



# Climate change fact sheet

## Climate change in Scotland

As a result of climate change, Scotland is facing rising temperatures, wetter and warmer winters and drier and hotter summers. This all has an impact on Scotland's heritage.

### Our climate is changing



Annual average temperatures have **risen by 0.9°C\***



**36% more rainfall** is now recorded on the wettest days in the West of Scotland\*



The hottest day of the year is now on average **0.8°C hotter\***



Sea levels are rising around **3mm per year** and rates of erosion increasing



Over the last decade, summers have been **13% wetter** and winters **12% wetter\***

\*Compared to 1961 to 1990 averages. Statistics from State of UK Climate reports issued by the Met Office. Adapted from *Guide to Climate Change Impacts on Scotland's Historic Environment* by Historic Environment Scotland (HES).

## What is climate change?

The changes in our climate that we are experiencing today and will continue to experience in the decades ahead, are a result of human influence on the global climate system.

Rapid industrialisation, dependence on fossil fuels and population growth in the past few hundred years have led to increased concentrations of greenhouse gases in the atmosphere.

The result is that our earth is warming rapidly, which in turn is driving additional changes in our climate beyond what is naturally expected. Extreme and unpredictable weather events, like flooding or storms are also happening more often.

## Why is climate change relevant to historic sites?

Our historic environment is an important resource that reflects several thousand years of human occupation in Scotland. Much of it may appear robust, but decades of poor maintenance, misguided interventions or abandonment has left many sites in poor condition. Careful stewardship is now needed if they are to survive into the future.

Built structures like castles need to be maintained and repaired over time due to wear and tear and natural processes of decay, but climate change accelerates this decay so it is happening much quicker than it should be.

How much damage is caused, and how quickly, depends on the level of exposure to hazards and how vulnerable or sensitive the sites/areas are.

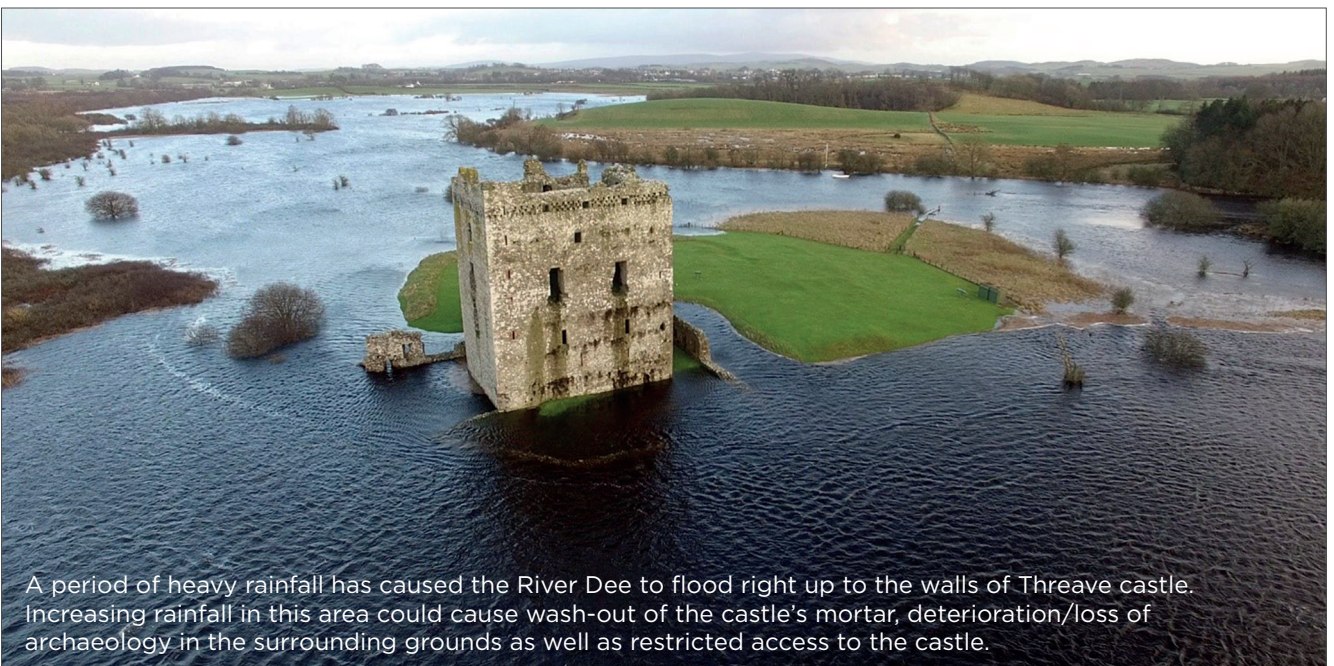


## How does climate change impact historic places?

People in the past chose places to build on for specific reasons: for example hills, islands or coastal promontories, provided natural defences.

However, those same choices may now be the very reason a historic place is under threat due to increased rainfall and storms, flooding, rising sea levels or coastal erosion caused by climate change.

For example, Threave Castle in Dumfries and Galloway, was built on an island to make the most of natural defences, because the land around it is low-lying. However, this has left the site vulnerable to fluvial flooding (when normally dry land is flooded due to a river exceeding its normal capacity). This now happens almost every year.



A period of heavy rainfall has caused the River Dee to flood right up to the walls of Threave castle. Increasing rainfall in this area could cause wash-out of the castle's mortar, deterioration/loss of archaeology in the surrounding grounds as well as restricted access to the castle.

## Other impacts on castle sites include:

### Fabric decay

- Increasing levels of rainfall pose a threat to semi-ruinous or roofless buildings like castles causing water ingress into stonework.
- Rainwater penetration to wallheads results in disfiguring and damaging growth of algae, staining and damage to stonework.
- Increased rainfall around a castle can lead to flooding, which then damages the stonework and fabric. When the ground beneath the castle becomes saturated, the castle could end up unstable.



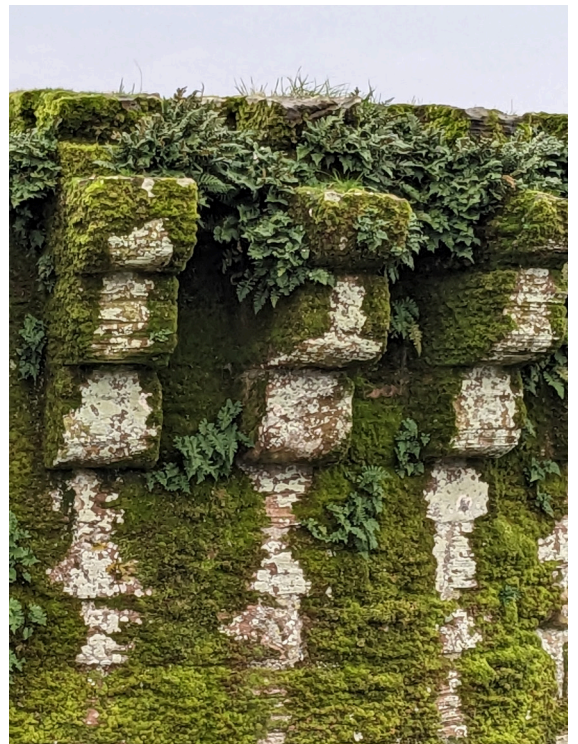
### Coastal erosion

- Rising sea levels mean castles which sit on the coast are at risk of damage or collapse as the cliff or promontory upon which they sit is eroded, washed away or falls away.
- More frequent weather extremes can also remove 'natural defences', such as dune systems, that provide protection to historic places



### Changes in vegetation patterns

- Increased temperatures mean plant species that are not native to Scotland arrive and become established, this can change the look and feel of a place - altering its historic character
- Change in temperature means plants may have a longer growing season. Some plant species and their roots can destabilise vulnerable stonework or ground surfaces and cause damage to historic places



**Top:** Stone erosion at Tantallon Castle

**Middle:** Coastal erosion at Skara Brae

**Bottom:** Vegetation on stone work at Caerlaverock Castle

# How HES is tackling the impact of climate change

## Climate Change Report



We produced a [Climate Change Report](#) in 2018 after assessing natural hazard risks.



The results inform a [Climate Change Risk Assessment of Historic Environment Scotland's properties](#).

The report highlighted that 28 out of the 352 sites HES look after are identified at 'high level risk' from most of the threats caused by climate change.

## Climate Change working group

We've set up a Climate Change working group to coordinate action and bring together individuals and organisations from across the historic environment sector to work together.

## Climate Change Action Plan

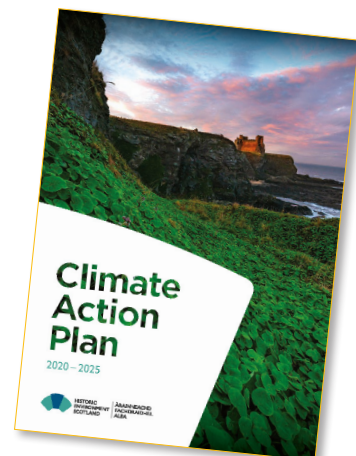
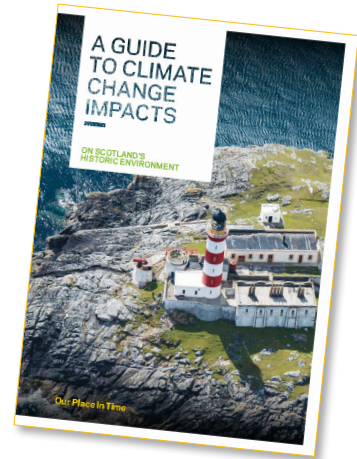


We've produced a [Climate Change Action Plan \(2020-2025\)](#), based around seven key themes, which sets out what we will do to combat climate change by 2025.

One of those seven themes is Climate Impacts and Adaptation. HES have committed to research and monitor the effects of climate change on the historic environment. The more we know, the better we can help it to adapt.

Things we aim to do include:

- Providing or organising training sessions and materials for all staff
- Carrying out research and development into climate change and using citizen science initiatives to allow the public to contribute
- Raising awareness about and communicating the effects of climate change impacts
- Creating training placements within the Climate Change department



## Practical protection

We are identifying practical ways that we can protect our castle sites from the impact of climate change. For example:

- **Carry out ongoing maintenance** to ensure buildings are as wind and watertight as possible.
- **Make appropriate repairs**
- **Undertake proactive conservation** e.g. soft capping of wall heads (putting a layer of clay then a layer of grass on top which controls water getting into the wall core). These materials are more sympathetic to the site and are visually more appealing to visitors than modern, artificial materials.
- **Installing external protection** (where appropriate and feasible) such as a low-profile roof or cover or shelter.
- **Controlling the routes visitors take** through properties to reduce erosion and damage to underground archaeology.
- **Securely closing sites** which are closed in winter months to reduce damage by walking on wet and muddy areas.

(Find out more in the **Conservation fact sheet**)

We're assessing the risks to establish how vulnerable our sites are, what threats they face and actions we can carry out in short, medium and long term. See page 6 for a table of the different types of site, the risks they face and what can be done.



**Top:** Maintenance at Edinburgh Castle  
**Middle:** Soft capping at Melrose Abbey  
**Bottom:** Visitor management to protect the Ring of Brodgar from the erosion caused by high footfall and weather.

## Find out more:



[Climate change in Scotland: assessing the risks](#)

YouTube (2m 32s)



[What does the climate crisis mean for Scotland's heritage?](#)

YouTube (2m 19s)



[On the front line: climate change impacts on the historic environment](#)

YouTube (4m 24s)



[Why COP26 matters for our climate heritage](#)

HES website

# Historic sites and areas at risk



## Resistance (R)

Actively seeking to halt/reverse impact through specific actions



## Acceptance (A)

Planning for damage and loss when it cannot be halted/reversed








Type of site or area	Specific risks	Measures to resist (protect) or accept (record)
 <p><b>Roofed buildings</b></p>	<ul style="list-style-type: none"> <li>• Unstable ground</li> <li>• Damage from high winds/storms</li> <li>• Increased rainfall causing saturation</li> <li>• More biological growth on buildings e.g. moss</li> </ul>	<ul style="list-style-type: none"> <li>Ⓡ Increased checks</li> <li>Ⓡ Improve drainage</li> <li>Ⓡ Use protective coatings or traditional building materials in repairs and maintenance</li> <li>Ⓡ Strengthen ground</li> </ul>
 <p><b>Gardens/ designed landscapes</b></p>	<ul style="list-style-type: none"> <li>• High winds and storms</li> <li>• Spread of pests and diseases</li> <li>• Unstable ground</li> <li>• Waterlogging due to rainfall and flooding</li> </ul>	<ul style="list-style-type: none"> <li>Ⓡ Improve drainage</li> <li>Ⓡ Use disease-resistant plant species</li> <li>Ⓡ Use trees and plants which can tolerate wet conditions</li> </ul>
 <p><b>Marine areas</b></p>	<ul style="list-style-type: none"> <li>• Increased wave action</li> <li>• Exposure and burial due to changing rates of river flows</li> <li>• Spread of invasive species</li> </ul>	<ul style="list-style-type: none"> <li>Ⓡ Monitor closely</li> <li>Ⓡ Build protective barriers</li> </ul>
 <p><b>Coastal areas</b></p>	<ul style="list-style-type: none"> <li>• Salt water damage</li> <li>• Erosion</li> <li>• Flooding</li> <li>• Increased wave height</li> </ul>	<ul style="list-style-type: none"> <li>Ⓡ Use temporary coastal defences</li> <li>Ⓡ Stabilise dunes and restore salt marshes</li> <li>Ⓜ Record or relocate assets before they are destroyed</li> <li>Ⓜ Plan for damaging events</li> </ul>

Table adapted from *A Guide to Climate Change Impacts on Scotland's Historic Environment*, published by Historic Environment Scotland, Oct 2019

Type of site or area	Specific risks	Measures to resist (protect) or accept (record)
<p><b>Surface remains</b></p> 	<ul style="list-style-type: none"> <li>• Water damage due to more rainfall and flooding</li> <li>• Changes in temperature causing cracking of surfaces</li> <li>• Plant and biological growth on surfaces</li> <li>• Ground instability</li> </ul>	<ul style="list-style-type: none"> <li>Ⓡ Regular and routine checking and maintenance</li> <li>Ⓡ Improve drainage systems</li> <li>Ⓡ Re-route water flow around remains</li> <li>Ⓡ Use traditional materials for repair</li> <li>Ⓜ Record and excavate or relocate assets before damage</li> <li>Ⓜ Plan for damaging events</li> </ul>
<p><b>Buried remains</b></p> 	<ul style="list-style-type: none"> <li>• Increased plant growing season damaging remains</li> <li>• Waterlogged areas, which preserve remains, drying out</li> <li>• High winds and storms uprooting trees and causing damage</li> <li>• Spread of invasive plant species</li> <li>• Ground saturation and movement</li> </ul>	<ul style="list-style-type: none"> <li>Ⓡ Improve drainage</li> <li>Ⓡ Use plants and tree species which will help stabilise ground</li> <li>Ⓡ Manage invasive plant species carefully</li> <li>Ⓡ Strengthen ground</li> <li>Ⓜ Record or relocate assets before they are destroyed</li> <li>Ⓜ Plan for damaging events</li> </ul>
<p><b>Collections and internal materials</b></p> 	<ul style="list-style-type: none"> <li>• Increased rainfall, dampness and humidity</li> <li>• Increased flooding events</li> <li>• Higher and fluctuating temperatures drying out collections and internal building materials</li> </ul>	<ul style="list-style-type: none"> <li>Ⓡ Frequent checking and maintenance</li> <li>Ⓡ Improve drainage systems and re-route water flow around protected remains</li> <li>Ⓡ Use protective coatings or traditional building materials in repairs and maintenance</li> <li>Ⓡ Increased use and monitoring of insect traps and humidity</li> <li>Ⓡ Regular assessment of storage and exhibition equipment</li> <li>Ⓡ Install fire detection and protection systems</li> <li>Ⓜ Re-location of protected assets</li> </ul>