

ARUP



Non-Technical Summary

# Climate Change Risk and Vulnerability Assessment

ANGUS



# 1. Introduction

## Why this report matters

Angus Council commissioned this assessment to understand how climate change will affect the Angus region, what risks are emerging, and how the community can become more resilient. The report looks at local climate projections, identifies vulnerable groups and places, reviews the impacts of recent extreme weather events, and suggests practical adaptation options.

This report provides **clear insights** into **how climate change will affect Angus** and identifies future risks. It offers **practical adaptation options** to strengthen resilience against more frequent and severe climate hazards. The report aligns with national climate duties (i.e. CCRA4) and fosters collaboration among the Council, communities, and external stakeholders. Early actions help protect communities, infrastructure, and natural assets, reducing long-term damage and costs.

Angus is experiencing warmer winters and summers, wetter winters, and drier summers, altering seasonal norms. Storms Arwen and Babet have caused widespread damage, increasing risks to infrastructure and public safety. Proactive planning is essential to mitigate intensifying climate impacts and protect communities and services.



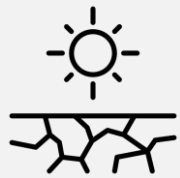
## 2. Climate Change Impacts on Angus

### Climate Change Projections & Key Climate Hazards

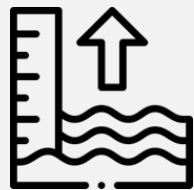
Using the latest climate change projections for the UK (UKCP18), the Angus region is projected to experience warmer, wetter winters and hotter, drier summers. Extreme weather events like storms and flooding will become more common which will cause significant damage to the region. Recent storms, Storm Arwen and Storm Babet caused widespread damage, including property loss, business disruption and impacts on health and wellbeing.

Seven key hazards have been identified for Angus; all will increase with climate change apart from extreme cold which will decrease. All seven hazards have been considered in the Climate Change Risk and Vulnerability Assessment (CCRVA).

Further detail on the climate change projections and associated hazards are provided within Section 2 and Appendix A1 within the full report.



Drought &  
water scarcity



Coastal  
flooding and  
erosion



Storms and  
high winds



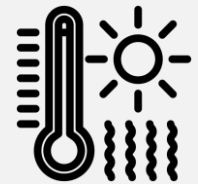
Average  
warming



River and  
surface water  
flooding



Frost days



Extreme heat

# 3. Vulnerable Groups and Places in Angus

## Mapping Vulnerability in Angus

Using the Scottish Index of Multiple Deprivation (SIMD) and Scottish Environmental Protection Agency (SEPA) flood mapping in the region, vulnerability in Angus has been mapped. Vulnerability has different multiple intersecting components including gender, ethnicity, age, disability, deprivation and geography (exposure risk to the hazard). As the two more influential factors, the analysis provided considers risks through the lenses of age and deprivation. By considering deprivation alongside SEPA flood mapping, physical exposure (i.e. flooding) can be combined with social vulnerability (i.e. multiple deprivation) to highlight hotspots where Angus Council and external stakeholders can come together to consider solutions.

Over 25% of the population in Angus are elderly, facing higher risks from heatwaves, floods, and storms due to health and mobility challenges. Town centres like Arbroath, Montrose, and Forfar show higher social vulnerability due to deprivation and older populations, limiting resources and reducing resilience to climate impacts. Rural areas suffer from poor access to services and infrastructure, increasing vulnerability to climate hazards. Communities exposed to flooding face compounded risks when social vulnerability and physical exposure overlap, such as areas of Brechin for surface water and river flooding and Montrose for coastal flooding.

These maps can help Angus Council and stakeholders to collaborate to prioritise resources, target community engagement and design tailored adaptation measures for the most at-risk groups. Further, it supports emergency planning and health resilience strategies for flooding, storms and heatwaves, respectively.

Figure 1 overleaf provides a high-level output for the vulnerability mapping. Further details can be found in Section 3 and Appendix A2 of the full report.

# 3. Vulnerable Groups and Places in Angus

## Mapping vulnerability in Angus

Visualising SIMD and SEPA flooding reveals flood risks in a neighbourhood, highlighting areas where social vulnerability flooding exposure overlap.

Maps have been provided for areas split into low, medium and high likelihoods as follows:

- Low likelihood: the area has a 0.1% chance of flooding each year
- Medium likelihood: the area has a 0.5% chance of flooding each year
- High likelihood: the area has a 10% chance of flooding each year

Figure 1 provides the overview for the full Angus area; however further details for each settlement are provided within the full report and Appendix A2.

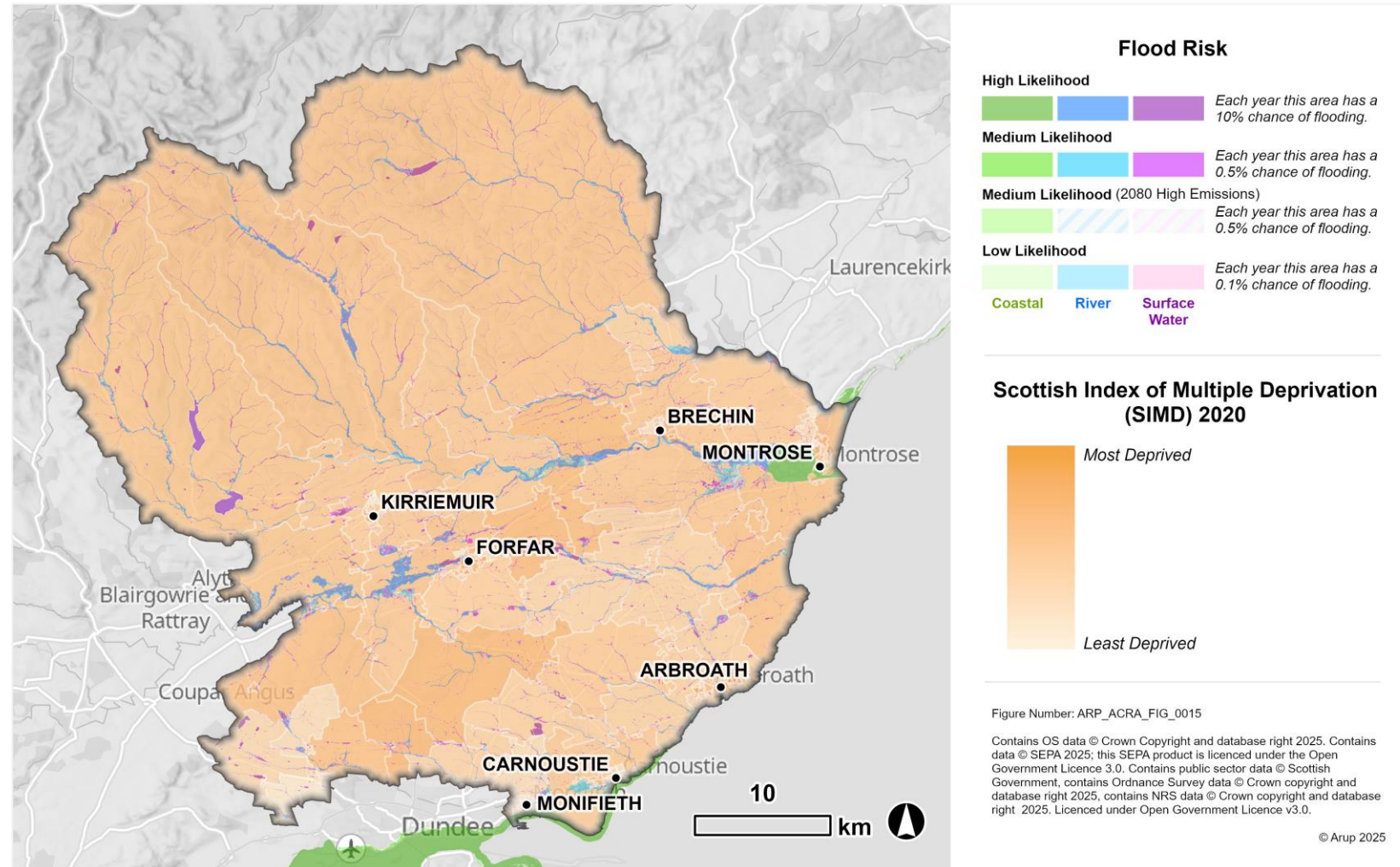







Figure 1: Angus flooding vulnerability for the full local authority boundary.

# 4. The Climate Change Risk and Vulnerability Assessment

## Sector Risks

In accordance with the UK's Fourth Climate Change Risk Assessment (CCRA4), the climate change risk and vulnerability assessment (CCRVA) for Angus has been broken into five main sectors:

-  1. **Built Environment:** private and council owned homes, council and private business office buildings, and cultural heritage sites face high risks from flooding, heat and coastal erosion.
-  2. **Health and Wellbeing:** health, social care and education can be disrupted by flooding and heatwaves, causing wider social issues such as physical and mental health issues.
-  3. **Economy:** businesses, tourism, agriculture, and recreation are threatened by storms, flooding, drought and coastal change.
-  4. **Infrastructure:** Transport, energy, water, and digital networks are vulnerable to disruption from storms, flooding, drought, and heat.
-  5. **Land, Nature and Food:** Natural habitats, wildlife, agriculture, and forestry are at risk from changing temperatures, drought, flooding, and invasive species.

Further details, including full scoring assessment, are provided in Section 4 and Appendix A4 of the main report.

# 5. The Cost of Past Events

## Lessons from recent storms

The assessment also provides further analysis on the cost (both direct and indirect costs) of previous events to ensure that Angus region learns from past storms to increase resilience in the region. Using an adapted version of the UN's loss and damage framework, direct economic losses, such as from businesses, tourism, services and transport, and properties, and indirect economic and non-economic losses such as on biodiversity, ecosystem services and health were analysed for Storm Arwen in 2021 and Storm Babet in 2023.

Both storms highlight the escalating financial burden for residents from extreme weather. After Storm Babet, estimates for repairing damage in Angus is estimated to be over £4 million, with the Angus Council claim to the Bellwin Scheme (a fund designed to help councils after large-scale emergencies) estimated at £6.9 million. In addition, there is a need for proactive investment in adaptation measures to reduce future costs and the wider business case for spending on preparedness for future rather than reactive recovery. Further details can be found in Section 5 of the full report.

### Storm Arwen in 2021

**Impact:** mostly wind damage, causing widespread power outages and significant damage to infrastructure, homes and forestry across Angus.

**Economic losses:** millions spent on emergency repairs and temporary generators, large scale tree damage led to economic losses in timber and increased clearance costs, additional expenditure for emergency accommodation, road clearance, and welfare support.

**Indirect costs:** business disruption, increased health and social care demand for vulnerable residents.

### Storm Babet in 2023

**Impact:** mostly flood damage, causing severe flooding in Brechin, Forfar and Montrose. There was significant damage to infrastructure and homes with many evacuated across Angus.

**Economic losses:** multi-millions spent on emergency repairs for homes, roads and bridges damaged, requiring major investment in restoration, high costs for emergency accommodation, road clearance, and welfare support.

**Indirect costs:** business disruption, increased health and social care demand for vulnerable residents, increased insurance premiums for vulnerable residents.

## 6. Adaptation Options

The report provides six adaptation options which external stakeholders, in collaboration with Angus Council, should consider to address the climate risks identified within the climate change risk and vulnerability assessment. These options aim to reduce climate-related risks and build resilience across the services, infrastructure, and communities within the Angus region. They are practical, actionable steps based on local vulnerabilities and lessons learned from recent storms.

These are:

- 1. Support Community Flood Groups:** Support local groups prepare for, improve response to, and recover from flooding events in the community.
- 2. Review Flood Risks for Properties:** Map and review flood risks for buildings in Angus and create targeted action plans to mitigate potential damage.
- 3. Emergency Planning for Coastal Areas:** Strengthen plans for communities and businesses at risk from coastal erosion and flooding from storm surge threats.
- 4. Educate on Storm Preparedness:** Provide clear guidance to residents and businesses on how to prepare for storms.
- 5. Address Heat Health Risks:** Set up a heat health working group to assess overheating risks in housing in Angus and develop a heatwave action plan.
- 6. Improve Water Management:** cross sectoral approach for stakeholders and landowners to plan for drought and water scarcity, encouraging water-saving habits during drought conditions.

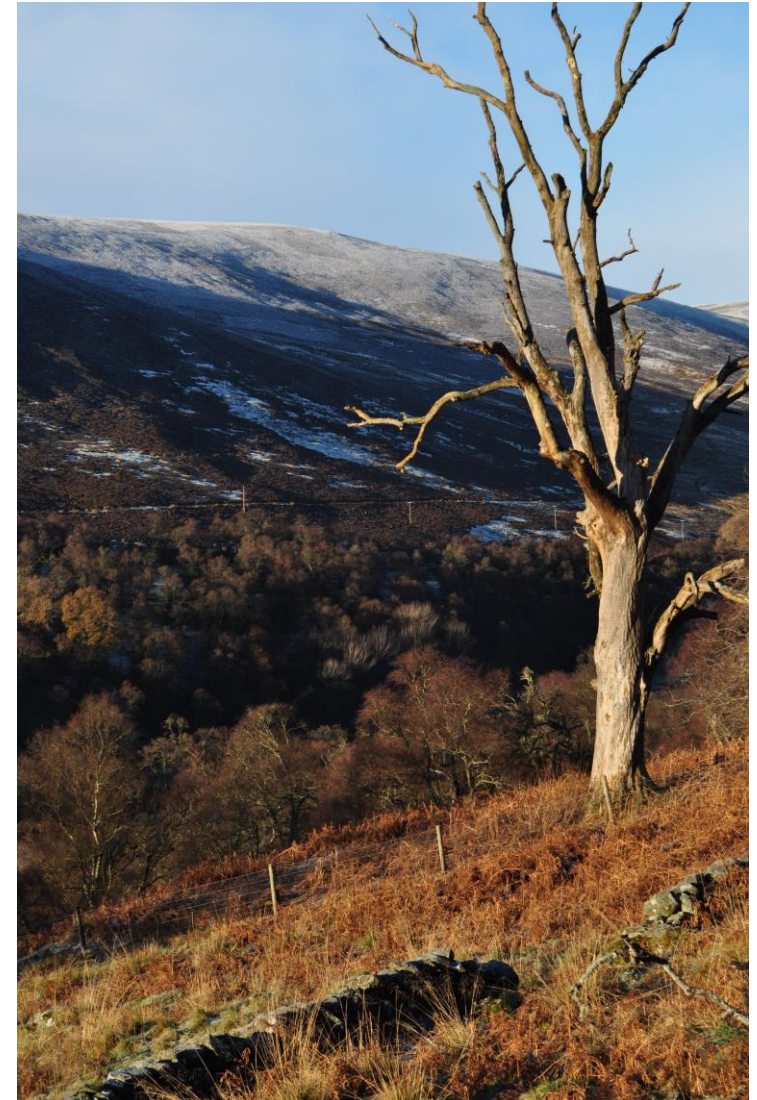
All six options encourage collaboration between external stakeholders, and the Council where appropriate, to enhance climate resilience in the region. Further details are found within Section 6 of the full report.

# 7. Next Steps & Conclusions

Climate change is already impacting Angus, and risks will increase in the coming decades, threatening communities, infrastructure and the natural world. To safeguard the region, proactive adaptation is essential.

By understanding local vulnerabilities and taking early action, Angus Council, its external stakeholders and communities can reduce risks, save money, and protect people, nature, and local assets. Working closely with regional partners will be vital to share knowledge and resources, review and implement detailed adaptation plans, and embed resilience into everyday operations. Regular monitoring and evaluation will ensure these measures remain effective.

By taking timely, collaborative action, Angus can reduce economic and social disruptions, protect people and assets, and create a sustainable future that lowers long-term costs while improving community wellbeing. This report, associated climate assessment and mapping provides the starting point for a roadmap to build climate change resilience in the region through practical, community-focused measures.



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