

Adapting to Climate Change



An introduction for **Public Sector** policy makers, resource managers & practitioners

The global climate is changing with far-reaching implications for Scotland. Greenhouse gases already emitted into the atmosphere mean that some climate change is unavoidable regardless of future emission reductions. Adapting to climate change is a significant challenge for organisations across Scotland's public sector, presenting both threats and opportunities. Public sector organisations have an essential role to play in helping Scotland prepare for and respond to changes in climate.

All public bodies need to be resilient to the future climate and to plan for business continuity in relation to delivery of their functions and the services they deliver to the wider community.

PUBLIC BODIES CLIMATE CHANGE DUTIES: PUTTING THEM INTO PRACTICE (SCOTTISH GOVERNMENT, 2011)

This document provides public sector policy makers, resource managers and practitioners with an introduction to climate change adaptation. It includes:

- **Climate information:** Facts and figures about observed climate change and the changes that are projected for this century.
- **Climate change and the public sector:** Ways that Scotland's public sector may be impacted by climate change.
- **Taking action to build resilience:** Public sector approaches to climate change adaptation.
- **Tools and support:** Resources that are available to help the public sector adapt to climate change.
- **Policy context:** Overview of climate change adaptation legislation and policy drivers.

**Adaptation
Scotland**
supporting climate change resilience

Adaptation Scotland aims to increase the resilience of organisations, businesses and communities in Scotland to meet the challenges and opportunities presented by the impacts of climate change.

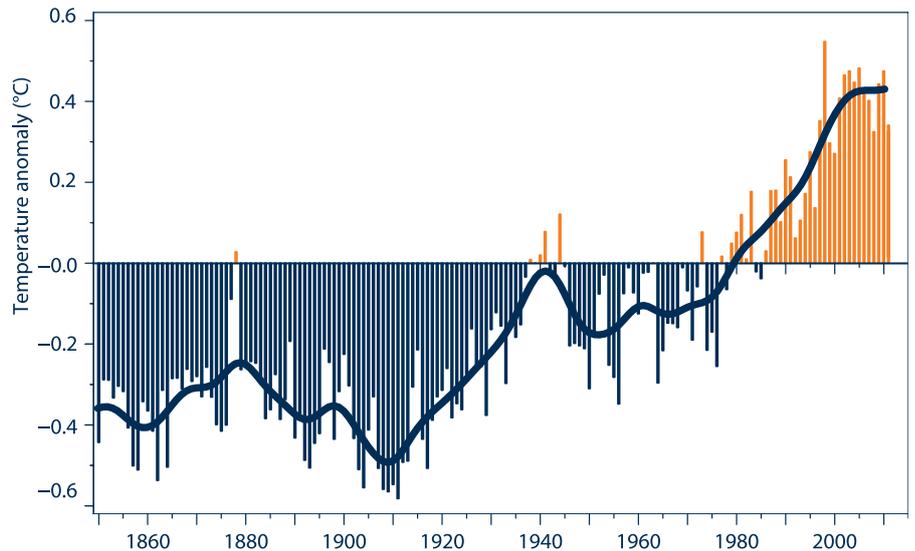
Climate information

Weather is what we experience every day. As anyone living in Scotland will know, the weather can vary by the minute, day, week and year.

Climate is a statistical characterisation of weather conditions averaged over a long period of time (often 30 year periods). A long-term trend (change) in climate conditions is known as *climate change*.

Greenhouse gas emissions are changing the atmosphere. In the future this will be reflected both in the weather and in the climate.

Figure 1: Change in global average temperature 1850 - 2011



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Global climate change

The Intergovernmental Panel on Climate Change has concluded that the 'scientific evidence for warming of the climate system is unequivocal' (IPCC AR4, 2007). All major reconstructions of global temperature show a warming trend over the last century, especially since the 1970s.

The global average temperature in 2012 was among the warmest years ever recorded, all of which have occurred since 1998 (WMO, 2012). 2012 saw many climate anomalies, including a record Arctic sea ice loss and severe drought and record high temperatures across North America (NOAA, 2013).

In the UK 2012 began relatively warm and dry but soon became an exceptionally wet across most of Britain with the second highest annual rainfall ever recorded. In contrast, northern Scotland experienced a relatively dry year (Met Office, 2012).

Recent climate trends in Scotland

Scotland's climate is changing. Over the last few decades it has become warmer and wetter, with an increase in both total rainfall (especially in winter) and the occurrence of heavy rainfall events (see table 1).

Recent years have shown that climate change and severe weather events are already impacting many aspects of society, including buildings, health, agriculture, transport, water resources and energy demands.

Future projected changes in climate

The UK Climate Projections (UKCP09) are the latest generation of climate information for the United Kingdom. They are based on state-of-the-art climate modelling by the Met Office Hadley Centre, UK Climate Impacts Programme (UKCIP) and over thirty contributing organisations.

Figure 2: Projected changes in summer and winter temperature and precipitation for Scottish climate regions (2050s – medium emissions scenario*)

North Scotland

WINTER	Mean temperature increase:	1.6°C (0.6°C – 2.8°C)
	Mean precipitation increase:	13% (3% – 24%)
SUMMER	Mean temperature increase:	2.0°C (0.9°C – 3.4°C)
	Mean precipitation increase:	-11% (-24% – 2%)

East Scotland

WINTER	Mean temperature increase:	1.7°C (0.7°C – 2.9°C)
	Mean precipitation increase:	10% (1% – 20%)
SUMMER	Mean temperature increase:	2.3°C (1.1°C – 3.9°C)
	Mean precipitation increase:	-13% (-27% – 1%)

West Scotland

WINTER	Mean temperature increase:	2.0°C (1.0°C – 3.0°C)
	Mean precipitation increase:	15% (5% – 29%)
SUMMER	Mean temperature increase:	2.4°C (1.1°C – 3.8°C)
	Mean precipitation increase:	-13% (-27% – 1%)



* UKCP09 provides probability ranges for future climate. The number in bold is the central estimate, with the 'very likely' range in brackets

Table 1: Observed changes in Scotland's climate between 1961 and 2004*

Temperature
Recent temperatures for Scotland are the highest on record. Average annual temperature increased 1 °C between 1961 and 2004. This applies across all seasons.
Rainfall
Annual precipitation in Scotland increased by 21% between 1961 and 2004, with almost 70% increase in winter precipitation for Northern Scotland. Heavy rainfall events have increased significantly in winter, particularly in northern and western regions.
Snow cover
There has been a 25% reduction in winter days with snow cover, with even larger percentage decreases in spring and autumn. The snow season has shortened, starting later and finishing earlier in the year.
Days of frost
Since 1961 there has been more than a 25% reduction in the number of frost days across Scotland, with a downward trend since the 1980s.
Growing season
The growing season is now nearly 5 weeks longer in Scotland (comparing 1961 to 2004), with the greatest change occurring at the beginning of the season.
Sea level**
Sea level at all of Scotland's ports has been rising over the last century, with the rate accelerating over the last two decades (now exceeding 3-4 mm/yr in 9 out of 10 ports).

* *A Handbook of Climate Trends Across Scotland (Sniffer, 2006)* compiles and analyses observed climate data across Scotland over the last century (1914-2004), providing a benchmark of observed climate trends for Scotland.

** Recent analysis of sea level trends by Rennie and Hansom (2010)

The key long-term projected climate change trends for Scotland are:

- average summer is warmer and drier;
- average autumn/winter is milder and wetter; and
- weather will remain variable (for example year-to-year), and it may become more variable.

We can also expect to see:

- increase in summer heat waves, extreme temperatures and drought;
- increased frequency and intensity of extreme precipitation events;
- reduced occurrence of frost and snowfall; and
- sea level rise.

UKCP09 provides extensive climate projections data for Scotland. A selection for the three Scottish 'climate regions' (as defined by the Met Office) are shown in Figure 2.

How will climate change affect Scotland's public sector?

Buildings need to be fit-for-purpose in a future climate.

Building performance will be challenged by a changing climate. Buildings will need to cope with overheating, intense rainfall events and possible changes in wind and storm patterns. This will require appropriate planning, design and building standards, but also retrofitting existing building stock.

Climate change may damage and disrupt national infrastructure.

The potential for increased flooding, landslides, drought, heat waves and rising sea levels – particularly when combined with storms – may damage national infrastructure. Disruption to energy, transport, water and ICT networks could affect business continuity. Failure of key infrastructure hubs in one area can affect large parts of the network. Organisations need to consider how this may affect delivery of vital services.

Rising seas threaten Scotland's coastal communities and infrastructure.

Sea level rise is already having a widespread impact on Scotland's coast. With this set to accelerate over the coming decades, we can expect more coastal flooding, erosion and coastline retreat with consequences for coastal communities and supporting infrastructure. Coastal management which addresses these impacts will be necessary to reduce risk.

The natural environment has a critical role in responding to the challenges of climate change.

Climate change will transform Scotland's habitats and biodiversity, adding to existing pressures. Some Scottish species could be lost and invasive species (including pests and disease) may thrive. We need action to protect the ecosystem services which support the economy and contribute to quality of life in Scotland, for example through use of green networks with space for natural flood management and wildlife corridors.

The productivity of our agriculture and forests will change.

A warming climate has the potential to improve growing conditions and increase the productivity of agriculture and forestry. However, changes in the natural environment may contribute to degraded ecosystems less able to sustain productive agriculture and forestry. More variable and extreme weather may limit the potential for improved conditions, making effective land and water management more important.

Climate change will affect the health and wellbeing of individuals and communities.

A warmer climate may provide opportunities to enjoy a healthy, active outdoor lifestyle as well as reducing winter mortality. However, more disruptive weather events will have consequences for people's physical and mental health. Changes to climate could also alter patterns of disease and exacerbate respiratory illness.

Demands on emergency and rescue services will change.

In a changing climate emergency services may need to respond to an increased number of floods, landslides and wildfires. There may also be changes in social and recreational behaviour that present new challenges to emergency and rescue services. Emergency services need to consider how these changes may impact procedures, premises, staff and equipment.

Effective land use and development planning has a critical role in adapting to climate change.

Planning can help ensure that new and existing developments, infrastructure and communities are resilient to climate change. Resilient features include using sustainable urban drainage systems, green infrastructure and avoiding development in areas vulnerable to flood risk, coastal erosion and rising sea levels.

Policy context

The UK Climate Change Risk Assessment

One of the duties under the UK Climate Change Act 2008 is to lay a report before Parliament containing an assessment of the current and future climate-related risks to the UK to 2100. This report is known as the UK Climate Change Risk Assessment (UK CCRA). The UK CCRA was published in January 2012. It is the first Government assessment of the risks posed by climate change to social, environmental and economic assets at UK, national and regional levels. Updated reports will be published every five years.

Climate Change (Scotland) Act 2009 and Scotland's Climate Change Adaptation Framework

The Climate Change (Scotland) Act 2009 places a duty on ministers to produce an adaptation programme to address risks identified for Scotland in the UK CCRA. Scotland's first Climate Change Adaptation Framework, published in December 2009, is a non-statutory forerunner to the Adaptation Programme that will be published in 2013. The Climate Change Adaptation Framework provides a coordinated approach to ensuring that Scotland understands the risks and opportunities that climate change will present. The framework is underpinned by twelve sector action plans that will mainstream adaptation actions across policy areas and build capacity throughout government and among partner organisations.

Public Bodies Climate Change Duties

Part 4 of the Climate Change (Scotland) Act 2009 places duties on public bodies (defined as a Scottish public authority within the meaning of Section 3(1)(a) of the Freedom of Information (Scotland) Act 2002 (as amended)) relating to climate change. These duties came into force on 1 January 2011. The adaptation duty specifies that public bodies *must, in exercising their functions, act in the way best calculated to deliver any statutory adaptation programme*. Whilst public bodies are not yet formally required to help deliver Scotland's Adaptation Framework they are strongly encouraged to take a planned approach:

'Scottish Ministers would strongly advise public bodies to consider the risks and opportunities climate change presents to their business continuity now and how, in delivering their functions, they may build broader resilience to change in Scotland'.

PUBLIC BODIES CLIMATE CHANGE DUTIES: PUTTING THEM INTO PRACTICE, SCOTTISH GOVERNMENT, 2011

Adapting to climate change will be a challenging and ongoing process. It is a new area of work for many organisations. There are substantial benefits from working together to understand and address the likely impacts of climate change. Planned and effective action will minimise risks and make the most of opportunities.

Taking action to build resilience

Building resilience is a long-term investment, but we can start now, particularly for risks where decisions have long-term consequences, for example planning our infrastructure.

(UK CCRA, GOVERNMENT REPORT, 2012).

Public sector organisations across Scotland are already taking action to adapt to climate change. Some are building action into 'business as usual'. Others are developing dedicated climate change adaptation action plans and strategies. By taking early action to adapt public sector organisations can:

- **reduce the cost of service disruption** by identifying low cost, win-win actions that build resilience to climate change and can be implemented as part of scheduled maintenance and development;
- **protect vulnerable sites, services and communities** by co-ordinating a response to the risks identified – this will ensure that climate change impacts are considered as part of business continuity and emergency planning helping to increase current and future resilience;
- **comply with the Public Bodies Climate Change Duties** (section 44 of the Climate Change (Scotland) Act 2009) by acting in the best way calculated to deliver any statutory adaptation programme; and
- **encourage joint ownership of shared risks by improving the capacity of stakeholders** including partner organisations, businesses, communities and individuals to adapt to the impacts of climate change.

Public sector organisations can undertake their own adaptation studies to inform policies, plans and actions which can be implemented either as 'business as usual' or through dedicated climate change adaptation action plans.



Taking action to build resilience: case studies



Adaptation – part of business as usual

The land use planning system has been identified as a priority area for adaptation action (Adaptation Sub Committee, 2012) which will allow adaptation to be considered alongside other social, economic and environmental issues.

TAYplan: Strategic Development Plan 2012-2032

The TAYplan Strategic Development Plan 2012 – 2032 is recognised as a leading example of how adaptation is being supported through strategic planning.

The TAYplan region covers an area of 8,112 square kilometres including Dundee, Angus, Perth and Kinross and the northern part of Fife. In 2011 TAYplan won the Royal Town Planning Institute Silver Jubilee Cup for being “original and visionary in scope”.

The TAYplan authority’s work is underpinned by a vision for improving the quality of life for those affected by the plan through sustainable economic growth, shaping good places and responding to climate change.

TAYplan is innovative and forward-looking in putting climate change adaptation at it’s heart. The plan identifies the following cross-service actions to increase resilience in light of future climate change:

- consider the appropriateness of location and layout of development;
- use sustainable urban drainage systems to reduce surface water runoff;
- identify and enhance existing green infrastructure; and
- avoid development in areas vulnerable to coastal erosion, flood risk and rising sea levels.

For more information about TAYplan visit: www.tayplan-sdpa.gov.uk



Risk-based approach to adapting to climate change

It is vital that plans, policies and actions to address climate change adaptation are underpinned by a thorough assessment of the risks and opportunities that climate change presents. Scotland’s Climate Change Adaptation Programme, to be published in Autumn 2013, will be informed by risks identified in the first UK Climate Change Risk Assessment (January 2012).

Aberdeenshire Council Climate Change Risk Register

Aberdeenshire Council has developed its own Climate Change Risk Register, and provides a model for other public sector bodies to follow.

The Risk Management and Business Continuity team at Aberdeenshire Council developed a Climate Change Risk Register to enable the Council to build capacity and start taking action on adaptation. The register includes 18 risks relating to flooding, drought and severe weather events amongst others. The development of the Climate Change Risk Register was driven by:

- increased awareness of climate change risks following completion of a Local Climate Impacts Profile;
- requirements of the Flood Risk Management Act;
- the need to assess the probability and consequence of climate change-related events on the council;
- the need to have a corporate, cross-service overview of climate change risks; and
- the need to ensure that climate change risks are visible and managed at the right level.

The Climate Change Risk Register will be mainstreamed within corporate risk assessment processes and will be reviewed and updated by senior managers on a regular basis, securing adaptation as a priority commitment.



Partnership working

No single organisation, business or community can adapt to climate change alone. We are all dependent on and influenced by the decisions of others and will need to work together to adapt.

Climate Ready Clyde

Glasgow and the Clyde Valley’s approach to climate change adaptation is one example of a partnership approach through the Climate Ready Clyde project.

The Climate Ready Clyde project was set up by Adaptation Scotland in Autumn 2011 to raise awareness of the challenges that the region faces as a result of climate change.

Over 40 different public sector, business and community organisations have been involved in developing the Climate Ready Clyde project. They now have a shared vision and have identified the need for a shared regional climate change adaptation strategy and action plan.

For more information about the Climate Ready Clyde project visit: <http://www.adaptationscotland.org.uk/4/110/0/Area-based-project--Climate-Ready-Clyde.aspx>



Tools and support

The Adaptation Scotland website provides links to a wide range of tools and resources that can support organisations, businesses and communities to adapt to climate change. This includes Scotland's Climate Change Adaptation Workbook, a step-by-step guide to adapting to climate change. The workbook is divided into five phases:

- 1 Getting started:** Gather evidence on how your organisation has been affected by recent weather, as well as views on how future climate change might affect your organisation.
- 2 Investigating:** Examine the climate projections and undertake a vulnerability and risk assessment; identify and prioritise the risks that pose the most serious threat to your organisation.
- 3 Planning:** Develop a planned approach to adaptation; establish a vision; identify and prioritise adaptation options and assign responsibility for implementation.
- 4 Implementing adaptation actions:** Implement a planned approach to adopting adaptation options, including building adaptive capacity and delivering actions.
- 5 Monitoring and review:** Appraise the effectiveness of adaptation actions; re-visit your vulnerability and risk assessment in light of new evidence; and update actions as appropriate.

“By taking early action to adapt, public sector organisations can reduce the cost of service disruption; protect vulnerable sites, services and communities; comply with the Public Bodies Climate Change Duties and encourage joint ownership of shared risks.”

Information and Support

Adaptation Scotland provides information, tools, training and events aimed at helping organisations understand and respond to the challenges and opportunities presented by climate change.

Adaptation Scotland benefits from the advice and expertise of a wide range of partner organisations all of whom can provide adaptation information to support adaptation planning in your organisation.

- UK Climate Impacts Programme (UKCIP) www.ukcip.org.uk
- UK Climate Projections <http://ukclimateprojections.defra.gov.uk/>
- Scottish Environment Protection Agency (SEPA) www.sepa.org.uk
- Sustainable Scotland Network (SSN) www.sustainable-scotland.net
- Scottish Government www.scotland.gov.uk/climatechangeadaptation

Contact Adaptation Scotland

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The **Adaptation Scotland** programme is delivered by Sniffer www.sniffer.org.uk

