

Extreme Weather: Impact on Tourism & Events



Insight Department

VisitScotland

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Introduction

The purpose of this paper is to:

- Look at the frequency and intensity of extreme weather events in Scotland, historically, currently and in the future
- Examine the risks associated with extreme weather impacting on tourism and events, and the vulnerability of the sector to such weather, both currently and in the future
- Consider how risks may be mitigated against and resilience improved, and examine the opportunities and benefits of doing this

During 2012 the weather made the headlines time after time, starting with an early drought and summer temperatures in March, when Eastern Scotland saw less than a third of its usual rainfall, and the temperature reached 23.6°C in Aboyne. This was followed by a wet April with Eastern Scotland getting more than twice its usual rainfall, and cold, unsettled conditions continuing until late May which was characterised by a settled, warmer period, particularly in the Highlands. A new Scottish record high temperature for the month was set on 25th May, with 30.9°C being reached in Inverailort. The respite was short, as June was very wet, with the exception of the far North-West. The Borders, Lothians and Fife received up to three times their usual rainfall. One of the dullest Julys on record saw flooding in Edinburgh and the East, which disrupted roads and the rail link between Edinburgh and Glasgow. Meanwhile the Western and Northern Isles remained much drier than usual. The same general pattern continued through August and September, and then Scotland's coldest October since 1981 again saw floods disrupting transport links, although there were also some settled spells. This weather volatility, from a severe drought to incessant downpours, may become a more familiar pattern in future according to Professor Nigel Arnell of the University of Reading.¹

The weather is always an important topic of conversation in Scotland, and we are accustomed to very changeable weather as a result of our geographic location on the front-line of different air masses. However, the recent unusual conditions have focussed our attention. Indeed this trend is evident at a global scale. 2012 saw extreme cold wreak havoc in Eastern Europe, severe drought badly affect harvests in Russia and Eastern Europe, and heatwaves and drought in the USA. This was followed by the devastation of Hurricane Sandy, a superstorm that crippled the US East Coast. The storm killed more than 125 people in the USA and more than 70 in the Caribbean.² It caused widespread damage in New Jersey and New York, bringing Manhattan to a standstill as the New York Stock Exchange and subway were closed for days and power outages in some areas lasted for weeks. Some 19,000 flights were cancelled. The total bill for the damage has been estimated at \$45 billion. The seeming plethora of extreme weather events in recent years, and the linking of this pattern to climate change, has led to them being described as 'the new normal', indicating a conceptual change in our expectations regarding weather and climate change. The phrase was widely used in the media during 2012, especially in relation to Hurricane Sandy³.

¹ <http://www.guardian.co.uk/environment/2013/jan/04/2012-year-british-weather-dangerous?INTCMP=SRCH>

² http://www.climatetrendshandbook.adaptationscotland.org.uk/Chapter02/2_05.html


³ <http://blogs.nottingham.ac.uk/makingsciencepublic/2013/01/30/extreme-weather-events/>

What's happening with the weather?


Scotland's climate has changed over the course of the last century. Weather data shows that the climate is warming and rainfall distribution is changing, with drier summers, wetter winters and heavy rainfall events occurring more frequently.

Whilst any single extreme weather event cannot be ascribed to climate change, it is generally recognised that one of the characteristics of climate change is an increase in the frequency of extreme weather events. With a warming climate, there is a higher probability of extreme weather events occurring. Extreme rainfall is defined by the Met Office as the sort of event expected to occur every 100 days. During 2012, extreme rainfall occurred once every 70 days in the UK.⁴

Changes in the observed climate over Scotland

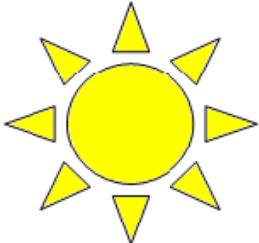


Between 1961 and 2004 Scotland's annual precipitation increased by 21%. In northern Scotland winter precipitation increased by almost 70%.



The proportion of winter precipitation from heavy rainfall events has increased over the last 45 years, particularly in the North and West.

The amount of summer rainfall has decreased, except in the North.



Temperatures have increased by 0.7 to 0.8°C since 1980.

Sea surface temperatures around UK waters have increased by around 0.7°C over the last 30 years.

Severe windstorms have increased in frequency (however have not reached/exceeded the levels experienced in the 1920s).

According to Met Office statistics, 2012 was the second wettest year in the UK in the last 100 years and only marginally short of the record year, which was 2000. It was the 17th wettest year for Scotland. In the UK, four of the five wettest years on record have occurred since 2000.

⁴ <http://www.bbc.co.uk/news/uk-20896049>

Why are we getting more extreme weather?

Most of the extreme conditions the UK saw in 2012 resulted from the position of the jet stream, the air current that flows from America across the Atlantic. During 2012 the flow varied widely and got 'locked' into certain patterns. Over the latter part of the year, the jet stream was 'stuck' further south than usual, leading to intense rainfall. Conversely, a northward shift in the jet stream brings high pressure and dry conditions from continental Europe, associated with freezing conditions in winter and hot in summer. Researchers believe that climate change may cause the jet stream's path to become much more variable, although this is still the subject of ongoing research and subject to considerable uncertainty.⁵ Factors being investigated include the warming of the Atlantic Ocean and Arctic ice cap melt. If the researchers are correct about the jet stream becoming more erratic, the UK, being situated underneath its path, is likely to see considerably more extreme weather, including heavy rainfall and droughts as well as extremes of temperature, including cold spells. The idea that the UK will simply shift gradually to a warmer climate is misguided.

Because global temperatures have increased by 0.7°C since the 1970s, the atmosphere can hold 4% more moisture. This extra moisture means storms can bring more intense rain, which increases the risk of flooding.⁶

According to a European Environment Agency report published in November 2012⁷, the last decade was the warmest on record. Extreme weather related costs across Europe have increased from €9bn in the 1980s to over €13bn in the 2000s as a result of floods, droughts and heatwaves. This trend is expected to continue as extreme weather events become more frequent.

What does the future hold?

The UK Climate Projections (UKCP09) use the latest climate modelling from the Met Office and the UK Climate Impacts Programme along with several other organisations. These projections identify key trends in our future climate⁸. Recorded weather observations show that these trends are already apparent⁹. The UKCP09 projections cover three forecast periods, centred on the 2020s, 2050s and 2080s.

The key climate change trends identified for Scotland using UKCP09 include:

- Hotter, drier summers
- Milder, wetter autumn and winters

It is also projected there will be

- More heat waves in summer, extreme temperatures and drought
- More frequent and intense extreme precipitation events

⁵ <http://www.bbc.co.uk/news/science-environment-20803992>

⁶ <http://www.bbc.co.uk/news/science-environment-18783422>

⁷ 'Climate change, impacts and vulnerability in Europe 2012', EEA Report No 12/2012.

<http://www.eea.europa.eu/pressroom/publications/climate-impacts-and-vulnerability-2012/>

⁸ [http://www.adaptationscotland.org.uk/4/69/0/Future-Climate--The-UK-Climate-Projections-\(UKCP09\).aspx](http://www.adaptationscotland.org.uk/4/69/0/Future-Climate--The-UK-Climate-Projections-(UKCP09).aspx)

⁹ 'A Handbook of Climate Trends Across Scotland' SNIFFER, 2006

- Fewer occurrences of frost and snowfall
- Sea level rise

The UKCP09 projections are among the most detailed available in the world. Very few countries have such detailed projections of projected climate change impacts at a regional level. This is because of the complexity of modelling the future climate: many models work quite well at a global level, but it is much harder to predict at a local level.

Sources of uncertainty in climate projections include:

- Natural climate variability
- Incomplete understanding of Earth system processes and their imperfect representation in climate models (modelling uncertainty)
- Uncertainty in future man-made emissions of greenhouse gases such as CO₂ and other pollutants

To manage this uncertainty, the projections produced by UKCP09, and those discussed by the Intergovernmental Panel on Climate Change (IPCC) have a probability level attached, to indicate how likely various outcomes are. This helps facilitate the planning of adaptation to the changing climate.

It is extremely difficult to make projections about extreme wind speeds. Some researchers have found an increase, but there is considerable uncertainty in projections. It's thought this could generate more North Sea storms with increases in coastal storm surges which would probably affect the Netherlands, Germany and Denmark most severely.¹⁰

Risks: Impacts of extreme weather

Potential impacts can be recognised, monitored and managed using risk management strategies. Risk management is an ongoing process, requiring effective anticipation and mitigation of risks¹¹. Some impacts may be positive and provide opportunities.

The tourism sector is vulnerable to a number of risks related to severe weather events, such as:

- Lower visitor numbers
- Water stress in times of drought
- Disruption of road and rail links due to flooding or landslides, particularly for remote and island communities that rely heavily on tourism
- Coastal flooding
- Disruption of ferry services due to storms or high winds
- Disruption of ICT links due to storms or floods: remote areas often depend on a single ICT link

¹⁰ IPCC, AR4 WGII Chapter 12: Europe - 12.3.1.2 Extreme events.
http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch12s12-3-1-2.html

¹¹ 'Seeds of Knowledge - Contributing to Climate Change Solutions' UNEP (2012)
http://wiki.mdgfund.net/images/4/47/Seeds_of_Knowledge.pdf

- Winter sports activity curtailed by high winds, extreme or unreliable conditions
- Pressure of extra visitors during unusually warm spells
- Disruption to supply chain for food and drink industry
- Storm surge damage to golf courses
- Public health issues
- Higher overheads resulting from damage repair or adaptation work, e.g. flood drainage

Risks for events include:

- Fewer attendees
- Higher than expected attendees in warmer, sunnier than usual conditions
- Health and safety issues
- Unsuitable ground conditions (for sports, car parking or susceptibility to site damage)
- Disruption to transport links
- Increased infrastructure costs (including water supply, energy supply, waste disposal, ICT, supply chain)

In recent years, there have been many examples of extreme weather impacts.

Winter sports have suffered from lack of snow, and, when there is plenty of snow, from gales and blocked roads preventing access to the slopes.

Following a record-breaking drought in April 2011, at least 29 wild fires broke out across the Highlands in early May, spread by high winds. In Torridon several people and a dog were airlifted to safety by helicopter, while homes had to be evacuated in Glen Shiel, Kintail and the A82 had to be closed for a short time. The fires destroyed forest regeneration projects and damaged sensitive ecosystems and rare wildlife. As the landscapes and wildlife are major draws for tourists visiting the Highlands, such damage, valued at £100,000, poses a risk to the sector.

In the Western Isles, 2012 saw one of the worst droughts in living memory. In June, they received only 4% of normal rainfall. Residents were asked to conserve water as reservoir levels dropped. Wild fires broke out, with four significant blazes in the grounds of Lews Castle in Stornoway. Golf courses were scorched and sports pitches were rock hard. The drought halted production at Tobermory distillery after the loch which supplies its process water dried up.

The Western Isles are heavily reliant upon ferry services operated by Caledonian MacBrayne. Routes between Oban and Barra and South Uist, and to Tiree and Coll are most often disrupted by weather, with up to 5% of services affected each year (cancelled, diverted or delayed by over one hour). According to the Government's 'Climate Change Risk Assessment for Scotland', this could increase to 12.5% of services costing the Western Isles' economy £15 million a year.¹²

The Rest and Be Thankful Pass on the A83, the main route between the central belt and southern Argyll, has been subjected to multiple closures following landslips in recent years. Remedial actions have included a £470,000 drainage project to reduce the landslide risk, and the recent opening of an

¹² <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/adaptation>

emergency diversion route utilising the Old Military Road through Glen Croe, to avoid a 50 mile detour.¹³

In July 2011, the Scottish Open at Castle Stuart faced chaos as play was halted because of lightning before heavy rain caused landslides that damaged two of the holes. In the end only 54 holes could be played instead of the planned 72, spectators had to be excluded from parts of the course on safety grounds after two people suffered broken legs, and cars had to be towed from waterlogged car parks.¹⁴

Strathclyde Loch, the designated venue for the Commonwealth Games swim event, saw the cancellation of the Great Scottish Swim and the swim element of the GE Strathclyde Park Triathlon in 2012 after a number of swimmers took ill following an earlier mass participation swim event. The pollution problem resulted from runoff after heavy rainfall, which led to the loch being contaminated with norovirus bacteria.

Following the Tough Mudder event held at Drumlanrig Castle, Dumfriesshire in July 2012, a small number of competitors suffered E. Coli infections. At several points during the 12 mile course, competitors were immersed in mud, which may have been contaminated with slurry or animal faeces. The incident led to the Scottish Government alerting health authorities across the UK, and in the home countries of international participants. The Health Protection Service (HPS) stresses the importance of event organisers liaising with local authorities during event planning, including consideration of what health and safety information should be provided to those participating in extreme activities.¹⁵

In 2012, a number of high profile events in Scotland were cancelled or rescheduled because of the weather. Others went ahead but suffered disruption in atrocious weather conditions, such as unusable car parks due to waterlogging.

An article in Farmers Weekly estimated that cancellation of agricultural shows and country events in the UK incurred losses in event revenue and to the local rural economy of some £243 million.

In 2003/2004, Edinburgh's Hogmanay had to be cancelled due to high winds and rain. The festivities were called off just an hour and a half before midnight, with 100,000 revellers already in the city centre¹⁶. Following this, more robust staging and equipment and weatherproof fireworks were introduced. However, the 2006/2007 event was again cancelled for reasons of crowd safety¹⁷, this time at 8.30pm, following a sharp deterioration in the weather conditions and forecast (gales). A smaller fireworks display still took place.

An Event Scotland survey found that almost 70% of the 2012 events surveyed were adversely impacted by the weather. Most of these experienced reduced attendance. Other impacts included

¹³ <http://www.bbc.co.uk/news/uk-scotland-glasgow-west-21581326>

¹⁴ <http://www.guardian.co.uk/sport/2011/jul/09/scottish-open-golf>

¹⁵ <http://www.bbc.co.uk/news/uk-scotland-south-scotland-19179992>

¹⁶ <http://news.bbc.co.uk/1/hi/uk/3358977.stm>

¹⁷ <http://news.bbc.co.uk/1/hi/scotland/6221557.stm>

increased infrastructure costs, increased build and break-down/site reinstatement costs, increased financial risk and delays.

Mitigating risks and improving resilience

There are various actions that can be taken in order to adapt to a changing climate and build resilience to extreme weather events. Different tourism sectors and destinations will face different threats, so strategy has to be developed on an individual basis. Nevertheless, there are common criteria that provide guidance and help the planning process.

Adaptation actions can be divided into the following three groups (ClimateXChange Scotland):

- No-regret actions: cost-effective now and consistent with addressing risks of climate change
- Low-regret: relatively low cost and providing relatively large benefits under predicted future climates
- Win-win: contribute to adaptation and have additional social, economic and environmental policy benefits, including climate change mitigation.

Identifying these types of action can enable implementation of short term solutions, despite the uncertainty surrounding future weather projections. In this way the adaptation and resilience building process can begin while minimising the risk of spending on unnecessary or inappropriate actions.

The types of actions that might be considered include:

- Land use and planning: avoid high risk flood areas.
- Water: Drought risk – improve water efficiency, reduce leakage from water utility infrastructure
- Built environment: Drought risk – install low flow toilets, showers and taps. Flood risk – move electrical appliances, cables and controls higher up, install door guards and air brick covers

By starting now with relatively inexpensive measures, resilience can be improved and flexibility retained.

Careful planning and assessment is needed to ensure adaptation actions are commensurate and appropriate. Maladaptation (adaptation in the wrong direction) or to either an inadequate or a greater extent than is needed could have negative impacts. It could mean exposure to expensive impacts and endanger lives, or simply be a waste of money.

Events

Contingency planning for extreme weather can be expensive, particularly for small events. But a lack of such planning has the potential to be far more costly, both financially and in terms of visitor experience and reputation.

Julie's Bicycle, a not-for-profit organisation that works on sustainability within the creative sector, conducted a survey of 37 festivals and other outdoor events in 2012, finding that weather is a vital component of the planning process.¹⁸

- 77% said extreme weather conditions had to be included in contingency planning to avoid loss in revenue (e.g. ticket and bar sales) and a poor audience experience.
- 80% of the events included had been negatively impacted by the weather, with over a quarter suffering 'major impact'.
- Nearly half claimed weather impacted ticket sales.
- Two thirds say the risk of inclement weather is changing the cost of running an event and their planning process.
- Nearly 60% of events already have adverse weather action plans in place. Social media is widely used to inform audiences of advice or cancellations.

Julie's Bicycle suggest the following measures for outdoor events:

- Implement an effective weather risk management strategy. Prepare contingency plans for extreme weather conditions, such as high or low temperatures, sunshine, rain and wind.
- Budget for a minimum 5 to 20% increase in weather-related costs. Allow more time for building and break-down of site.
- If appropriate, obtain weather-related event cancellation insurance. It may be possible for insurance to cover extra weather-proofing costs at short notice, instead of cancellation.
- Be aware of the environmental impacts associated with the event and start introducing measures to reduce these impacts, helping mitigate future climate change. This has added reputational benefits, with visitors increasingly expecting events to be environmentally responsible.

Case Study: Glastonbury¹⁹

Glastonbury Festival has experienced heavy rainfall events in recent years which, combined with poor drainage on the site, resulted in several severe floods. In 2005 the camping area was submerged under 6 feet of flood water, and a festival representative admitted they were lucky no-one drowned. Recognising that in addition to safety concerns, bad audience experiences and negative publicity could deter visitors, the festival invested in improvement measures for the site.

These included:

- Installation of bigger drainage pipes, with three times the capacity of the existing infrastructure
- Checking and clearing debris from ditches and culverts, and increasing capacity
- More vehicle access roads and turning areas
- More robust equipment

¹⁸ 'The Impact of Weather on outdoor events 2012' Julie's Bicycle
<http://www.juliesbicycle.com/media/downloads/Weather-survey-findings-and-recommendations-dec-2012.pdf>

¹⁹ <http://www.oursouthwest.com/climate/registry/090500-glastonbury-festival-case-study.pdf>

In addition, health and safety advice is sent to audiences in advance, and staff are trained to advise attendees in coping with extreme weather including storms, heavy rain and heatwaves.

Although the costs of the measures were significant, they were considered essential to the future running of the festival.

Forecasting Event Weather

As dealing with the weather is fundamental to event planning, having access to relevant weather forecasts at the appropriate time is a key factor. Tailored meteorology services are available for event organisers.

For example, the Met Office offers 3 types of service used by events:

1. **Weather warning alerts** for a precise location and altitude, delivered by email, voicemail or SMS. Critical weather thresholds are identified with the event organiser, e.g. wind gusting above 30 knots; rain exceeding 30mm within 24 hours. When a threshold breach is forecast an alert is sent detailing the risk and timing, allowing time to plan for potential problems.
2. **Detailed forecasts** available for precise location and altitude for various durations, level of detail, parameters, risks, etc. Typically a 6 day forecast updated each day with detailed information on weather elements, any potential exceptional events and a general summary.
3. **Talk to a forecaster** is a 'pay-as-you-go' service. Event organisers can phone a forecaster and discuss the weather situation for the precise location and altitude. This allows the organiser to ask questions directly to ensure they have the detail required.

For big events such as Wimbledon, forecasters can be based on-site to provide constant monitoring of the weather situation.

What does this mean for Scottish Tourism?

Changeable weather has always been a fact of life in Scotland, and visitors do not come here for the weather. According to the Scottish Visitor Survey²⁰ the top motivator is scenery and landscape, cited by 55% of respondents, while history and culture are also important, mentioned by 28%. Meeting and interacting with local people was widely cited as a positive element of the trip, 52% indicating that it really added to their holiday experience.

The drama of Scotland's scenery can be enhanced by the changing weather. Misty landscapes provide an atmosphere and beauty of their own, while the changing clouds and light inspire photographers and artists alike. Turner's Scottish landscapes feature storm clouds, rainbows and sunshine, while Raeburn's famous 'The Reverend Robert Walker skating on Duddingston Loch' depicts a frozen wintry landscape. The contrasts of the seasons provide endless variety and can encourage visitors to return at a different time of year for a different Scottish experience.

²⁰ Scottish Visitor Survey, 2011 - 2012



For some activities such as wilderness experience and ‘slow adventure’ trips where what matters is the journey rather than the destination, the unpredictability of the weather is part of the adventure and the overall experience. It enables visitors to enjoy something unique, rather than a ubiquitous ‘packaged’ experience.

While visitors will generally expect and accept changeable weather, there is a risk of adverse visitor experiences in extreme weather conditions, particularly where there is inadequate planning or management of the risks. This could result in a lack of facilities and activities available in the event of poor weather, or in visitors’ comfort and safety being compromised.

The important message is that tourism providers and businesses must be prepared and be able to cope so that:

- They can continue to offer a good product while ensuring customers’ needs are met, and health and safety issues are addressed in a robust and effective manner.
- Flexibility and partnerships are key elements in developing and implementing an effective risk management strategy and adaptation to extreme weather.

Finally, in the words of Billy Connolly ‘There’s no such thing as bad weather, just the wrong clothing, so get yourself a sexy raincoat and live a little’²¹.

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²¹ http://en.wikiquote.org/wiki/Billy_Connolly

Further Information

The Met Office <http://www.metoffice.gov.uk/>

Adaptation Scotland <http://www.adaptationscotland.org.uk/1/1/0/Home.aspx>

Julie's Bicycle <http://www.juliesbicycle.com/>

ClimateXChange <http://www.climatexchange.org.uk/>

Climate Change Risk Assessment for Scotland

Scottish Climate Change Impacts Partnership (SCCIP) <http://www.sccip.org.uk>

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