plan: Mid Wales Place. <https://cdn.cyfoethnaturiol.cymru/3hwgt4vp/frmp-cycle-2-place-section-mid.pdf>.

Natural Resources Wales. 2024. Natural Resources Wales Flood Risk Management Plan: Mid Wales Place. <https://cdn.cyfoethnaturiol.cymru/3hwgt4vp/frmp-cycle-2-place-section-mid.pdf>.

Natural Resources Wales. 2024. Natural Resources Wales Flood Risk Management Plan: South West Wales Place. <https://cdn.cyfoethnaturiol.cymru/10hnbj/ffmp-cycle-2-place-section-south-west.pdf>.

Natural Resources Wales. 2025. Flood risk management annual report 2024 to 2025. <https://naturalresources.wales/evidence-and-data/research-and-reports/flooding-reports-evidence-and-data/flood-risk-management-annual-report-2024-to-2025/?lang=en>.

Natural Resources Wales. 2025. State of Natural Resources Report 2025. <https://cdn.cyfoethnaturiol.cymru/f45ehjei/sonarr2025-final-report.pdf>.

Natural Resources Wales. 2026. Marine Area Statement. <https://naturalresources.wales/about-us/what-we-do/strategies-plans-and-policies/area-statements/marine-area-statement/?lang=en>.

Natural Resources Wales. 2026. Marine Area Statement: Nature-based solutions and adaption at the coast. <https://naturalresources.wales/about-us/what-we-do/strategies-plans-and-policies/area-statements/marine-area-statement/nature-based-solutions-and-adaptation-at-the-coast/?lang=en>.

Public Health Wales & World Health Organization Collaborating Centre on Investment for Health and Wellbeing. July 2023. D5.3/P6.2 Flooding. <https://phwwhocc.co.uk/wp-content/uploads/2023/07/D5.3P6.2-Flooding-Eng-final.pdf>.

Public Health Wales & World Health Organization Collaborating Centre on Investment for Health and Wellbeing. July 2023. D5.5 Water Supply and Quality. <https://phwwhocc.co.uk/wp-content/uploads/2023/07/D5.5-Water-Supply-and-Quality-Eng-final.pdf>.

South Wales Local Resilience Forum. 2022. Community Risk Register 2022/23. <https://www.southwaleslrf.co.uk/media/ktgaychh/swlrf-risk-register-2022-version-14-public.pdf>

UK Climate Risk. June 2021. Evidence for the third UK Climate Change Risk Assessment (CCRA3): Summary for Wales. <https://www.ukclimaterisk.org/publications/summary-for-wales-ccra3-ia/#section-1-about-this-document>.

Welsh Government. January 2012. Regional and Local Economic Impacts of Rail Investments. <https://www.gov.wales/sites/default/files/statistics-and-research/2018-12/120130railreporten.pdf>.

Welsh Government. March 2025. Flood and Coastal Erosion Risk Management Programme 2025 to 2026. <https://www.gov.wales/flood-and-coastal-erosion-risk-management-programme-2025-2026.html>.

Welsh Government. May 2025. Local Resilience Forums. <https://www.gov.wales/local-resilience-forums>.

Welsh Government. October 2020. Strategic Environmental Assessment: Environmental Report: Flood and Coastal Erosion Risk Management: Development of a National Strategy for Wales. <https://www.gov.wales/sites/default/files/publications/2020-10/strategic-environmental-assessment-flood-and-coastal-erosion-risk-management-national-strategy-for-wales.pdf>.

Welsh Government. October 2024. Climate Adaption Strategy for Wales.
<https://www.gov.wales/sites/default/files/publications/2024-10/climate-adaptation-strategy-for-wales-2024.pdf>.

Welsh Government. 2019. Transport: Sector Emission Pathway.
<https://www.gov.wales/sites/default/files/publications/2019-06/transport-sector-emissionpathway-factsheet.pdf>.

Welsh Government. 2020. The Nature Recovery Action Plan for Wales 2020-21.
<https://www.gov.wales/sites/default/files/publications/2020-10/nature-recovery-action-plan-wales-2020-2021.pdf>.

Welsh Government. 2025. Wales Resilience Framework 2025: Working in partnership to strengthen Wales' resilience and preparedness.
<https://www.gov.wales/sites/default/files/publications/2025-05/wales-resilience-framework-2025.pdf>.

Welsh Government. 2026. StatsWales: Properties at risk of flooding in Wales.
https://stats.gov.wales/en-GB/44557520-6234-4a77-9263-cabfc00f4d72/filtered/37lk0xulq3b0?page_size=100.

Younis et al,. August 2025. Urbanisation and Its Environmental Impact in Ceredigion County, Wales: A 20-Year Remote Sensing and GIS-Based Assessment (2003-2023).
doi: 10.3390/s25175332.