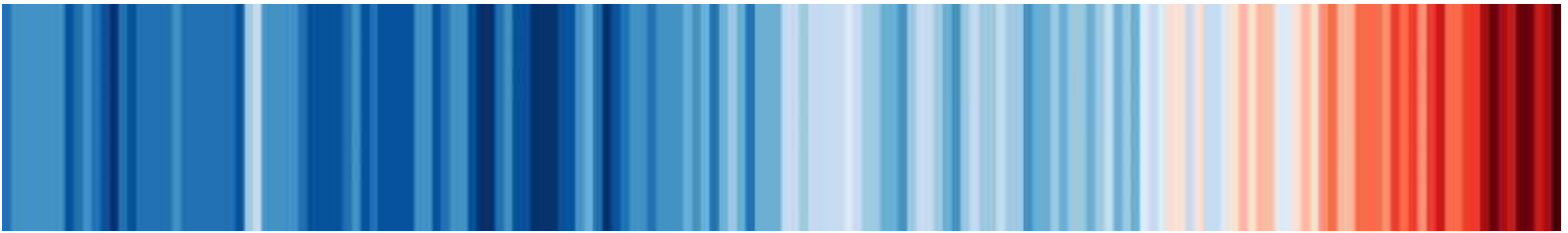


Draft Climate Adaptation Strategy

2025-2035





*The warming stripes image in the header above illustrates **global temperature change** between 1850 and 2023, using data from the UK Met Office. Each stripe represents the temperature across our planet averaged over a year. Shades of blue indicate cooler than average years, while red shows years that were hotter than average. Dark red stripes on the right-hand side show the rapid heating of our planet in recent years.*

The Climate Stripes graphic was created by Professor Ed Hawkins at the University of Reading in 2018. Stripes images have now been created for more than 200 countries, states and cities (including Edinburgh, Glasgow, Scotland, and the whole of the UK) and are available to download for free from the show-your-stripes.info website.

More than a million people downloaded the stripes from the site within weeks of their launch. They have since appeared at United Nations meetings, on the BBC, at school climate strikes, numerous events and festivals, art installations, and on football strips and various promotional materials, including electric cars, buses and trains.

*The warming stripes on the back page of this document illustrate annual average temperature change in **Scotland** between 1884 and 2023.*

Contents

Foreword	3
Executive Summary: Our Plan on a page	4
1. Introduction	7
Our Warming World.....	7
2. Main Climate Issues	10
The Past: How has our climate changed?	10
The Future: How is our climate likely to change in future?.....	16
What are the likely impacts?.....	18
What do we need to do?.....	20
3. Our Strategy	22
Purpose of this Strategy	22
Development of the Strategy.....	22
Strategic & Legal Context.....	23
Our Plan for Action.....	24
Strategic Approach.....	27
Governance	35
4. Our Action Plan	36
Programme of Improvement	36
5. Measuring Progress	37
Performance Indicators.....	37
Monitoring and Reporting	37
6. Glossary	38
7. Key References	41

See also:

Appendix 1. Climate Risks and Opportunities for Stirling

Appendix 2. Strategic and Legal Context.....

Foreword

Foreword

The extraordinary range of climate-related records that have been broken around the world in the last couple of years provides stark evidence of how severely human-caused global heating is supercharging extreme weather. Studies assessing how much worse the consequences of extreme weather are with global heating show that the burning of fossil fuels has so dramatically changed the climate that the impacts are hitting communities with a severity and frequency not seen during the entire development of human civilisation.

Impacts range from abnormal heat in Antarctica to wildfires raging across Canada, Hawaii and southern Europe; heatwaves over USA, China, North Africa and the Middle East; record rainfall in Japan, northern India, Greece and California; and severe flooding in Libya, Spain and across southern England. This is a new world for which our towns, cities, roads, hospitals, farms and businesses are largely unprepared, and a world that is becoming more dangerous every day as greenhouse gases continue to be pumped into the atmosphere.

Stirling Council formally recognised the Climate and Nature Emergency in October 2019 and subsequently developed our Emergency Plan for 2021-2045. That Plan identifies adapting to the impacts of our changing climate as one of 5 key areas for action and this Climate Adaptation Strategy outlines our objectives to plan and prepare for those impacts.

Delivering the objectives in this Strategy requires action not only from all Council services, but also needs the input of public, private and third sector organisations, individuals, communities and visitors to the area. This means we need everyone working together to inspire and deliver the changes needed to tackle this major challenge of our time so that we achieve a more secure, resilient future for everyone in the Stirling area, and beyond.

[Insert Signature]

Executive Summary:

Our plan on a page

What is the Climate Adaptation Strategy?

This document outlines the steps we need to take to prepare for the effects of climate change across the Stirling Council area. It summarises the potential impacts and risks arising from our changing climate. It then sets out our Vision, Outcomes and Objectives to begin guiding Council activity that aims to reduce and minimise those impacts. An accompanying Strategy Action Plan outlines tasks the Council will be taking, in collaboration with key partners, to support delivery of the Strategy. A set of Appendices containing more detail on climate risks and relevant legislation completes the package.

Why do we need to act?

For many decades, scientists have warned consistently of a future marked by extreme climate conditions because of escalating global temperatures caused by human activities that release harmful greenhouse gases into the atmosphere (Figure 1). We are now seeing those predictions play out as weather trends reveal new climate-related records and deeply concerning patterns of climate-related disasters. Unfortunately, limited progress is being made to slow humanity's emissions of climate changing gases. This means we need to be taking action to prepare for the inevitable changes now built into global climate systems.

Our Vision is for: A well-prepared, collaborative and climate resilient Stirling.

We will know we have achieved this vision when Stirling Council is an organisation that understands how climate change will affect our area, our businesses and our communities and works actively with others to reduce our exposure to climate risks and to capture new opportunities to transform Stirling into one of the best prepared, climate resilient areas of Scotland.

Delivered through four Objectives

1. Develop and maintain a clear understanding of climate impacts, risks, opportunities, and adaptation actions in collaboration with key partners
2. Ensure the resilience of our buildings and critical infrastructure to local climate impacts
3. Protect and enhance our natural environment
4. Encourage and support individual and community resilience

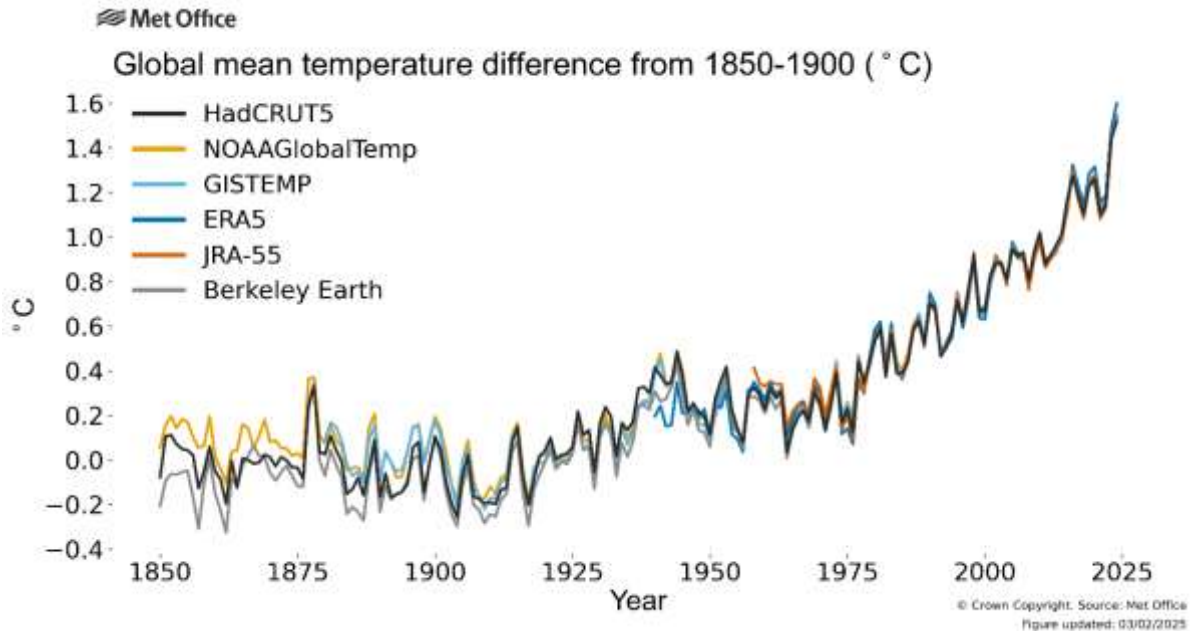
Urgent Action Required

We are entering unfamiliar territory as the climate crisis pushes us well outside the range of conditions that allowed human civilisation to flourish (Figure 2). Our world is warming and climates that were once familiar and predictable are becoming increasingly volatile and erratic. This Climate Adaptation Strategy outlines the initial steps required to begin transforming the Stirling Council area into a climate-resilient place for all.

Executive Summary:

What the data says

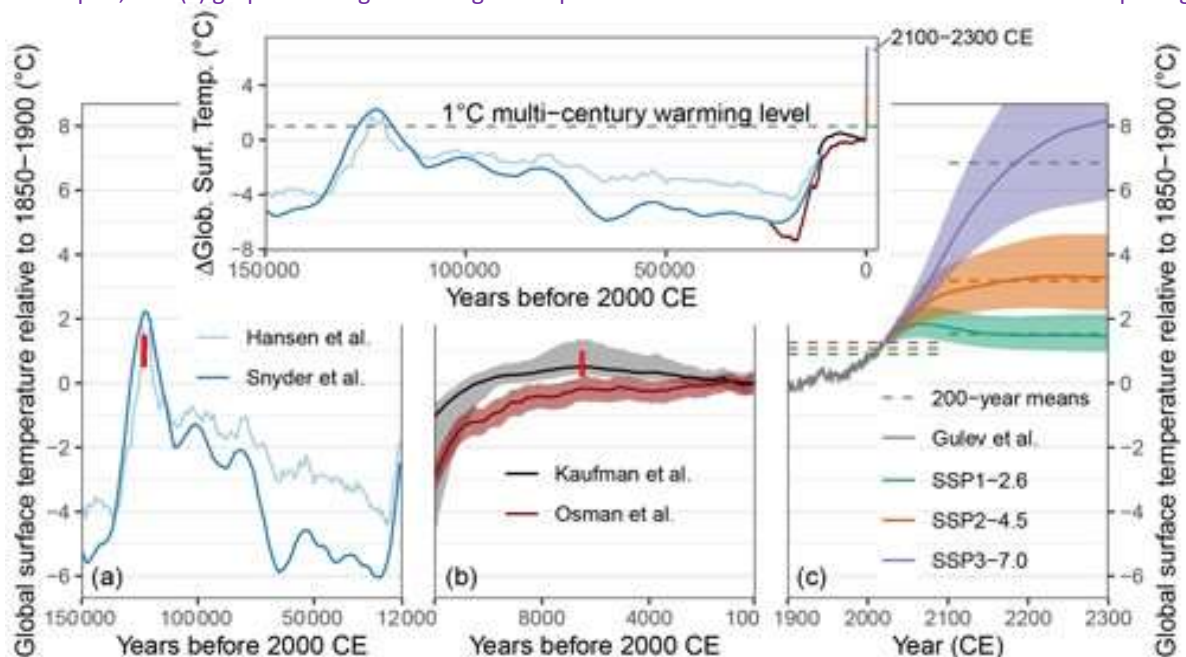
Figure 1. Global average temperature rise since 1850-1900 (using range of data-sets)
Graph shows a gradual increase in temperatures since the industrial revolution that speeds up in the 1970s.



Source: Met Office Climate Dashboard. Annual global mean temperature difference from pre-industrial conditions. Available at [Global temperature | Climate Dashboard \(metoffice.cloud\)](https://www.metoffice.gov.uk/global-temperature). Contains public sector information licensed under the Open Government Licence v3.0.

Figure 2. Global surface temperatures over 150,000 years (relative to 1850-1900).

Three timescales show (a) pre-historic heat then the last ice ages, (b) stable climate when human civilisation developed, and (c) graph from Fig. 1 feeding into 3 potential future scenarios. All three combined in top image.



Source: Copernicus Publications - European Geosciences Union. Technical note: Past and future warming – direct comparison on multi-century timescales. Available at <https://cp.copernicus.org/articles/18/911/2022/>. Copyright © 2022 by the Author(s) 2022. Distributed under the Creative Commons Attribution 4.0 License. CE = Common Era (aka AD).

Executive Summary:

Taking Action

Delivering Change

Successful delivery of this Strategy will depend on the availability of resources and positive collaboration with partners, other organisations and local communities.

The following list, while not exhaustive, includes a range of stakeholders, each of which has an important role to play in our transition to a well-prepared, climate resilient future:

- Community Planning Partnership and Sustainable Stirling Partnership (SSP)
- Loch Lomond & Trossachs National Park (LLTNP)
- Forestry & Land Scotland (FLS)
- Forth Climate Forest and Scottish International Environment Centre
- TreeLink
- Central Scotland Green Network (CSGN)
- Scottish Environment Protection Agency (SEPA)
- Nature Scot
- Scottish Flood Forum
- Transport Scotland (TS), TACTRAN
- Scottish Water (SW)
- Forth Fisheries Trust
- Utility Companies (SSE, SSEN)
- Emergency Services (Fire & Rescue Service, Police Scotland)
- NHS Forth Valley
- Historic Environment Scotland (HES)
- Farming and land-owning groups and individuals
- Community Councils, Community Resilience Groups
- Forth Environment Link (FEL) and Forth Climate Action Hub
- Keep Scotland Beautiful (KSB)
- University of Stirling, FV College and student groups
- Stirling schools and pupil groups
- FV Chamber of Commerce, Stirling Enterprise Park (STEP), Go Forth Stirling / BID
- Trade Unions
- Adaptation Scotland and Sustainable Scotland Network (SSN)
- Scottish Government, CoSLA, Clackmannanshire and Falkirk Councils

Actions the Council will be taking to support delivery of our Adaptation Strategy are given in a separate Action Plan document, which will evolve in response to changes in knowledge, understanding, legislation, guidance, and availability of resources.

1. Introduction

Our Warming World

Our Warming World

The Earth is warming and, with more energy entering the atmosphere, climates that were once familiar are becoming increasingly disrupted and less predictable. The continued addition of global warming greenhouse gases from human activity will only increase and intensify the climate impacts already being experienced.

Research has shown that, if humanity sharply cuts emissions to near zero, global temperatures could stop rising within 5 years. This could keep alive the aim to maintain global average temperature increase below a 2°C rise above pre-industrial levels (agreed in Paris at COP 21 in 2015). That level would, however, bring violent storms, significant flooding, devastating droughts, and problematic sea-level rise, but would avoid even more damaging consequences. Average global temperature has already risen by around 1.5°C since the industrial revolution but, without further commitments, current national pledges commit us to around 2.7°C or more of warming by the end of this century (Figure 3).

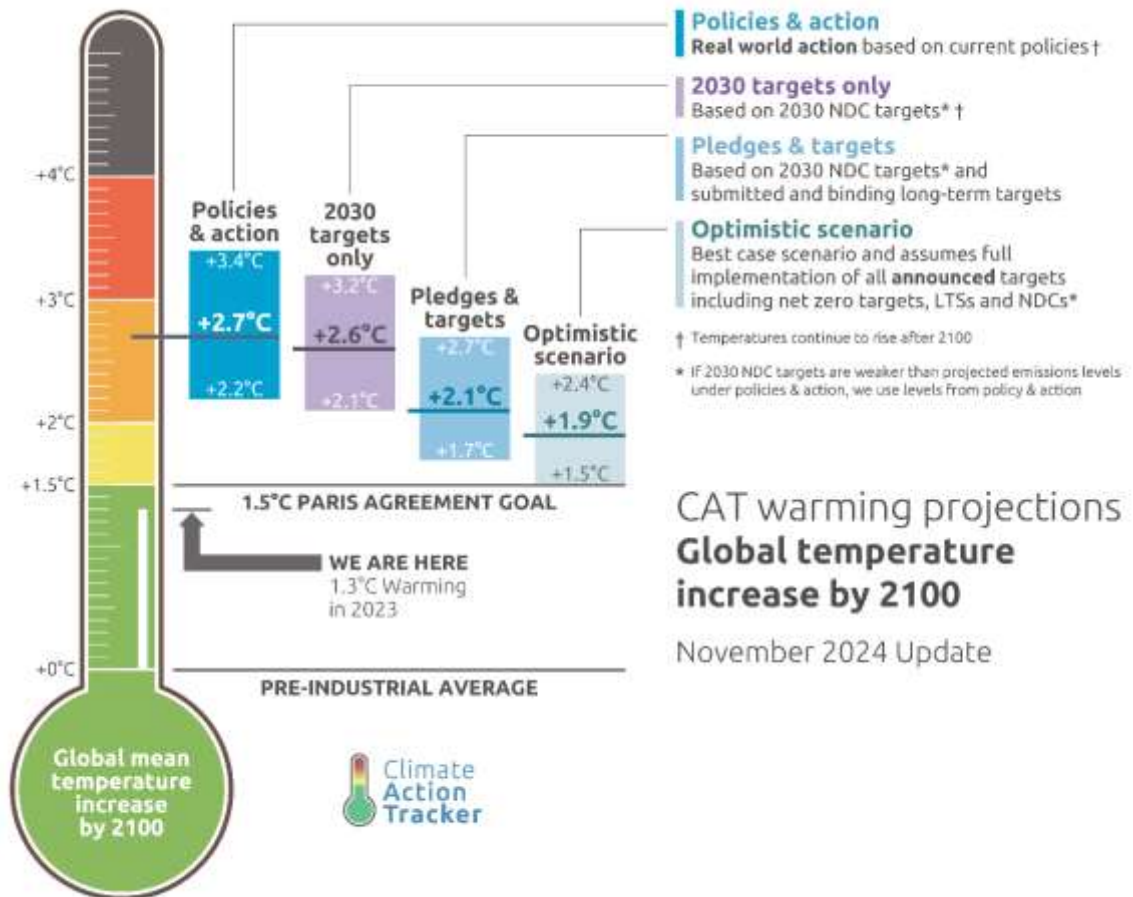
As the stable climate in which agriculture and human civilisation developed disappears, our conventional food system is coming under increasing pressure and is unlikely to be able to feed 10 billion people on a hot, resource-stressed planet. Everybody needs to eat every day and history shows that, if they don't, wars break out: two thirds of the wars fought in the last 100 years are said to have originated in disputes over food, land or water. Hundreds of thousands of people are already moving from less secure to more secure regions of the world every year and this movement is likely to increase.

To meet these challenges, we first need to understand how a warming world can and will impact on all elements of modern life and then use this understanding to prepare for the changes anticipated. Actions to plan and prepare for the impacts of a changing climate are known as Climate Adaptation and include preparing for heavy, intense rainfall episodes, increased flooding, extended droughts, and the consequences of extreme weather events impacting upon our global supply chains and other international dependencies.

1. Introduction

Our Warming World

Figure 3. Global Warming Projections: Policies, Pledges and Actions



NDCs = Nationally Determined Contributions; LTSs = Long-Term Strategies

Source: Climate Action Tracker (2024). The CAT Thermometer. November 2024. Available at: <https://climateactiontracker.org/global/cat-thermometer/> Copyright © 2024 by Climate Analytics and New Climate Institute. All rights reserved

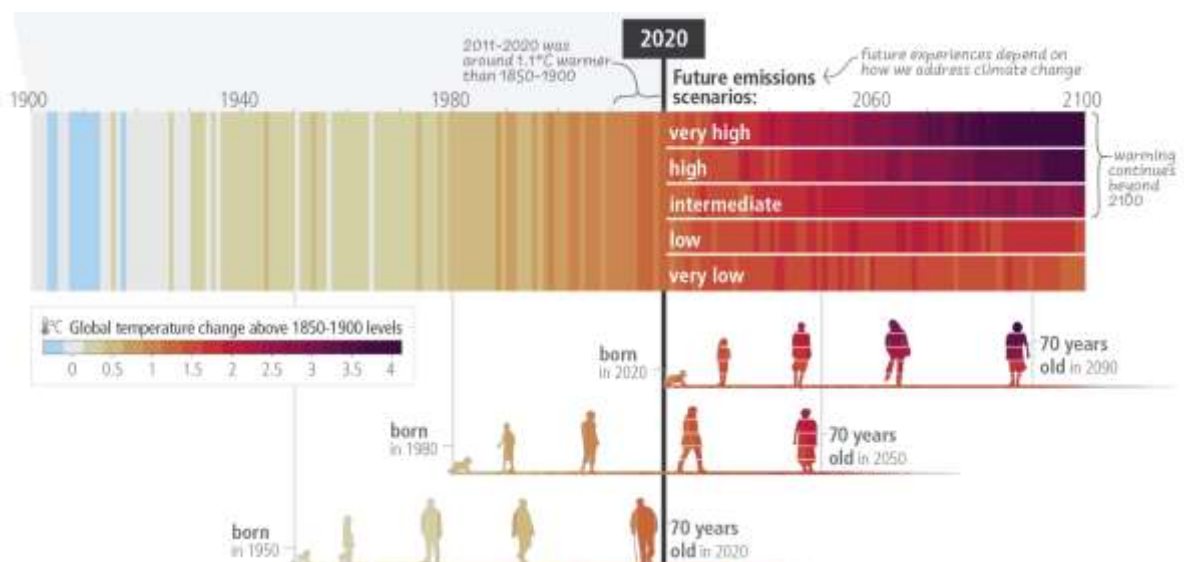


1. Introduction

Our Warming World

Scientific evidence indicates that we need to start preparing today for the impacts of a warming planet, while also continuing to reduce current and future greenhouse gas emissions (Figure 4). If we wait for more severe climate breakdown before developing preparedness strategies, we risk being poorly equipped to manage the economic, social and ecological consequences, or able to take advantage of any benefits. As changes in climate occur, it is expected there will be significant impacts on our built, natural, and social environments. This means that buildings, roadways, bridges, flood and storm-water control systems, parks, woodlands, public health systems, and other aspects of our communities will be affected. Some of these changes will have disastrous consequences for social well-being and our economic prosperity if no coping or adaptation measures are put in place. But it should also be borne in mind that there are limits to the amount of heat and associated impacts we will be able to adapt to: a rapid reduction in emissions to near zero is by far the best adaptive response to make sure humanity survives and thrives, along with the rest of the living world.

Figure 4. Current and future generations' experience is dependent on near-term choices



Source: Inter-governmental Panel on Climate Change 6th Assessment Report: Synthesis Report (IPCC AR6 SYR), March 2023. Figure SPM.1c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term. Available at [Figure AR6 WG2 \(ipcc.ch\)](https://www.ipcc.ch)

2. Main Climate Issues: Observed Changes



This section first considers observed changes in our PAST climate then goes on to look at likely changes the science indicates for the FUTURE climate¹.

The PAST: How has our climate changed?

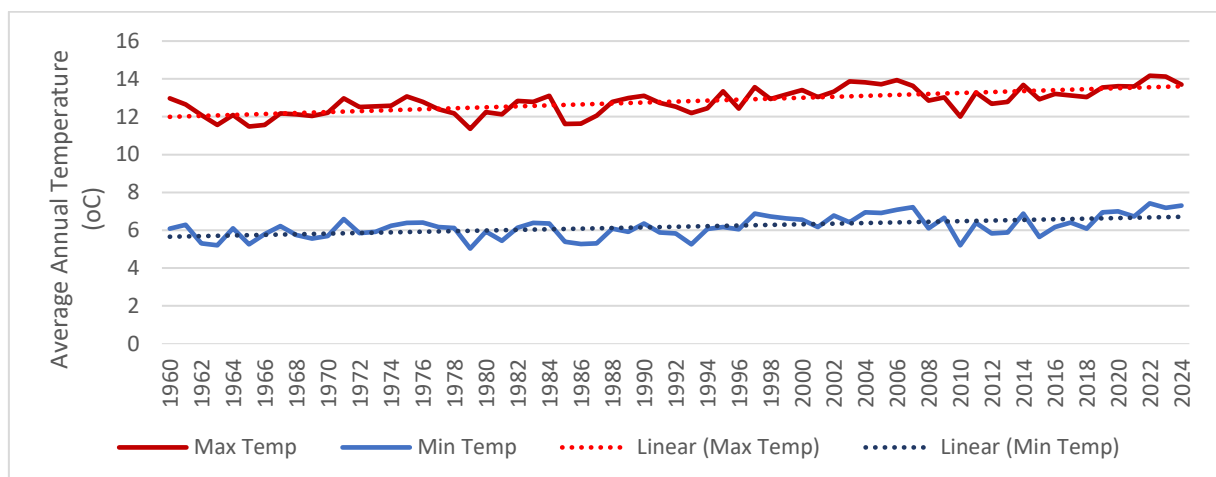
Over the last few decades, Scotland has experienced a warming trend, shifting rainfall patterns and rising sea levels. The weather extremes experienced are also changing, with our hottest days getting hotter and our wettest days getting wetter.

Temperature

In Scotland, the 10 warmest years recorded since 1884 have all occurred since 1997. The year 2022 was the warmest on record, measuring 1.5°C more than the 1961-90 average and 0.8°C more than the 1991-2020 average. The recent decade of 2013-2022 had 3% fewer days of air frost and 10% fewer days of ground frost per year compared with 1991-2020, and 14%/29% fewer than 1961-1990. This indicates substantial changes in Scotland's climate.

Based on the Central England Temperature record (the longest instrumental temperature record in the world), the 21st century has been warmer than any 20-year period in the previous three centuries, with the top 5 warmest years occurring since 2006. The same dataset shows that the 2009-2018 decade was around 1°C warmer than the pre-industrial period (1850-1900), with a similar trend observed around the world. All the top 10 warmest years across the UK have occurred in this century, but none of the top 10 coldest years.

Figure 5. Annual Average Temperature near Stirling, 1960-2024



Source: Met Office Historic Station Data for Paisley (closest to Stirling @ 27 miles). Available at [Historic station data - Met Office](#). Contains public sector information licensed under the Open Government Licence v3.0. Shortage of suitable data nearer to Stirling should resolve over time.

¹ Information from the third UK Climate Change Risk Assessment Technical Report Summary for Scotland, Central England Temperature series, and the Met Office State of the Climate 2022 Report (see Key References).

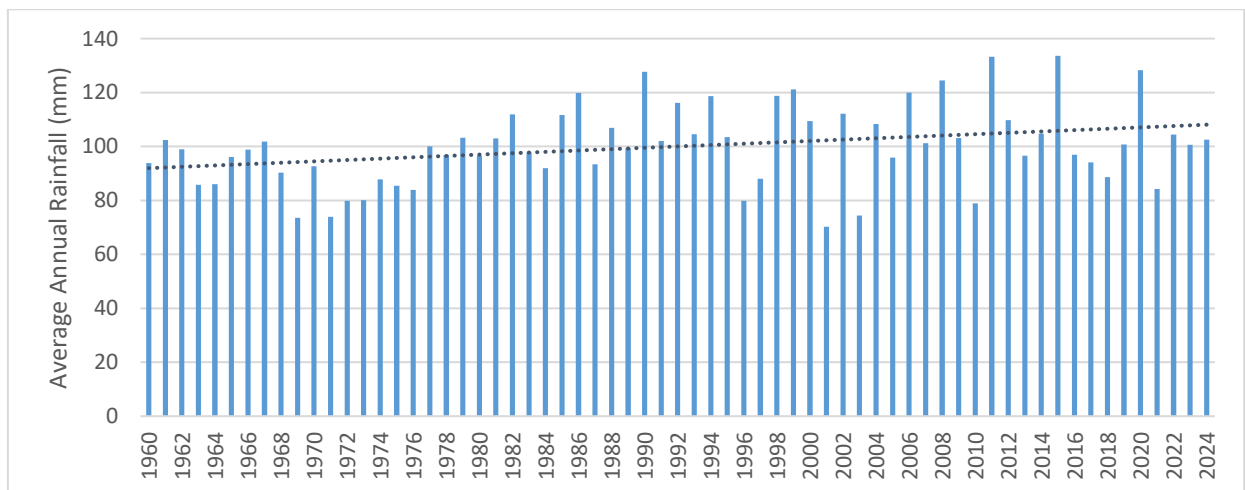
2. Main Climate Issues: Observed Changes

Rainfall

Although the UK's climate is getting wetter, there is large annual variability making it difficult to identify clear trends. Much of this is due to differences between the seasons, but changes between prolonged periods of constant rain and shorter periods of more intense rain are also lost in annual averages.

In the past few decades, rainfall over Scotland has increased, with an increasing proportion coming from heavy rainfall events. There has been a marked increase in winter rainfall in the most recent decade. Rainfall in summer has also increased, while spring rain has decreased slightly and there has been little change in autumn rain. Five of the 10 wettest years in the UK series from 1836 have occurred in the 21st century, but none of the driest years.

Figure 6. Annual Average Rainfall near Stirling, 1960-2024



Source: Met Office Historic Station Data for Paisley (closest to Stirling @ 27 miles). Available at [Historic station data - Met Office](#). Contains public sector information licensed under the Open Government Licence v3.0. Shortage of suitable data for rain gauges nearer to Stirling should resolve over time.

Weather extremes

Many of the UK's extreme monthly temperature records have been set in the most recent decade, with more reflecting high rather than low temperature extremes. There is a growing body of evidence for changes in the frequency and intensity of high-impact weather events, such as extreme daily rainfall and heatwaves. New records are being set more frequently, with the UK experiencing unprecedented high temperatures and heavy rainfall.



2. Main Climate Issues: Observed Changes

Sea level rise

Mean sea level around the UK has risen by approximately 1.4mm a year to about 17cm since the start of the 20th century. The increase has been less in Scotland than the south of England as the land continued to rise in response to loss of ice since the end of the last ice age. This sea level trend is expected to continue, with the extent of increase dependent on the amount and rate of ice melt from land, especially at high latitudes (i.e. Antarctica, Canada and Greenland).

Phenology

Phenology is the study of periodic events in life cycles and how these are influenced by variations in climate between seasons and between years. Examples include the date leaves and flowers appear, the first flight of butterflies, the first and last sightings of migratory birds, and dates for leaf fall by deciduous trees.

Records show that the overall period of active plant growth each year is lengthening, with the Met Office estimating it to be, on average, a month longer during the past decade compared with 1961 to 1990.

- Spring events like budburst, leafing and flowering are getting earlier
- Fruiting of trees and shrubs is getting earlier
- Late autumn events, such as leaf fall, may be delayed.

Because these life cycle events are very sensitive to small variations in climate, especially to temperature, phenological records can be a useful proxy for temperature in estimating historical climates. As well as providing a longer historical baseline than direct temperature measurements, phenological observations can provide detailed indications of ongoing changes related to global warming.



Case Studies: Recent Extreme Weather Events

CASE STUDIES: Recent Extreme Weather Events

Torrential Rain:

Flash flooding, 24 June 2019 (Stirling City).

Around an hour's torrential rain caused flash flooding that affected many roads and properties in Stirling. A river of water flowed down Spittal Street and Friar Street into Murray Place, severely impacting many businesses and the Council's contact centre was flooded, significantly affecting information exchange about the event. At Craig's roundabout, flood water rushed down underpass steps then over-topped the roundabout to flood back out onto the carriageway and impede traffic. Stirling's Sainsbury's store on Drip Road had to close as water poured from the ceiling, as did Tesco's on Wallace Street after rain brought down part of that ceiling. Stirling Fire and Rescue Service's Water Rescue Unit helped 14 people from Stirling County Rugby Club trapped due to flooding at Causewayhead, while canoeists made the most of a temporary lake at a nearby road junction between Dumyat and Dunster Roads.



Photo: Mr Jamie Grant

Case Studies: Recent Extreme Weather Events

Strong Winds:

Storm Arwen, 26 into 27 November 2021 (*across the Stirling Council area*).

A rare red warning for wind was issued by the Met Office for coastal areas along eastern Scotland. An unusual wind direction from the north and north-east (rather than the usual south and west), caused greater damage than would normally be expected. Winds in parts of Stirling reached 96 mph during the storm. More than 5 times as many power faults as any weather event in the area in 20 years were recorded. Around 350 homes were left without power for 7 days after winds brought down trees and power lines. Killin, Callander, Doune and Port of Menteith had supplies cut off after main transport routes were blocked.

Across Scotland, it has been estimated that 16 million trees were lost or damaged, while Scottish & Southern Electricity Networks (SSEN) estimated 135,000 homes lost power. The event led to the Scottish Resilience Partnership developing a Winter Preparedness Programme to ensure Scotland is better prepared for significant weather events in future.



Case Studies: Recent Extreme Weather Events

Extreme Heat: 19 July 2022 (across the UK).



The UK experienced an unprecedented heatwave in July 2022, with extreme temperatures recorded on both 18th and 19th of the month. Coningsby in Lincolnshire recorded 40.3°C on 19th July, setting a new UK record by a margin of 1.6°C. Several other weather stations across England also exceeded 40°C, while a new Scottish temperature record of 34.8°C was experienced in Chartershall in the Borders, beating the previous record by 1.9°C (32.9°C at Greycrook in the Borders, 9 August 2003). The World Weather Attribution Service found global warming made the heatwave 4°C hotter and 10 times more likely.

The heat brought challenging conditions for the NHS, with a spike in 999 calls, and care services supporting the elderly and vulnerable were put under

increased stress. There were over 1,000 estimated excess deaths in those aged 65 and over in England during this event. Multiple fires broke out and several fire services declared major incidents. Network Rail issued a 'do not travel' warning and rail services were severely disrupted due to tracks buckling and overhead cables sagging. There were some problems with power cuts in the North and East of England, and several fatalities associated with open water swimming were recorded.

2. Main Climate Issues: Projected Changes



The FUTURE:

How is our climate likely to change in the future?

Climate change trends for the UK were published in the 2018 Climate Projections (UKCP18)² and show an increased chance of warmer, wetter winters and hotter, drier summers, along with an increase in the frequency and intensity of extreme weather events.

Climate projections indicate that the changes we have already experienced in our climate over the last century will continue and also intensify over the coming decades. The amount of change that takes place will depend on how successful we are in reducing greenhouse gas emissions globally.

Temperature

Average annual temperatures in Scotland are expected to rise by approximately 1.2°C by the 2050s and by up to 2.0°C by the 2080s (from a 1981-2000 baseline). Under a medium emissions scenario, an extreme year such as 2022 would be considered an average year by around 2060 and a cool year by 2100 for the UK. Temperatures of 40°C are likely to be seen once every 15 years, and as frequently as every 3-4 years under a high emissions scenario.

Rainfall

Rainfall is a complex variable and annual mean rainfall figures will mask many potential aspects of future changes. This includes distribution throughout the year (such as winter rainfall increasing compared with summer rainfall decreasing), changes in dry periods, or changes in rainfall intensity in wet weather.

In winter, rainfall is expected to increase by around 7% by the 2050s and by between 7 and 13% by the 2080s (from a 1981-2000 baseline). This is expected to lead to an increase in the likelihood of flooding of infrastructure, businesses, and homes. In contrast, summer rainfall is expected to reduce by around 7% by the 2050s and by between 12 and 16% by the 2080s, with periods of water scarcity more common.

Despite overall drying trends for summers in the future, data suggests an increase in the intensity of heavy summer rainfall events. This has implications for how we manage water and, for urban areas particularly, this will impact on the frequency and severity of surface water flooding.

² <https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf>

2. Main Climate Issues: Projected Changes



Weather extremes

More extreme heatwave events causing impacts for people's health and wellbeing are likely to become more common, with their severity dependent on global efforts to reduce greenhouse gas emissions. The frequency and intensity of extreme temperature and rainfall events are also likely to increase, with many areas likely to see daily temperatures higher than 30°C more often, while the intensity of rainfall is expected to increase by as much as 25%. Despite summers becoming drier with less frequent wet days, when it does rain the rainfall will be more intense.

Sea level rise

Scenarios for Edinburgh estimate sea level rise of between 12 and 18 cm by the 2050s, and by around 23 to 54 cm by the 2080s, compared with a 1981-2000 baseline. Such rises would lead to an increase in the likelihood of flooding of coastal communities and infrastructure.

Phenology

Ongoing changes to life cycle events will affect food chains for plants, insects and birds, with some species potentially falling out of sync with each other because each responds individually and at different rates to rising temperatures. The abundance and geographical range of different species are likely to change, with some becoming locally extinct in areas that become less favourable.

2. Main Climate Issues: Climate Impacts & Risks



What are the likely impacts?

Climate Risks and Vulnerabilities

Global warming is most visible when seen through changes in the intensity and frequency of disasters, such as **storms, floods, heat waves, and wildfires**. With the prospect of more frequent extreme weather events, we need to be able to prevent, protect and recover from such events. This means moving people and assets out of harm's way through better planning and investment decisions. At the same time, we need to scale-up efforts to warn and prepare people ahead of disasters - actions that can dramatically reduce the loss of life and also bring high returns on investment. Social safety nets and improvements in forecast-based planning can also help speed up recovery from disasters when they strike.

Risk and Opportunity Assessments investigate the nature and extent of climate-related risks by analysing potential hazards and assessing vulnerabilities that could pose a threat or harm to people, property, livelihoods and the environment in an area. Climate impacts can then be identified for each climate hazard for a range of sectors, with an estimate of how likely they are to occur, the level of impact and the time period for occurrence.

Council officers prepared a briefing paper that summarised global warming implications for Stirling based on evidence for the UK's 3rd Climate Change Risk Assessment (CCRA3) and a Summary for Scotland. Both documents have helped inform this Strategy by assisting the Council to understand how the changing climate is likely to impact the area's people, communities, land, natural environment, buildings, infrastructure, businesses, and international dependencies so that appropriate adaptation measures can be identified and developed (see Appendix 1). More locally-focused risk assessments for the Stirling area will be undertaken as the Council's adaptation work matures.

As extreme weather events are becoming more intense and frequent, the Council and key partners also need to plan for how they will continue delivering essential services during climate disruptions and be good stewards in the management of their own buildings, land and other assets. An overview of the main impacts and likely future risks is given in Table 1. These risk assessment exercises will need to be reviewed regularly to make sure any new risks are identified and incorporated into adaptation plans.



2. Main Climate Issues: Climate Impacts & Risks

Table 1. Current and future weather impacts for Council assets

	Current impacts	Future climate risks
Properties <i>(Domestic & non-domestic)</i>	<ul style="list-style-type: none"> • Over-heating experienced in some buildings with poor design / ventilation. • Some damage to building mechanical, electrical and water services from flooding / water penetration. • Burst pipes from frost / ice. • Damage to buildings and walls from winds & tree fall 	<ul style="list-style-type: none"> • Increased damage from flooding, water penetration, subsidence, high winds and tree fall. • Higher maintenance and repair costs. • Risk of power outages. • Increased need for water efficiency measures and cooling.
Roads / Transport	<ul style="list-style-type: none"> • Travel disruptions from flood water, fallen trees, electricity cables and other blockages. • Damaged road surfaces from flooding and freeze / thaw. 	<ul style="list-style-type: none"> • Higher maintenance and repair costs for road and path surfaces, potholes, and sink holes. • Lifespan of roads, pavements and paths reduced. • Greater travel disruptions.
Land & Water	<ul style="list-style-type: none"> • Fallen and damaged trees. • Damage from dry periods / drought. • Risk of pollution from increased run-off and flooding 	<ul style="list-style-type: none"> • Increasing problems from waterlogging and drought • Increased tree damage & fall. • Longer growing season. • Increase in pests, disease, and risk of wildfires.
Finance	<ul style="list-style-type: none"> • Costs for damage and repair. • Emergency response and recovery. • Costs and demands on staff time from flood response, gritting, snow, tree and debris clearance. 	<ul style="list-style-type: none"> • Increased pressure on budgets. • Increased insurance costs. • More demands for emergency response & recovery. • Disruptions to service delivery. • Impacts on the cost and availability of goods.

2. Main Climate Issues: What do we need to do?



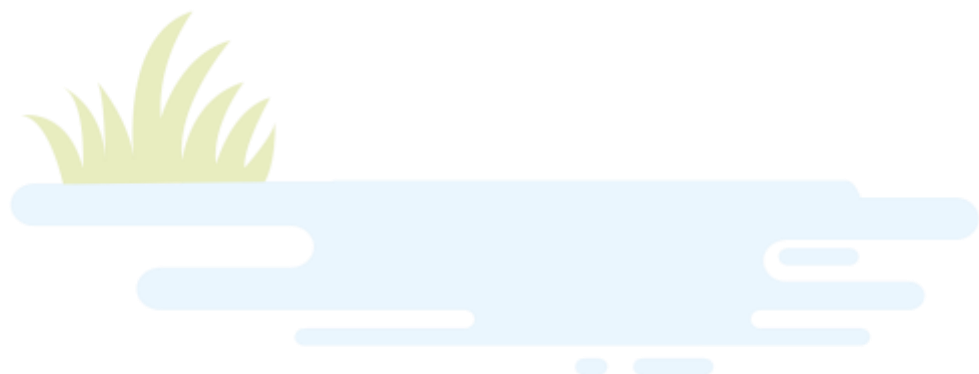
Where do we need to get to?

Challenges & Opportunities

The experience of recent years has shown that global warming and extreme weather events have already impacted many aspects of society and our natural environment, including buildings and property, energy demand, transport, water resources, agriculture, forestry, and health. A well-adapted area needs to change processes, practices, and structures to minimise potential damages and make the most of any benefits from opportunities associated with a changing climate, both locally and overseas.

Improving resilience to direct climatic changes means making adjustments to reduce the impacts of warmer, wetter winters, warmer, drier summers, and more frequent extreme weather events. This requires a whole watershed approach that maximises the ability of the landform and vegetation to slow down the flow of water, store it during periods of scarcity, and cool down urban areas. The built environment also needs to be designed and re-engineered to cope with more unreliable and extreme weather events. Diverse, species-rich natural environments are more resilient to change so conserving and enhancing a mosaic of natural habitats is crucial for maintaining the ecosystem services we rely upon, as well as ensuring that species can migrate. Better access to more diverse local food production will improve food security, while reconfigured national and local economies that integrate more local design, production, and re-use of materials will reduce dependence on increasingly vulnerable global supply chains.

These solutions have wider co-benefits that will also improve air quality, biodiversity, carbon emissions, attractiveness of places, as well as the health and well-being of people and communities. The Council and our partners need to implement adaptation solutions that deal with the impacts of climate change that are already happening, as well as prepare for future impacts, and encourage everyone living and working in the area to do similar.



Climate Distress

As people learn about and begin to understand the risks and impacts of climate change, they can experience difficult and uncomfortable emotions, such as fear, anger, sadness, guilt or despair. They can also feel mixed emotions, such as being both hopeful and worried. These responses are common, appropriate, and a sign that a person is in touch with the severity of the emergency. They can, however, be distressing and difficult to experience, which may lead some people to feel overwhelmed or numb, to want to avoid thinking about climate change, and to suppress or push their emotions away.

Such difficult, distressing emotions can be managed in a healthy way that motivates positive action and helps build psychological resilience. This is important because chronic emotional stress and suppression of emotions over the long-term can have negative impacts on health and wellbeing and can undermine an individual's capacity to deal with the climate crisis.

Resources to help deal with climate distress:

- [Climate Psychologist's recordings on climate distress for adults and children](#)
- [Climate Psychology Alliance Scotland](#) resources (organisations, books, and podcasts)
- [Childline](#) toolkits and games. They can also offer more support, if needed.
- Young.Scot campaign [Aye Feel](#), including information on understanding [climate-anxiety](#)
- [Good Grief](#) Network resources, including a Field Guide to Climate Anxiety.



3. Our Strategy



Purpose of this Strategy

This Climate Adaptation Strategy is a major supporting document that will help to deliver the Council's Climate & Nature Emergency Plan. It provides a framework for the Council to work with key partners in the area to deliver actions that will help us adapt to the climate impacts coming our way. In doing so, we will ensure more resilient, green, prosperous and healthy people and places.

The Strategy identifies and sets out our response to the increasingly dangerous risks associated with our changing climate caused by global heating. It then identifies outcomes and objectives supported by tasks that will better prepare us for dealing with the expected consequences of those risks. These tasks revolve around protecting and enhancing our surroundings to ensure a resilient environment that will help people and wildlife adapt to our changing climate.

The Strategy is also the Council's main method for meeting our Public Bodies' Climate Adaptation Duty, as laid out in the Climate Change (Scotland) Act 2009.

Development of the Strategy

To create this Adaptation Strategy the Council:

- Carried out a desk-top analysis of strategic-level climate risks likely to affect the Stirling Council area to identify issues of concern.
- Established a senior Advisory Group to steer development and delivery of our strategic approach to remove or minimise identified climate risks.
- Established a cross-service Working Group to propose and agree practical solutions and actions from across our organisation to better prepare and protect local infrastructure, people, organisations, and Council assets from identified risks.

This Climate Adaptation Strategy was developed by regular meetings of officers from Stirling Council and discussion with key partners in the Sustainable Stirling Partnership. The Vision, Outcomes, and Objectives have been influenced by the policy context (set out on the next page and Appendix 2) and more detailed background information collected from several sources, summarised in the Main Issues section above.

All elements of the draft Strategy have been further refined through internal and external consultation, with the final Strategy shaped by the information and opinions gathered. The objectives and tasks listed in the Strategy Action Plan show how we will begin tackling the Council's adaptation priorities to achieve the Strategy's over-arching Vision.

3. Our Strategy: Strategic & legal Context

Strategic & Legal Context

Stirling’s Climate Adaptation Strategy is directed and supported by a range of legislation, regulation, strategies, policies and plans at international, national and local levels (see diagram below). It is important to consider these to ensure compliance but also to provide justification for delivery and funding of projects that emerge from the Strategy. Further details of the most relevant documents can be found in Appendix 2.



3. Our Strategy: Plan for Action

Our Plan for Action

This section outlines our strategic framework for tackling the impacts of climate change.

The Strategy will help achieve several of the council's **10 Key Priorities**, especially:

Priority 8: *Tackling the climate and nature emergency and pursuing our net zero ambition through action.*

It will also fulfil **Objective 5** of the Council's Climate & Nature Emergency Plan, to:

Plan and prepare for the impacts of climate change.

Our Vision

A well-prepared, collaborative, and climate-resilient Stirling

We will know we have achieved this vision when Stirling Council is an organisation that understands how climate change will affect our area, our businesses and our communities. The Council will work actively with critical agencies and partners to reduce our exposure to climate risks and to capture new opportunities, making Stirling one of the best prepared, climate resilient areas of Scotland.

Our Outcomes

This strategy will result in four main outcomes:

1. Awareness and understanding of risks, opportunities, and adaptation actions.
2. Resilient buildings and infrastructure.
3. Protected and enhanced natural environment.
4. Engaged and supported communities.

Our Objectives

To help us achieve the **Vision** and associated **Outcomes**, we have established a set of **Objectives**, divided into four thematic areas. These provide a focus for tackling climate adaptation by the Council and pave the way for making the outcomes and vision a reality. Each Objective is divided into four **Sub-objectives** designed to capture the breadth of activity required to deliver climate resilience for the Stirling Council area. The approach is outlined in the table on page 25.

The Strategy Vision will be delivered by a set of **Actions** aligned with the four objectives, while **Indicators** of delivered actions will identify progress, support monitoring, and help us understand where improvement is required. These are outlined in a separate Action Plan.

3. Our Strategy: Guiding Principles

Our Guiding Principles

The following guiding principles will be embedded throughout climate adaptation activity:

1. Our approach will put **people first** by placing them at the heart of all that we do.
2. We will listen to and engage with experts to ensure an **evidence-based** approach.
3. Climate justice and a **just transition** will be embedded within our approach.
4. We will encourage **participation** through two-way dialogue on climate change.
5. Our approach will be **inclusive and accessible** to all.
6. We will be **open and transparent** to make sure people can see and understand our actions.
7. We will take a **positive approach** by promoting the many benefits of taking climate action.
8. We will maintain **appropriate governance** and support to ensure delivery.



3. Our Strategy: Climate Adaptation Framework

Climate Adaptation Framework	
Stirling Council: Key Priority 8	<ul style="list-style-type: none"> Tackling the climate and nature emergency and pursuing our net zero ambition through action
CaNE Plan: Objective 5	<ul style="list-style-type: none"> Plan and prepare for the impacts of climate change
Climate Adaptation Strategy Vision	<ul style="list-style-type: none"> A well-prepared, collaborative and climate-resilient Stirling
Outcome	Objective and sub-objectives
1. Awareness and understanding of risks, opportunities & adaptation actions	<p>Develop and maintain a clear understanding of climate impacts, risks, opportunities, and adaptation actions in collaboration with key partners</p> <ol style="list-style-type: none"> Undertake research Promote and build awareness Encourage new and ongoing joint planning and response Promote and support engagement and participation
2. Resilient buildings & infrastructure	<p>Ensure the resilience of our buildings and critical infrastructure to local climate impacts</p> <ol style="list-style-type: none"> Protect buildings and historic assets Resilient and responsive transport Secure utilities and communications Manage flooding, shade & shelter
3. Protected and enhanced natural environment	<p>Protect and enhance our natural environment</p> <ol style="list-style-type: none"> Make space for nature Maintain healthy soils Protect and expand tree and woodland habitat Protect wetlands, watercourses, and coastline
4. Engaged and supported communities	<p>Encourage and support individual and community resilience</p> <ol style="list-style-type: none"> Ensure prepared individuals and communities Promote health and wellbeing Build resilience in the local economy Encourage food security and resilient supply chains

3. Our Strategy: Strategic Approach



Strategic Approach

This section outlines considerations and activities that will help deliver each of the outcomes and objectives in our Climate Adaptation Framework.

Outcome 1. Awareness and understanding of risks, opportunities & adaptation actions

One of the biggest challenges in tackling climate change is public recognition of the risks and acceptance of the changes needed to reduce those risks. This is especially the case where there is a perception that changes might have a negative impact on current lifestyles, familiar habits, or be costly to implement. A better awareness and understanding of the seriousness of the risks to life, property, income and the wider economy from the changing climate versus the benefits of action should help address many concerns.

There are two types of adaptive solutions: top-down, such as government policy and regulations, and bottom-up, led by community demand for change. Success in reducing climate impacts will require both types of solution to be implemented.

The scale of the climate challenge is so great it needs everyone to play their part, working together to achieve an effective response. No single entity has all the answers, requiring ongoing consultation and engagement to promote understanding of the issues and options to find the most appropriate decisions and reach consensus on the best way forward.

Objective 1 Develop and maintain a clear understanding of climate impacts, risks, opportunities, and adaptation actions in collaboration with others.

1.1 Undertake research

Research into climate impacts for the area, potential responses and practical solutions will help to identify future challenges and potential tools to help take effective initial action.

Improved identification, analysis and management of reliable and accurate data will help inform Council decision-making and promote continuous improvement in performance. Adaptation information will be included in the Council's platform for collating, monitoring and reporting the Council's Climate and Nature Emergency Plan. The Council will also identify, examine and strengthen delivery of our climate priorities through our procurement processes, including how we can support our suppliers to build climate resilience.

1.2 Promote and build awareness

Engaging local people to improve understanding of climate change issues and the benefits of adaptation will support our strategic approach. The Council will lead work with Community Planning Partners, Locality Partnerships, schools, young people, businesses, communities

3. Our Strategy: Strategic Approach

and individuals to raise public awareness of the need to tackle climate change and the vital role each has to play. This will include a clear communication plan that uses a range of communication methods to make sure information is accessible, consistent and relevant.

1.3 Encourage new and ongoing joint planning and response

Tackling the enormity of the climate emergency requires a collaborative approach that reaches beyond traditional boundaries and brings together organisations from across central Scotland and beyond. Partnerships between public, private and third sector organisations will help to develop and monitor the area's adaptation response, making sure plans are balanced and effective.

1.4 Promote and support engagement and participation

The Council alone cannot deliver all that is required for the Stirling area to adapt adequately to the impacts of climate change. Everyone will be affected by climate impacts and need to be involved in reaching the best decisions and solutions to make sure the local area is fully prepared for the coming changes.



3. Our Strategy: Strategic Approach



Outcome 2. Resilient Buildings and Infrastructure

Our critical ‘grey’ infrastructure (roads, railways, power, sanitation, sewers, and communications systems) needs to be designed and managed to withstand current and future climate impacts. This will make sure our aspirations for the economy are realised and productivity levels are not severely constrained. Climate-proofing existing infrastructure and building new infrastructure that is more climate resilient makes sound economic sense, with benefits generally outweighing up-front costs.

We need to think beyond protecting individual assets to ensuring that whole systems are more resilient by making the right choices about where and what to build, which existing assets to upgrade, prioritising green infrastructure wherever applicable, and ensuring infrastructure continues to work, even as damages occur. We also need a clear understanding of user’s reliance on infrastructure networks to be able to target improvements to support both individual and collective resilience. Adaptation considerations also need to be integrated into all stages of project development, management and maintenance of any infrastructure the Council maintains and manages.

Objective 2 Ensure the resilience of our buildings and critical infrastructure to local climate impacts

2.1 Protect buildings and historic assets

Planning for current and projected changes to our climate by modifying design requirements and maintenance programmes will help ensure our buildings are resilient, people are kept safe, and ongoing costs are kept low. Improvements include upgrades to roofs, external rendering, gutters, downpipes and water efficiency measures and appliances. Changes to the care and management of historic sites and buildings will be needed to make sure the Stirling area’s valued heritage can be protected and preserved for the benefit of future generations.

2.2 Resilient and responsive transport

Making local transport infrastructure resilient to the impacts of increasingly erratic and severe weather requires long-term planning, regular assessment, and close collaboration with partners to make sure people are protected and able to continue to live fulfilling lives. Potential actions include opening some culverted watercourses, reducing hard engineering in open channels, and increased use of permeable surfaces, sustainable urban drainage systems (SuDS), and swales in car parks and around our buildings.

3. Our Strategy: Strategic Approach

2.3 Secure utilities and communications

Innovations, collaboration and forward-thinking will help keep critical communications, energy and water infrastructure secure, efficient and reliable. Actions include ensuring that main services and plant rooms servicing buildings are not exposed to flood risks. A resilient digital infrastructure will require smart solutions to monitor change and inform remedial action to support a more flexible response to extreme weather impacts.

2.4 Manage flooding, shade & shelter

Many organisations and individuals are involved in flood risk management. The causes and effects of flooding are complex, and issues cross the boundaries of neighbouring authorities as well as the responsibilities of different organisations. To be successful, flood risk management requires collaboration and coordination between those responsible for flood management, along with a commitment to work in partnership with other organisations and stakeholders who can contribute to the sustainable management of flooding. Partnership working sits at the heart of our flood response.

Integrating blue and green features and modified leisure facilities into public open space can build resilience by providing an effective defence against the elements when required. Nature-based solutions, such as green roofs, rain gardens and street trees, can help reduce flood risk by slowing the flow of rainwater, provide shade and shelter, and create spaces of interest for people and wildlife. Actions include supporting re-naturalisation projects and modelling to identify appropriate natural methods for flood storage areas, continued use of CCTV and gauges to support a faster response in reducing the risk and impacts from flooding, continued development and delivery of flood risk and surface water management plans, and increased rainwater capture to reduce the need for mains water in green spaces.



3. Our Strategy: Strategic Approach



Outcome 3. Protected and Enhanced Natural Environment

Use of nature is one of the most cost-effective and enduring solutions to the climate crisis: natural features such as marshes, individual trees and woodlands act as natural barriers to flooding and over-heating while also filtering out harmful sediments and air pollutants. Successful adaptation will require scaled-up investments in healthy watersheds and water infrastructure, improvements in efficiency of water use, and the integration of flood and drought risk at every level of planning and operation. Well-protected, intact ecosystems and migration corridors will also help plant and animal species adapt to a changing climate by providing important habitat and connectivity.

Creating places that most effectively integrate adaptation considerations should involve all properties installing adaptations that slow down or store rainwater to reduce flooding during heavy rainfall and retain water during drought conditions. Solutions involve replacing hard surfaces with soft landscaping and including more features in gardens and public open spaces, such as street trees, rain gardens, SUDS, residential drainage channels, swales, detention ponds and eco-corridors. Solutions to over-heating include street trees, green roofs, green walls, and open water features. The aim should be for naturally holistic solutions that consider the wide range of issues outlined in this Plan so that features not only withstand climatic changes but also support increased biodiversity, active travel, and community use of public spaces.

Objective 3 Protect and enhance our natural environment

3.1 Make space for nature

Increasing naturalised areas and improving the connectivity of green spaces will provide more space for local wildlife to adapt. Incorporating more resilient features in greenspace and park design and management will provide greater capacity for these sites to flourish in drier conditions and cope with more erratic and intense rainfall. Monitoring species numbers and habitat health will highlight problems as they arise and support a quick response to any new challenges.

3.2 Maintain healthy soils

Good soil health provides essential but frequently overlooked services for people and the wider environment we all depend upon. As well as being a vital medium for growing much of our food, soil purifies water, protects against flooding, combats drought, captures and stores vast amounts of carbon, and is needed to support green, blue and grey infrastructure.



3. Our Strategy: Strategic Approach

3.3 Protect and expand tree and woodland habitat

Given the multiple benefits provided by trees and woodlands, it is difficult to exaggerate their importance in our response to tackling the twin threats of the climate and nature emergencies. Expanding tree cover in both urban and rural areas, while making sure we plant the right tree in the right place, will help keep Stirling healthy, resilient and habitable.

3.4 Protect wetlands, watercourses, and coastline

Better design, management and maintenance of the full range of water features will become increasingly important as rainfall patterns become increasingly erratic and extreme. Extra care will be needed to make sure our rivers, lochs and wetland areas remain healthy, natural resources, with excellent water quality feeding into our water supplies while sustaining a diverse range of species.



3. Our Strategy: Strategic Approach



Outcome 4. Engaged and Supported Communities

A crucial aspect in building local resilience will be for individuals and communities to share collective responsibility for protecting their own properties and localities. The public sector and partners can provide guidance and support to communities for dealing with increasingly volatile weather events. The Council has developed a community resilience scheme, with web-pages sign-posting additional information and best practice, and encourages Community Councils to establish Community Resilience Groups (CRGs) to plan their local response.

Re-invigorating urban centres by accommodating a range of alternative uses will help support changing consumer habits and restore derelict or unproductive local spaces while reducing reliance on increasingly vulnerable global supply chains. Creating vibrant high streets could involve co-locating civic centres, public meeting spaces, stores and markets with small businesses, shared workspaces, residential properties, repair hubs, urban gardens, and start-up spaces. This would help create community hubs where people come together to give a place vitality and meaning while building greater community cohesion.

Objective 4 Encourage and support individual and community resilience

4.1 Ensure prepared individuals and communities

Well-informed individuals who are aware of their options will be better prepared for severe weather and associated disruptions, while connected communities are more likely to work together naturally when challenges arise. Workspace hubs can become centres of community activity, providing safe places and a connection to local services in times of need.

4.2 Promote health and wellbeing

As our climate continues to change, new and ongoing risks to health will continue to have an impact. This is likely to increase health inequalities, and inequality more generally, making the vulnerable more vulnerable and increasing the overall number of those considered vulnerable. Strong partnerships between the health and wider public sectors will ensure all are better prepared to respond effectively to the impacts on people and health facilities.

Public open spaces designed to support our adaptation response by integrating resilient blue and green features will also help improve the health and wellbeing of people and their surroundings.



3. Our Strategy: Strategic Approach



4.3 Build resilience in the local economy

By working together, businesses can share experience in climate-proofing their activities and ensure business continuity by transferring skills and learning across industries. A more resilient area with attractive public spaces that maximise the multiple benefits of nature-based solutions will be more appealing to investors and well-placed for businesses to locate and make the most of any new opportunities. Development of community hubs and spaces will both provide and support local services and identity, while improving connectivity and resilience, and promote pride in the local area.

4.4 Encourage food security and resilient supply chains

Investment in more circular local, regional and national economies, with reduced dependence on vulnerable overseas supply chains and materials, will be more resilient and secure due to greater diversity and by creating jobs in re-purposing, repair and recycling of goods and materials. A strong local food sector, with more food produced locally, will be more resilient and support greater food security through access to safe, healthy and affordable food.



3. Our Strategy: Governance



Enabling Delivery

Making sure climate adaptation considerations are embedded across the Council, and are given the attention the science dictates, requires recognition at the highest level, supported by an aligned framework of policies and processes. The Council recognised the Climate and Nature Emergency (CaNE) in 2019 and published a delivery plan in 2021. Oversight of delivery and progress is provided by a Board of senior officers and a Member / Officer Group (MOG) to ensure relevant issues are considered in all decisions, across all services.

Maintaining appropriate governance and support from key partners is vital to ensuring delivery of this strategy

The Head of Environment & Place is the nominated Senior Responsible Officer for Climate Adaptation within the Council and chairs an Advisory Group of key officers and a cross-service Adaptation Working Group of service representatives. These groups develop, review, and oversee delivery of Council adaptation action and monitor progress, reporting regularly to the CaNE Plan Board and MOG. This work builds on existing actions already in place to embed climate change action, with committee reports requiring information on climate impacts to help inform member decision-making, Strategic Environmental Assessment (SEA) applied to the development of relevant programmes, plans and strategies, and climate risks included in the Council's Corporate Risk Register. A proposed Regional Adaptation Partnership across the Forth Valley area is likely to become the main forum for guiding and driving climate adaptation action between key partners.



Photo: Ian Masterson

4. Our Action Plan

Programme of Improvement

As indicated throughout this Strategy, successful delivery of our vision, outcomes and objectives is dependent on the availability of resources and positive collaboration with a wide range of stakeholders.

The Council will build on existing partnerships and strengthen links with a variety of organisations, programmes and initiatives across the area to embed Climate Adaptation across local policy and action. This includes our Community Planning Partnership and key agencies, the emergency and health Services, the third sector, educational establishments, utility companies, business groups, land-owners, national government and neighbouring councils, trade unions, community groups, and individuals.

Actions the Council will be taking to support delivery of our Adaptation Strategy are given in a separate Action Plan document. This will evolve in response to developing partnerships, changes in knowledge, understanding, legislation, guidance, and availability of resources. Where delivery does not align with deadlines set, particularly if the performance is not meeting expectations, then corrective actions will be pursued.



5. Measuring Progress



Measuring progress

Stirling Council is the lead authority for delivering this Strategy, with the Council’s cross-service Adaptation Working Group the main body for tracking delivery.

Performance Indicators

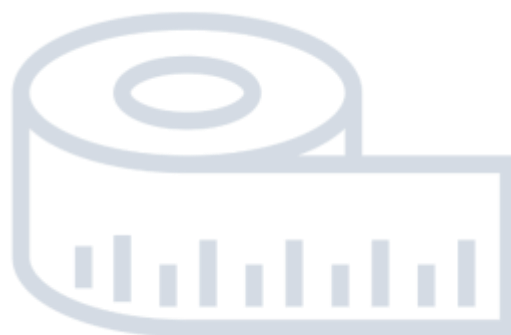
Measuring the impacts from delivering the actions included in this Strategy will be challenging. The benefits from Climate Adaptation work are generally localised but, unlike work to reduce carbon emissions, there is no single measure to report success. There are numerous *potential* Adaptation Indicators, but most are unavailable at a local authority level or are not measured regularly enough to be of use.

Identifying appropriate indicators to monitor and track progress towards meeting our Objectives is therefore a key action for the Strategy. In the meantime, measures of progress in implementing the actions in the Action Plan will be used to indicate progress in delivering each one.

Monitoring and Reporting

Any issues of concern will be raised with the CaNE Plan Board and Member/Officer Group, with progress reported annually to the relevant Council Committee. The Council also reports every November to Scottish Government on performance in adapting to climate change through statutory Public Bodies’ Climate Change Duty Reports.

In addition, the Council is a participant in Adaptation Scotland’s Public Sector Climate Action Network and will carry out regular reviews of progress using their Capability Framework for a Climate Ready Public Sector.



6. Glossary

Active Travel	Any method of non-motorised travel, such as walking and cycling.
Agro-ecology	Farming in a way that imitates natural cycles to harness ecological interactions to benefit both agriculture and the environment. Includes low-till, mulching, inter-cropping and use of cover crops.
Biodiversity	The variety of all forms of life on Earth and the habitats on which they rely. This includes diversity within species, between systems and of ecosystems.
Blue & Green Infrastructure	Blue infrastructure relates to water features, such as rivers, canals, ponds, wetlands, and storm water provision. Green infrastructure refers to networks of trees, woodlands, grasslands, roadside verges, and parks.
Carbon Capture and Storage	Methods for separating, compressing and transporting carbon dioxide to a storage location for long-term isolation from the atmosphere.
Carbon Dioxide (CO₂)	The main gas that causes global warming, produced mainly by burning fossil fuels and clearing land.
Carbon Reduction	The process where an organisation reduces carbon dioxide and other global warming gas emissions from its activities.
Carbon Sequestration	The active process of absorbing carbon from the atmosphere by natural means (such as growing trees and maintaining peat) or industrial processes to deposit in a reservoir, such as former coal mines and geological seams.
Climate Adaptation	The process of adjusting to the effects of climate change by taking actions to limit the harmful consequences and to exploit any beneficial opportunities from the impacts of actual or expected climatic changes.
Climate Change	A long-term change in the average weather patterns that have come to define Earth's local, regional and global climates.
Climate Impact	The effect of climate on a situation, process, or person.
COP: Conference of the Parties	The governing body of an international convention (or treaty / written agreement). The COP is made up of representatives of member countries that have signed up to the convention, such as the UN Framework Convention on Climate Change (UNFCCC).
Detention Pond	A basin designed to collect and release storm water run-off to prevent flooding.
Eco-corridor	A geographical space on land or water that connects areas of natural habitat and allows species and natural processes to move freely. The aim of eco-corridors is to maintain or restore ecological connectivity and biodiversity.
Ecosystem	A natural environment that includes the flora and fauna that live and interact within that environment.

6. Glossary

Ecosystem Services	The many and varied benefits to humans provided by the natural environment, including pollination of crops, clean air, clean drinking water, waste decomposition, and the resilience and productivity of food systems.
Emissions	The production and discharge of something, especially a gas such as carbon dioxide.
Global Warming or Heating	The long-term heating of Earth’s surface observed since the pre-industrial period (between 1850 and 1900) due to human activities, mainly fossil fuel burning and land use changes, which increase heat trapping gases.
Greenhouse Gas (GHG)	One of a group of gases that cause global heating: Carbon Dioxide, Methane, Nitrous Oxide, Chlorofluorocarbons, and Sulphur Hexafluoride.
Green or Living Roof	Roof of a building or structure that is partially or completely covered with plants and a growing medium, planted over a waterproof membrane. It may also include a root barrier and drainage & irrigation systems.
Green Wall	A vertical built structure intentionally covered by plants. Green walls include a vertically applied growth medium, such as soil or hydroculture felt, as well as an integrated hydration and fertilising system.
Habitat	The natural home or environment of an animal, plant or other organism.
Hazard	An object, situation or behaviour that has the potential to cause harm in terms of injury, ill-health, damage to property, damage to the environment, or a combination of these.
Nationally Determined Contributions (NDCs)	Non-binding national climate action plan to reduce national emissions, including targets to reduce GHGs. Each signatory to the Paris Agreement is required to establish a NDC Plan and update it every 5 years.
Natural Capital	The value of elements of the natural environment which provide valuable goods and services to people and society at large.
Nature-based Solutions	Conservation, restoration and improved land management actions that remove or reduce the impacts of climate change and/or increase carbon storage and GHG emissions.
Permeable	A material or membrane that allows liquids or gases to pass through it.
Phenology	The study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life.
Rain Garden	A garden that collects rainwater, holds and filters it before slowly releasing into the ground. They collect rainwater from impermeable surfaces like roofs, pavements, driveways, patios, or car parks, allowing the water to seep back into the ground to prevent runoff from flooding local waterways.

6. Glossary

Residential Drainage Channel	A linear channel used to remove surface water away from a given area, such as a patio, drive, pavement, or garden to prevent flooding.
Resilience	The ability or capacity to recover and return to an original state after experiencing difficulties or disturbance.
Risk	The possibility that something bad or unpleasant (such as injury or loss) will happen.
Sustainable Urban Drainage Systems (SUDS)	Built components that mimic natural features to manage storm water locally (as close to its source as possible) to mimic natural drainage and encourage infiltration, slow water throughput, and treat passively.
Sustainability	The capacity to maintain or improve the state and availability of desirable conditions or materials over the long term.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Swale	A shallow, broad, vegetated channel with gently sloping sides designed to store and / or convey runoff and remove pollutants
Watershed	An area of high ground which divides two or more river systems so that all streams on one side flow into one river and those on the other side flow into a different river.



7. Key References

Central England Temperature series:
[The Central England Temperature series - Met Office](#)

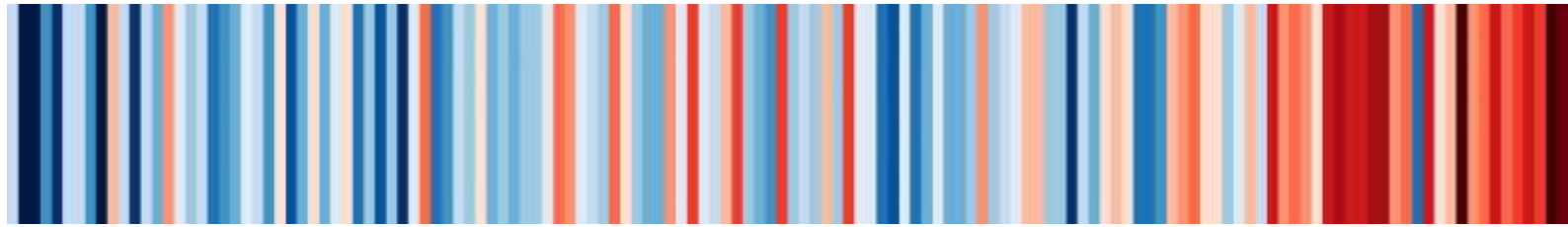
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Annual average temperature change in Scotland, 1884-2023

