

Angus Council Local Climate Impacts Profile (LCLIP)



**The impacts of recent weather events in Angus on towns,
organisations and services**



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1. Introduction

As climate change continues to be a topical subject globally, on a local scale it has become increasingly important at the local government level. Councils and other organisations are becoming more aware of the potential impacts of climate change on our communities and countryside and the need to develop adequate adaptation responses to provide protection in the future. Presently in Angus, there is no concise record of severe weather events, their impact on communities or for the range of organisations who respond to them. Do we understand which areas are most vulnerable to specific types of events, their frequency, potential changes in frequency and ultimately the cost of these events, socially and economically?

The Local Climate Impacts Profile (LCLIP) is a simple tool designed to help organisations to assess their exposure to weather and climate. By studying the past, the LCLIP process highlights a locality's vulnerability to severe weather events and how these events affect local communities as well as local authority assets, infrastructure and capacity to deliver services. It is a starting point for a better understanding of the future and undertaking a local climate impact profile (LCLIP) gives us a basis for identifying where the gaps in our knowledge are and which direction we must head in to put an adaptation strategy in place.



Flooding in Arbroath in 2009 © DC Thomson 2009



Dune erosion at Montrose

Angus Flood Funding a National Concern Angus Council 6 November 2009

Changes to flood protection legislation and government funding arrangements were discussed at the meeting of Angus Council on Thursday (5 November) where members considered the aftermath of the flooding earlier in the week. Significant flooding was experienced beyond the usual risk areas though out Angus.

Once again the severity of the weather necessitated that emergency procedures be invoked," said Councillor May. "The joint emergency control team that convened on Sunday afternoon co-ordinated the response from the council and emergency services, ensuring that resources were deployed where they were most needed." The council's Infrastructure Services convener David May formally recorded the council's thanks to all of the staff from the roads service and emergency planning for their response to the emergency and the work done during the recent flooding. The convener highlighted to members that "**extreme weather is happening more frequently** and the resulting flooding is happening in areas not previously believed to be at risk, a picture being replicated across Scotland".



Letham Grange & Brechin 2009 © DC Thomson 2009

Climate Change is one of the most serious threats facing Scotland and the world today. Climate refers to the average weather experienced over a long period, typically 30 years. The Earth's climate has changed many times in response to natural causes. The term *climate change* usually refers to changes that have occurred since the early 1900s. Due to past emissions, a certain degree of climate change is now unavoidable. Effects of changing weather patterns in Scotland will vary depending on the severity of global warming but even at the low end of the spectrum, the impacts are going to be significant. It is widely accepted that climate change is already being felt in Scotland.

Natural and human factors both affect global climate. Natural causes include interactions between the ocean and the atmosphere, changes in the Earth's orbit and volcanic eruptions. Humans influence global climate by releasing greenhouse gases – like carbon dioxide and methane – into the atmosphere. These gases absorb energy that is radiated from the Earth's surface, warming the atmosphere and increasing temperatures globally.

In 2007, the Intergovernmental Panel on Climate Change (IPCC), the world's most authoritative body on climate change, concluded that “***most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations***”.

How is global climate changing?

Temperatures have risen by about 0.74°C on average across the globe from 1906 to 2005. 2007 was the joint 2nd warmest year on record and the 14 warmest years since 1880 have all occurred since 1990 (IPCC). The examples below show what could happen extending up to the end of the 21st century assuming no specific climate policies to mitigate greenhouse gas emissions occur.

- **Europe** – Coastal flooding related to increasing storminess and sea-level rise is likely to threaten up to 1.6 million additional people annually
- **Africa** - The population at risk of increased water stress in Africa is projected to be between 75-250 million and 350-600 million people by the 2020s and 2050s, respectively.
- **USA** - Water-borne diseases and degraded water quality are very likely to increase with more heavy precipitation. Climate change is likely to increase risk and geographic spread of vector-borne infectious diseases, including Lyme disease and West Nile virus (Climate Change 2007: Impacts, Adaptation and Vulnerability, IPCC).

Historical climate trends in Scotland

The Handbook of "Climate Trends Across Scotland" analysed climate data recorded in Scotland over the past century and identified trends in climate change providing a valuable benchmark against which we can measure future climate change. Significant changes recorded across Scotland since 1961 include:

- **Temperature:** Temperatures have risen in every season and in all parts of Scotland;
- **Rainfall:** Scotland had become 20% wetter by 2004, with an increase of almost 70% in precipitation in northern Scotland; there is a trend of increasing rainfall intensity in both East and West Scotland.
- **Snow cover:** The snow season has shortened across the country, with the season starting later and finishing earlier in the year. The greatest reductions have occurred in northern and western Scotland;
- **Growing season:** The growing season length has increased significantly, with the greatest change occurring at the beginning of the season; and all regions have seen an increase of more than four weeks in the length of the growing season since 1961.
- **Days of frost:** There has been more than a 25% reduction in the number of days of frost (both air and ground frost) across the country.

Future climate scenarios for Scotland

Average temperatures have increased by 0.7°C in the UK since 1659. Summers have become hotter and drier; winters milder and wetter. The UK Climate Projections 2009 have been created to help the UK to plan for a changing climate. The Projections contain information on observed and future climate change, based on the latest scientific understanding and the Key findings for the East of Scotland in 2080 under a medium emissions scenario are:

- Central estimate of **increase** in **winter mean temperature** of **2.3°C**; it is very unlikely to be less than 1°C and is very unlikely to be more than 3.7°C.
- A central estimate of **increase** in **summer mean temperature** of **3.5°C**; it is unlikely to be less than 1.8°C and is very unlikely to be more than 5.6°C.
- A central estimate of **change** in **winter mean precipitation** of **+12%**; it is very unlikely to be less than 2% and is very unlikely to be more than 26%.
- A central estimate of **change** in **summer mean precipitation** of **-16%**; it is very unlikely to be less than -32% and is very unlikely to be more than 1%.

Angus's changing climate

The most recent set of UK Climate Projections for the UK were released in 2009. Assuming a future with medium-high global emissions production, changes to Angus's climate are likely to include:

- **Temperature:** Annual temperature on Scotland's East coast may rise by up to 3.5 °C in the summer and 2.5 °C in the winter by the 2080s becoming drier and warmer in summer months and wetter and warmer in winter months.
- **Rainfall:** While winters may become wetter, summers will become generally drier across Scotland by the 2080s; the pattern of change may not be the same across Scotland. UKCIP09 estimate eastern Scotland may experience the most extreme percentage changes in precipitation (going against the trend we have seen already), with an increase in winter and a reduction in summer by the 2080s.
- **Snow cover:** Average snowfall may decrease, perhaps by up to 90% less depending on the location, and snowless winters may become normal in some parts by the 2080s; Snowfall is likely to reduce by 50% or more across all of Scotland, particularly in eastern Scotland where it may reduce by up to 90% by the 2080s.
- **Growing season:** Scotland's growing season may become longer, by between 20 and 60 days by 2080
- **Sea level:** Scotland's sea levels may rise relative to the land, in some areas. By 2080 the current estimates range between 0 and 600 mm sea level rise.

One of the ways in which probabilistic climate projections can be visualised using the UK Climate Projections 09, which show how uncertainty in projected climate change evolves through time (based on the seven overlapping future time periods is by using plume plots. Plume plots display the temporal evolution of uncertainty in projected climate change at five probability levels (10, 33, 50, 67, 90%), for a particular climate variable. The UK Climate Projections site can be used to model possible climate projections for areas as small as 25 km². The projections below are based on Forfar as a mid point in all cases except for the sea level rise projection where Montrose is used as a reference point. The following scenarios are based on a high carbon emissions scenario.

When an organisation is working with the UK Climate Projections 09 models it is at the users' discretion as to which carbon output scenario is most suitable. Some experts believe that a high carbon scenario is most realistic and that the medium range results could offer a realistic glimpse of possible climate patterns in the UK. **It must be said however, that the scientific community are continually making new discoveries with regards to climate change and expert sites like the UK Climate Projections 09 should always be referred to for up to date guidance.**

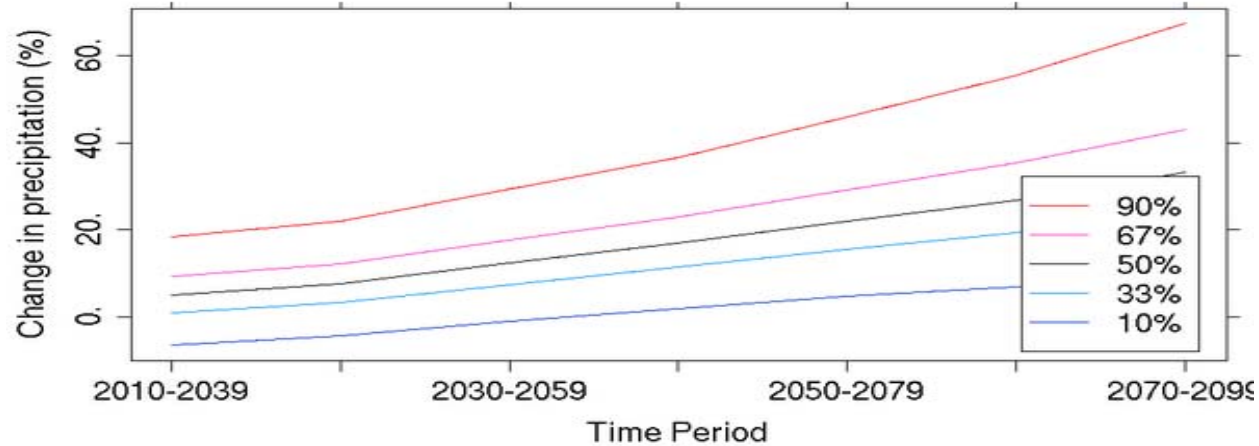


Figure 1. Change in Winter Precipitation

Figure 1 shows the predicted change in winter (DJF) rainfall in Angus over the next century, if carbon emissions remain at a high output level.

The % levels indicate the range that precipitation could change. Anything below the bottom blue line is unlikely, as is anything above the top red line.

It is clear however that rainfall is set to increase in winter.

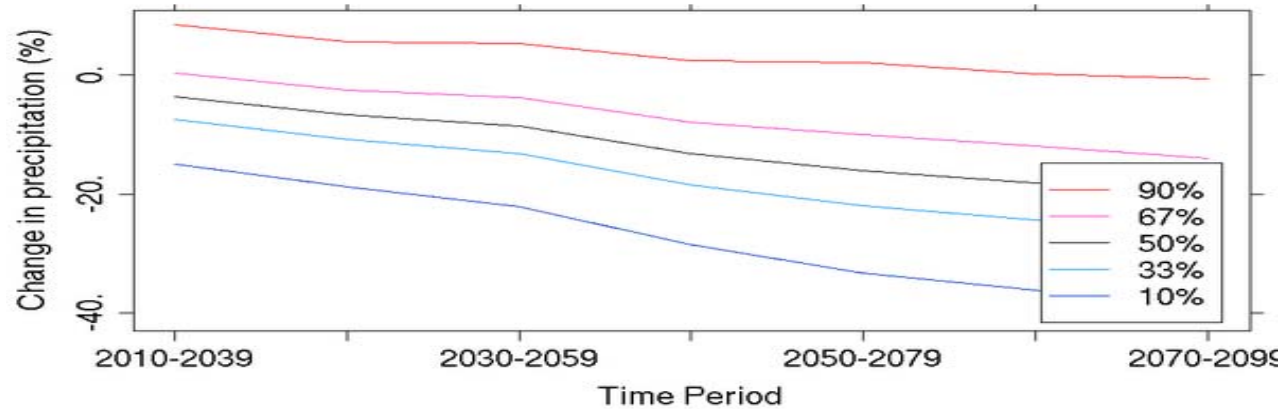


Figure 2. Change in Summer Precipitation

Figure 2 shows the predicted change in summer (JJA) rainfall in Angus over the next century, if carbon emissions remain at a high output level.

The % levels indicate the range that precipitation could change. Anything below the bottom blue line is unlikely, as is anything above the top red line.

It is clear however that rainfall is set to decrease in the summer months.

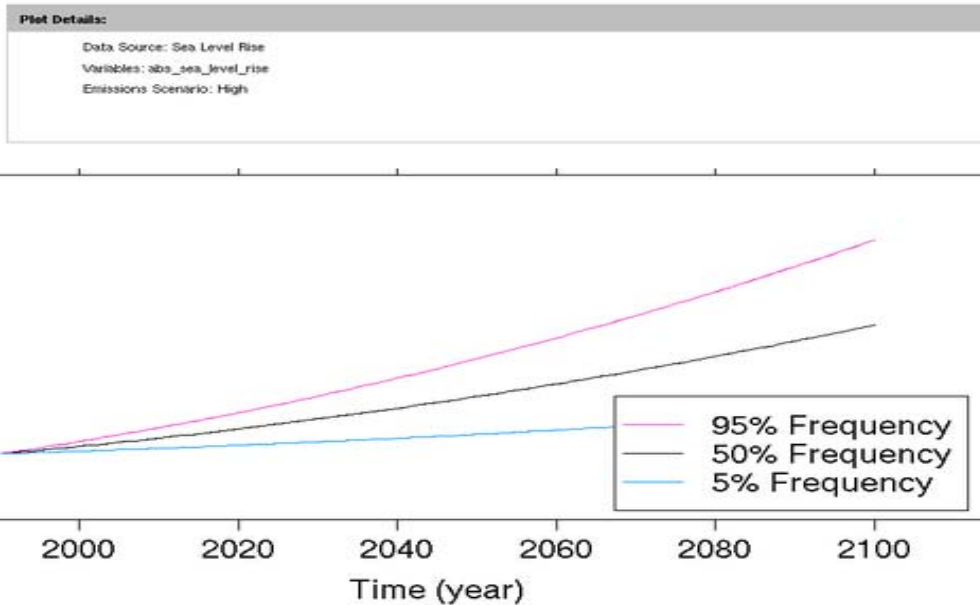


Figure 3. Change in Sea Levels

Figure 3 shows the predicted change in sea level rise along the Angus coast over the next century if carbon emissions remain at a high output level.

Sea level will rise but to what extent is still unknown. Anything below the bottom blue line is unlikely, as is anything above the top red line.

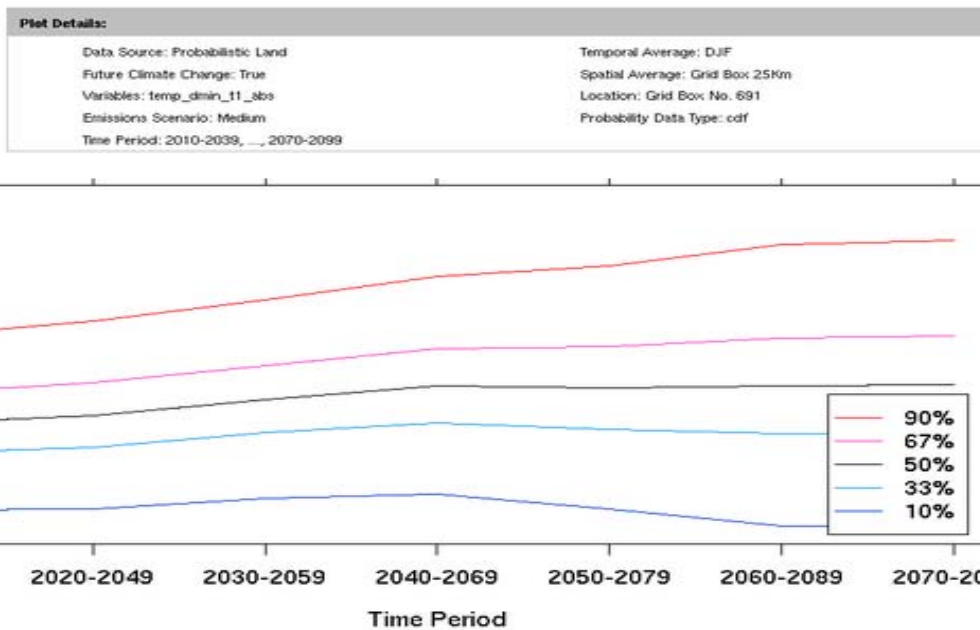


Figure 4. Change in temperature on the coldest night

Figure 4 shows the predicted change in temperature on the coldest night of the year in Angus over the next century, if carbon emissions remain at a high output level.

The % levels indicate the range in which change could occur. Anything below the bottom blue line is unlikely, as is anything above the top red line. The trend shows that night time temperatures will most likely increase.

The UK Climate Impacts Programme (UKCIP) & Local Climate Impacts Profile (LCLIP)

The UK Climate Impacts Programme (UKCIP) is funded by the Department for Environment, Food & Rural Affairs (Defra) and based at the University of Oxford. A pilot project was carried out in 2006 in conjunction with Oxfordshire County Council to provide a useful model for other authorities to build on. The process is known as a Local Climate Impact Profile (LCLIP) and uses past media releases to record the number of weather related incidents in an area and the consequences of these events in terms of population displacement, environmental damage, access to services and cost to an authority in order to prepare for such events.

In March 2008 Highland Council, City of Edinburgh, Perth & Kinross and South Lanarkshire Councils were selected to participate in a pilot LCLIP project for Scotland. The Scottish and Northern Ireland Forum For Environmental Research (SNIFFER) provided funding of £2500 to employ a temporary researcher to carry out a media trawl of weather events reported in the past six years. The objective of the project was to:

- Provide an understanding of weather events in the regions in the recent past;
- Assess the Councils vulnerability to weather events;
- Inform decision making on effectiveness of responses;
- Assist awareness raising i.e. staff, member, public;
- Contribute information towards a Service approach for adapting to the impacts of climate change

"The LCLIP process has allowed us to look in detail at the impacts of recent weather event in the local area, collecting information that has on the whole never been analysed in relation to climate change considerations before. While individual past events can't be linked specifically to climate change, being aware of the implications that they had for local people will allow us to reflect on how we respond to such events and so improve our robustness to future events. The information gathered will be incorporated into our State of the Environment report and used to inform future decision making as our plans, policies, programmes and strategies go through the SEA (strategic environmental assessment) process."

Lorna Jarvie, South Lanarkshire Council



Angus Council Local Climate Impacts Profile (LCLIP) 2009



Arbroath & Carnoustie ©DC Thomson 2009 / Lunan Bay ©Visitscotland Angus & Dundee

Angus LCLIP summary

At least 100 significant extreme weather events since 2001:

High winds	35
Heavy snow	24
Heavy rain	18
Heavy rain/flooding	9
High seas	6
Lightning	2
High winds & flooding	1
High temperature/heat wave	1
Drought	1

Event significance level:

Medium	64
Low	18
High	14

* no of events

5 Most significant impacts:

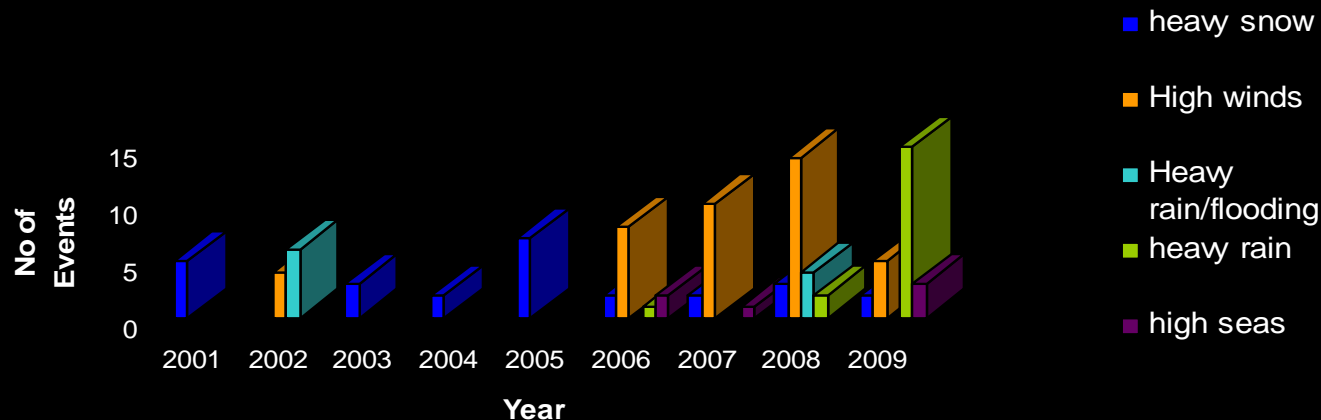
- Disruption to services
- Changes in lifestyle
- Damage to health
- Riverine flooding/ evacuation
- Damage to buildings

5 Services most frequently affected:

- Montrose Port Authority
- Roads Division
- Education Services
- Tayside Fire and Rescue
- Tayside Police



Increase in no of Extreme Weather Events from 2001 - 2009



Angus Council Local Climate Impacts Profile (LCLIP)

A Local Climate Impacts Profile (LCLIP) is a resource that Local Authorities can compile so that they better understand their exposure to weather and climate. It is based on evidence of a locality's vulnerability to severe weather events and in particular how these events affected a local community as well as the authority's assets and capacity to deliver services. In July 2009 Angus Council elected to participate in the LCLIP project. The Scottish and Northern Ireland Forum for Environmental Research (SNIFFER) provided funding to employ a temporary researcher to carry out a media search of weather events reported for the region. This report summarises the findings of Angus Council LCLIP media search, the affect of weather events and also the response of the local authority and community partners.

Project Objectives

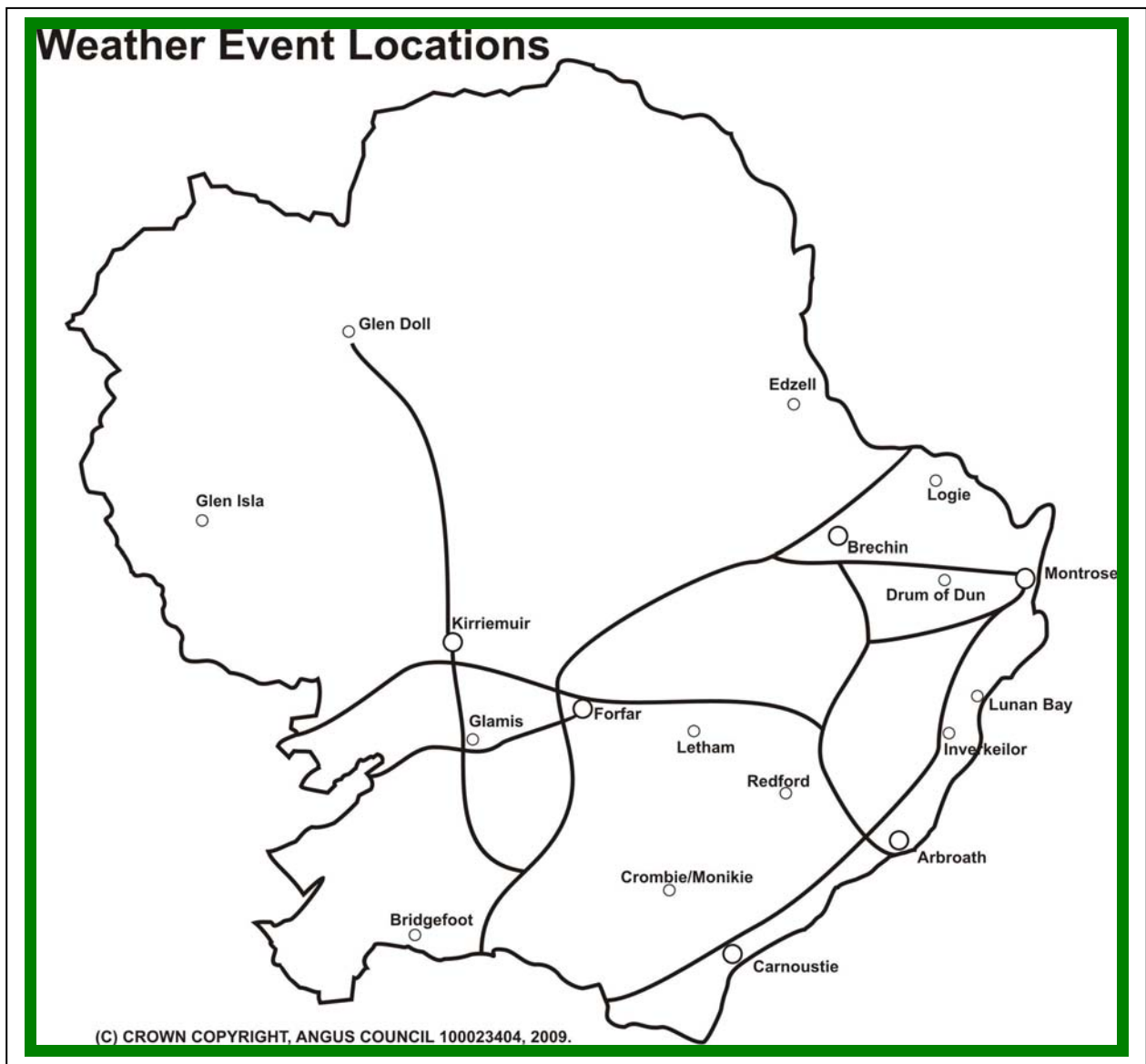
- Catalogue extreme weather events in the Angus region since 2001;
- Log Angus Council's, community partners and selected business or recreation responses to extreme weather conditions;
- Assess Angus's vulnerability to weather events;
- Inform decision making on effectiveness of responses;
- Assist awareness raising in staff, community partners and the public;
- Contribute information towards a Service approach for adapting to the impacts of climate change.

Project Focus

The project focused on extreme weather incidents in Angus and the affects for the Angus Council and its partners. "Weather" can be described as "the state of the atmosphere at a given locality and time". It should not be confused with climate. Climate is the average weather in a locality over a thirty year period. The LCLIPS project assessed weather events, in Angus over an eight year period since 2001.

Any media news items covering events that occurred as a direct result of the local weather is classed as an "Extreme weather event". Types of weather include:

- Heavy rain – often including flooding, High seas, Snow, hail or ice, Lightning or electrical storm, Temperature - high or low, High winds, Drought



The geographical range of the LCLIP project was the Local Authority area of Angus Council. Angus covers an area of 2,200 square kilometers and has a population of 108,400 (2001 census). Angus has seven main towns - Arbroath, Brechin, Carnoustie, Forfar, Kirriemuir, Monifieth and Montrose. Most of the population lives within these towns and the coastal & Strathmore areas, with the remote glens to the north of the county having a very sparse population.

The map to the left shows Angus and highlights the locations where severe weather events have occurred, as highlighted by the media trawl.

LCLIP KEY Media trawl weather type & impact

WEATHER TYPE

Extreme weather events recorded in the media trawl



Heavy snow



Drought



Heavy rain



Lightning



High winds



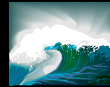
High temps



High winds & flooding



Heavy rain/flooding



High seas

IMPACT

The direct impacts of the extreme weather events



Damage to vegetation



Warning



Disruption to processes



Disruption to services



Algal bloom



Damage to infrastructure



Event cancellation



Changes in use of facilities



Damage to buildings



Power failure



Changes in lifestyle



Damage to property



Riverine flooding/evacuation



Damage to health
















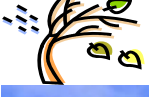






Riverine flooding
































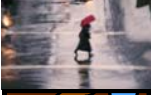










Surface water flooding












































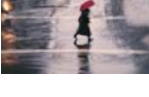
Damage to structures





















Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
news.bbc.co.uk	02.01.01			Football match between Brechin City and Montrose was postponed, thick snow on pitch.	Brechin	Brechin Football Club	L
Angus Council – school 'snowline' system	22.01.01			Climbers found dead in the Angus Glens due to adverse weather conditions.	Glen Doll	Tayside Police Mountain Rescue	H
news.bbc.co.uk	27.02.01			Major problems in Forfar where there was up to eight inches of snow and some serious drifting.	Forfar	Roads Division	M
news.bbc.co.uk	28.02.01			A92 at Lower Northwater Bridge was closed due to stranded HGVs.	Montrose	Roads Division	H
angus.gov.uk	08.11.01			Squally snow showers and high winds resulted in drifting in remote locations.	Angus	Roads Division	M
Angus Council committee report	28.02.02			Extensive damage to angus open spaces. Large specimen trees damaged.	Angus	Direct Services Parks & Cemeteries	M
Angus Council committee report	28.02.02			6000 large trees blown over, partly plantation stock.	Crombie /monikie	Direct Services Parks & Cemeteries	M
Angus Council committee report	28.02.02			Damage to 119 headstones blown over in storms.	Angus	Direct Services Parks & Cemeteries	M
Hope Newsletter 2002	00.03.02			Hope garden, Arbroath. Trees and structures devastated. Perimeter fence damaged.	Angus	Hope Trust	L
news.bbc.co.uk	22.10.02			Floods & fallen trees.	Angus	Roads Division	L



















Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
Angus Council Roads Report 115/03	02.11.02			Collapse of C19th agricultural flood prevention bank.	Logie	Roads Division	H
Angus Council Roads Report 115/03	02.11.02			Most severe flooding events ever recorded in Angus. Homes flooded and evacuated.	Logie	Roads Division	H
Angus Council Roads Report 115/03	02.11.02			4x4 police vehicle stranded and officers rescued by helicopters due to severe flooding.	Logie	Tayside Fire and Rescue	H
News.scotsman.com	23.11.02			Severe flooding on the River South Esk. 5 adults and 6 children in River Street were evacuated from their homes. South Esk broke its banks. Coastguard used inshore lifeboats to evacuate 3 families and marooned livestock. Severe flooding of areas surrounding major rivers.	Brechin	Tayside Fire and Rescue	H
News.scotsman.com	23.11.02				Drum of Dun	Montrose Coastguard /Lifeboat	H
News.scotsman.com	23.11.02				Angus	SEPA	H
Angus Council – school 'snowline' system	00.01.03			School closures throughout the region due to snow as reported on snowline. Jan 6.5, days	Angus	Education Services	M
Met office	31.01.03			Snow showers in the north and east. There was severe drifting in Angus.	Angus	Roads Division	M
Angus Council – school 'snowline' system	00.02.03			School closures throughout the region due to snow as reported on snowline. Feb 10.5, days.	Angus	Education Services	M
Angus Council – school 'snowline' system	00.01.04			School closures throughout the region due to snow as reported on snowline. Jan, 6.5 days.	Angus	Education Services	M






















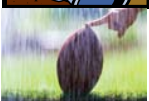
Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
Angus Council – school ‘snowline’ system	00.02.04			School closures throughout the region due to snow as reported on snowline. Feb, 43.5 days.	Angus	Education Services	M
ukdigitalradio.co.uk	07.04.04			Digital One transmitter struck by lightning twice. Radio signal lost. Engineers called out to restore service.	Angus	NTL engineers	L
thescotsman.com & opsi.gov.uk	31.07.04			Backwater/lintrathen reservoir suffering from low water (River Isla) Ordinary Drought Order 2004 was imposed.	Angus - Glen Isla	Scottish Water	H
Angus Council – school ‘snowline’ system	00.02.05			School closures throughout the region due to snow as reported on snowline. Feb, 43.5.	Angus	Education Services	M
Angus Council – school ‘snowline’ system	00.03.05			School closures throughout the region due to snow as reported on snowline. March, 15 days.	Angus	Education Services	M
eveningtelegraph.co.uk	01.03.05			Rural schools closed. Many contract buses could not complete their routes.	Angus	Education Services	M
eveningtelegraph.co.uk	01.03.05			A90 by Forfar. Jackknifed lorry at Muiryfaulds south of Forfar blocked the road.	Forfar	Roads Division	M
eveningtelegraph.co.uk	01.03.05			Letham affected by a power cut during the night.	Letham	Neighbourhood Services	M
eveningtelegraph.co.uk	01.03.05			Lorry jackknifed at Brechin. Southbound carriageway blocked for two hours. A further 7 lorries then became stuck.	Brechin	Roads Division	M
Angus Council – school ‘snowline’ system	00.11.05			School closures throughout the region due to snow as reported on snowline. Nov, 3.5 days.	Angus	Education Services	M



















Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
Angus Council – school 'snowline' system	00.03.06			School closures throughout the region due to snow as reported on snowline. March, 51 days.	Angus	Education Services	M
Montrose Port Authority	10.03.06			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	13.03.06			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	25.03.06			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
newsvote.bbc.co.uk	09.06.06			Erosion of the dune system at Montrose beach. Part of the Medal Golf course realigned.	Montrose	Montrose Golf Courses	H
newsvote.bbc.co.uk	03.12.06			Heavy rain had led to localised flood warnings, in particular the River Isla.	Angus		M
angus.gov.uk	19.12.06			Section of Montrose Beach very unstable. Movement of dune system. Access restrictions put in place.	Montrose	Roads Division	M
Eagle news	00.01.07			High winds brought down some trees over paths in Glen Doll, had to be cleared.	Glen Doll	Angus Council Rangers Service	L
Angus Council – school 'snowline' system	00.01.07			School closures throughout the region due to snow as reported on snowline. Jan 1 day.	Angus	Education Services	M
thecourier.co.uk	02.01.07			On A933, man injured in his car after a falling tree struck it.	Arbroath	Tayside Fire and Rescue	H



















Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
thecourier.co.uk	02.01.07			Car almost smashed in two by a fallen tree at Rosely Country House Hotel by Arbroath	Arbroath	Tayside Fire and Rescue	L
thecourier.co.uk	02.01.07			85mph wind and lightening strikes. 100's of homes in SE Angus without power.	Angus	Scottish and Southern Energy	M
thecourier.co.uk	02.01.07			85mph wind tore a section of the roofing of the new visitors centre at Arbroath Harbour.	Angus	WH Brown	L
newsvote.bbc.co.uk	04.01.07			A cargo vessel ran aground at Montrose as weather conditions pushed it onto the Annat bank.	Montrose	Montrose Port Authority	M
Montrose Port Authority	09.02.07			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	15.02.07			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	04.03.07			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	05.03.07			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	26.12.07			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Angus Council – school 'snowline' system	00.02.07			School closures throughout the region due to snow as reported on snowline. Feb, 4 days.	Angus	Education Services	M
Angus Council – school 'snowline' system	00.01.08			School closures throughout the region due to snow as reported on snowline. Jan, 0.5 days	Angus	Education Services	M

Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
Montrose Port Authority	01.01.08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
newsvote.bbc.co.uk	03.01.08			A man died on the A90 south of Edzell as his car slipped 30ft down an embankment.	Edzell	Tayside Police NHS Tayside	H
Montrose Port Authority	09.01.08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
thecourier.co.uk	10.01.08			70-90mph winds resulted in very violent, high seas.	Arbroath		M
thecourier.co.uk	10.01.08			Temporary closure of the B9128 Carnoustie to Forfar road due to an uprooted tree blocking the road.	Redford	Roads Division	L
thecourier.co.uk	10.01.08			Acorn Pets huge sign in Arbroath's westway had been torn from its fixings and was a heap in car park.	Arbroath		L
thecourier.co.uk	10.01.08			Roofing blown loose from lock up garages in River St/Wharf St.	Montrose		L
thecourier.co.uk	10.01.08			7 meter high sign on two storey building was swaying dangerously in the afternoon.	Brechin		L
Brechin Advertiser	18.01.08			Heavy flooding on Inchbare to Edzell road. Safety compromised.	Edzell	Roads Division	L
Montrose Port Authority	24.01.08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M

Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
Montrose Port Authority	10.03.08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	21.03.08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Brechin Advertiser	02.04.08			Flagpole snapped in high winds in Brechin, falling from the roof of City Hall into Swan Street below.	Brechin	Property Services	L
news.bbc.co.uk	25.06.08			Blue -Green algal bloom in Angus waterways. All Angus parks monitored.	Angus	Angus Council Rangers Service	L
news.bbc.co.uk	10.07.08			Heavy rainfall. SEPA was operating flood watches for Highland Angus rivers and Lowland Angus rivers.	Angus	SEPA	M
thecourier.co.uk	30.07.08			Torrential rain left Academy Street Medical Centre, car park flooded. police presence warning of flooding.	Forfar	Tayside Police	L
Guide & Gazette website	13.08.08			Severe flooding in, Barry Burn burst its banks flooding 9 properties in MacDonald Smith Drive.	Carnoustie	Tayside Fire and Rescue	H
Telegraph.co.uk (courier)	22.08.08			Train services halted between Dundee and Aberdeen. Rain deluged 150m of track.	Inverkielor	Network Rail	M
Brechin Advertiser	22.08.08			Heavy rain caused localised flooding in Brechin town centre.	Brechin	Roads Division	L

Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
Montrose Port Authority	08.11.08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	05.12. 08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	13.12.08			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	25.1.09			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	30.1.09			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Angus Council – school ‘snowline’ system	00.02.09			School closures throughout the region due to snow as reported on snowline. Feb, 9.5 days.	Angus	Education Services	M
Montrose Port Authority	02.02.09			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
thecourier.co.uk	03.02.09			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Angus	Roads Division	M
Montrose Port Authority	28.03.09			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Montrose Port Authority	15.5.09			Montrose Port closed. No vessel movement , logistics stevedoring or weighbridge.	Montrose	Montrose Port Authority	M
Scottish Highland Games Association	15.06.09			Events canceled at Forfar Highland games due to heavy rain and thunderstorms.	Glamis		M

Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
news.stv.tv	27.06.09			Tremendous swell off the Montrose coast. 2 kayakers had their kayaks overturned, one swept out to sea and perished.	Lunan Bay	Tayside Fire and Rescue	H
news.stv.tv	27.06.09			3 teenage boys swept into a strong undercurrent at Montrose beach, got but taken to hospital due to exposure.	Montrose	Tayside Fire and Rescue	M
Angus council Intranet	06.07.09			Flash heavy rain warning issued by Met Office. rainfall of 20mm in a 3hr period.	Angus	Roads Division	L
Angus council Intranet	15.07.09			Flash heavy rain warning issued by Met Office. Rainfall of 15-20mm in a 3hr period.	Angus	Roads Division	L
apps.sepa.org.uk	15.07.09			Lowland Angus rivers flood watch issued by SEPA.	Angus	SEPA	M
news.stv.tv	20.07.09			Kirriemuir Show cancelled. 1st time in 22 years. Location drenched and unsafe. 6000 visitors to the area lost.	Kirriemuir		M
thecourier.co.uk	23.07.09			Lightning strikes the Signal Tower Museum. Electrical systems badly affected. Museum closed for few days.	Arbroath	Neighbourhood Services	M
weatheronline.co.uk	17.07.09			Prolonged heavy rain, 25 -50 mm. Treacherous roads and localised flooding.	Angus	Roads Division	L
Angus council Intranet	24.08.09			Bad weather and high tides had eroded the ramp at Montrose beach. Public access denied to ramp.	Montrose	Roads Division	M

Source	Date of story	Weather type	Impact	Event Detail	Location	Responsible unit	Impact
the courier	05.09.09			65.6mm in one day more than the whole month average. East Coast rail line shut at Montrose.	Montrose	Network Rail	M
the courier	05.09.09			65.6mm in one day. Swollen Barry Burn Carnoustie, sewage seeping onto the street.	Carnoustie	Roads Division	M
the courier	05.09.09			65.6mm in one. Sandbags used to protect threatened homes in Millfield Place in Arbroath.	Arbroath	Roads Division	M
the courier	05.09.09			Elliot Water at the Elliot roundabout in Arbroath spilled onto the dual carriageway closing the road.	Arbroath	Roads Division	M
the courier	05.09.09			A933 Friocheim-Arbroath Road closed as crews' pumped water from a burst culvert.	Arbroath	Roads Division	M
The press and journal	05.09.09			A family is rescued from their car after the Dighty burn burst its banks and they had got stranded in the floodwater.	Bridgefoot	Tayside Fire and Rescue	M
The press and journal	05.09.09			Homeowner in Bridgefoot had to break down a wall in his garden to allow out flood water encroaching on his home.	Bridgefoot	Tayside Fire and Rescue	M
The press and journal	05.09.09			Main roads throughout Angus closed. B9128 Forfar - Carnoustie road closed.	Angus	Roads Division	M
the courier	05.09.09			Heavy rain causes road accident in Angus. A car left the B9128 and landed on its roof.	Forfar	Tayside Police	M

LCLIP Media trawl findings – data analysis

The data collected from the media trawl shown on the previous pages can also be summarised in a format which at a glance gives us an idea of what patterns underlie weather events, their impacts and who most is at risk.

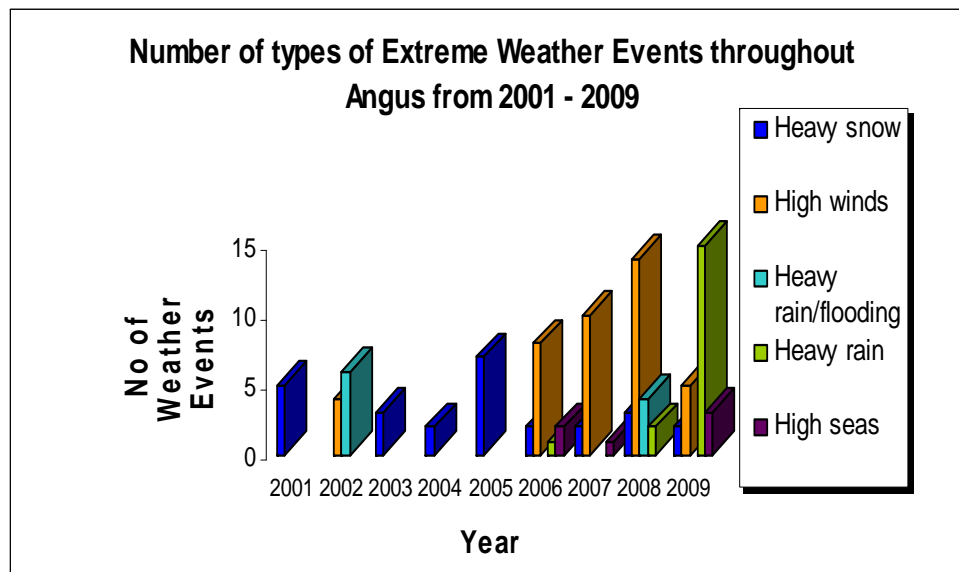


Figure 1. The frequency in which particular types of events have occurred in the study period.

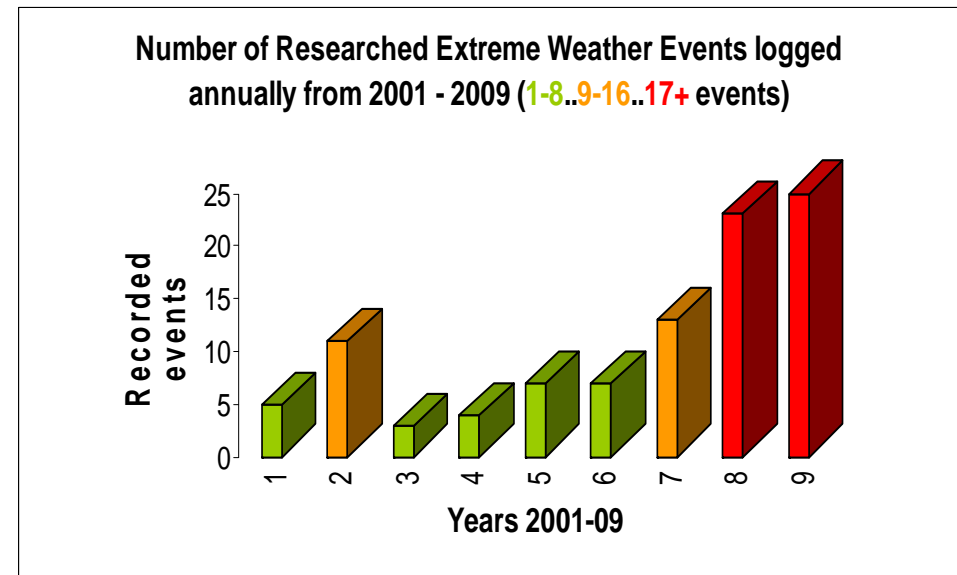
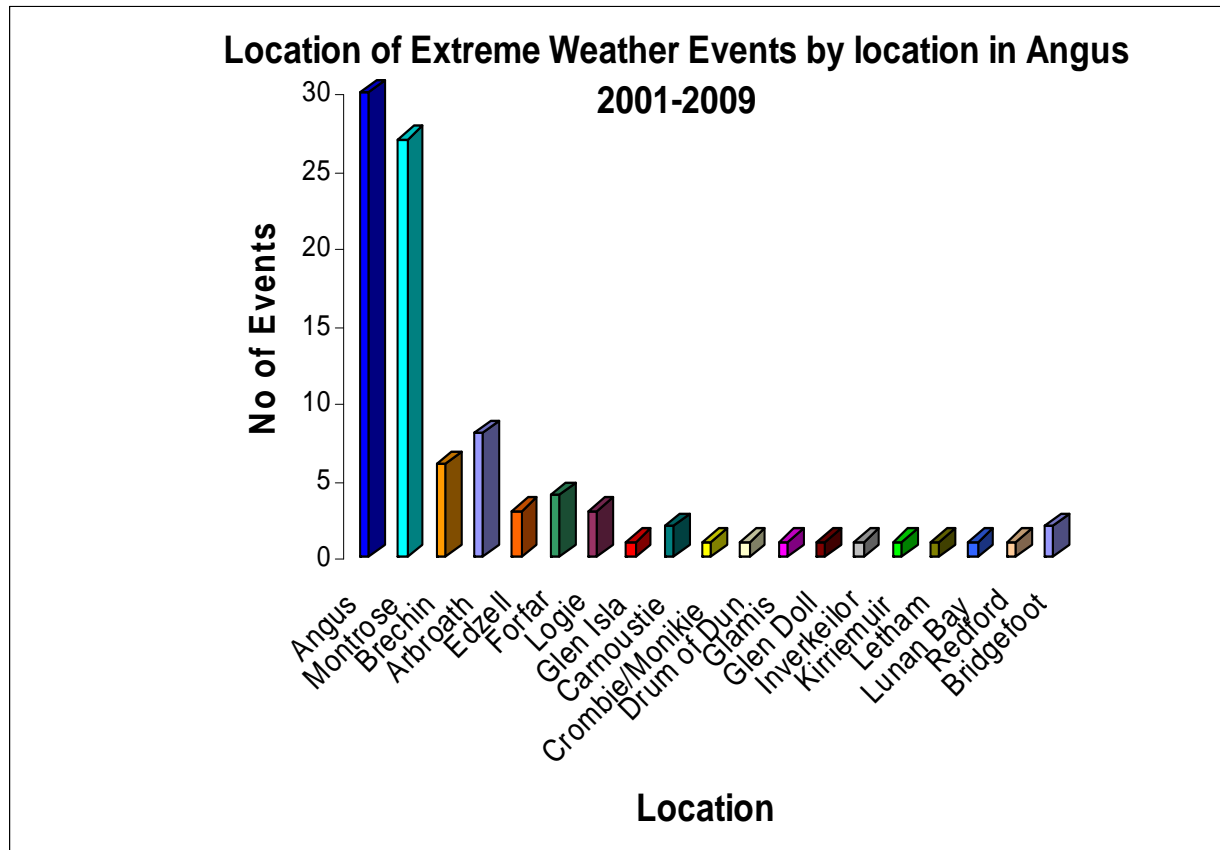


Figure 2. The increase in the number of extreme events from as little as eight in a year to more than seventeen.

Angus most frequently experiences high winds, heavy rain and heavy snow, all three weather types significantly affect infrastructure. High winds lead to damage to buildings, roads blocked by fallen trees, windblown forestry plantations and blown over gravestones. The resulting high seas which have often led to the temporary closure of Montrose Port result due to no vessel movement, logistics, stevedoring or weighbridge. High seas have also led to boat strandings, and in worst case scenarios deaths when swells along the coast are extremely large.

Heavy snow leads to blocked roads, increased snow ploughing, transportation problems, delays in services such as waste collection and periodic school closures throughout the area. School closures in particular lead to many other changes to daily life as many parents are forced to remain at home looking after children creating a knock on affect in the their own work places.

Heavy rain is perhaps the most destructive of all and in recent years riverine and surface flooding has increased in frequency throughout the entire area. Two large rivers the North and South Esk, the River Isla and many tributaries meander through the countryside and catchment management and planning in the past now means that some areas are more at threat from flooding than others. Surface flooding is also a major cause of problems as more frequent heavy rain fall does not allow the ground to dry out and many areas remain waterlogged, meaning that water is not absorbed into the water table as readily, causing flooding on roads, fields and residential areas.



18 locations in Angus experienced severe weather events over the eight year study period and as seen in figure 3. Many events caused impacts over the entire region. From the data collected Montrose Port is most regularly affected by high winds, Arbroath has also felt the affects of these high winds and has suffered periodic occurrences of structural damage. Towns like Brechin which sits on the areas largest river, the South Esk has been affected by heavy rain and flooding as have many areas of in land Angus bordering this river. The River North Esk has also flooded significantly in the north of the region, mainly in the Logie area. Locations through Angus have experienced wind damage, blocked roads, fallen trees, drifting snow, riverine flooding and surface flooding and there are strong links between the frequency and intensity of these events and the intensity of impacts to individuals and communities.

Figure 3. The areas in Angus most frequently affected by extreme weather events based on data collected through the media trawl and from information volunteered from participants.

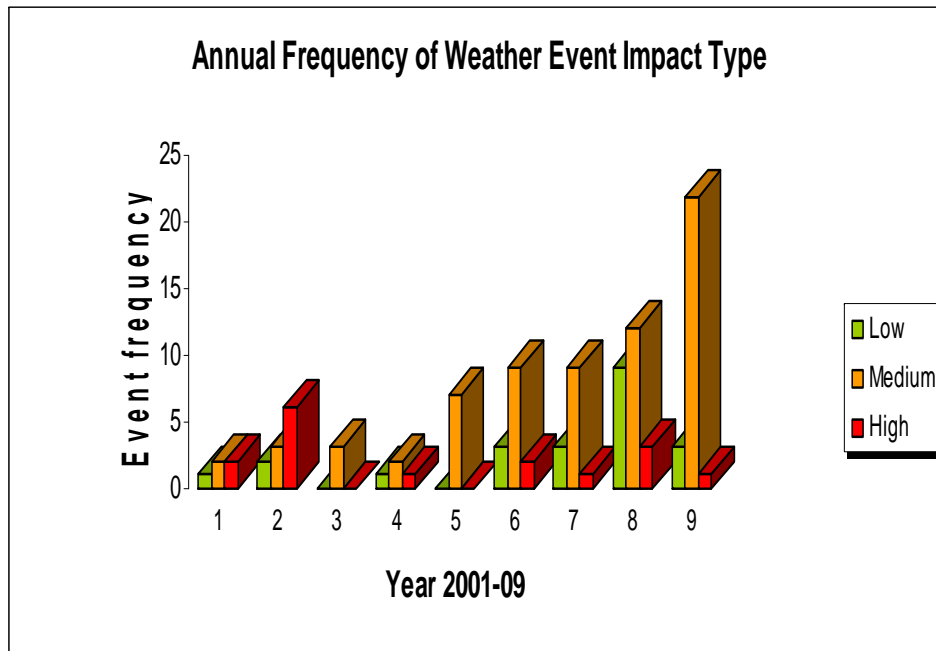


Figure 4. The breakdown of weather event impacts on an annual basis, highlighting the years most adversely affected.

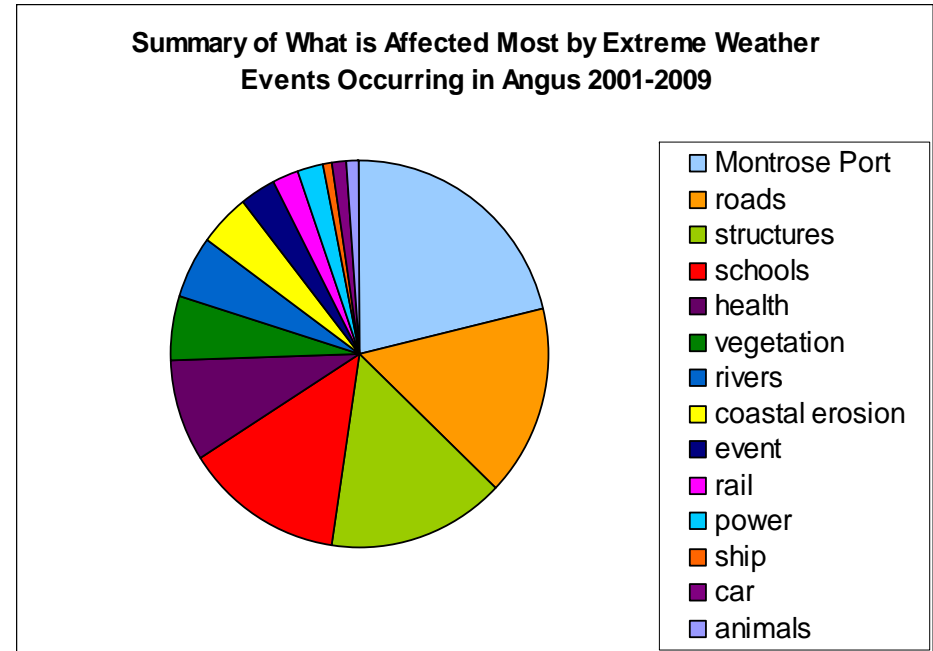


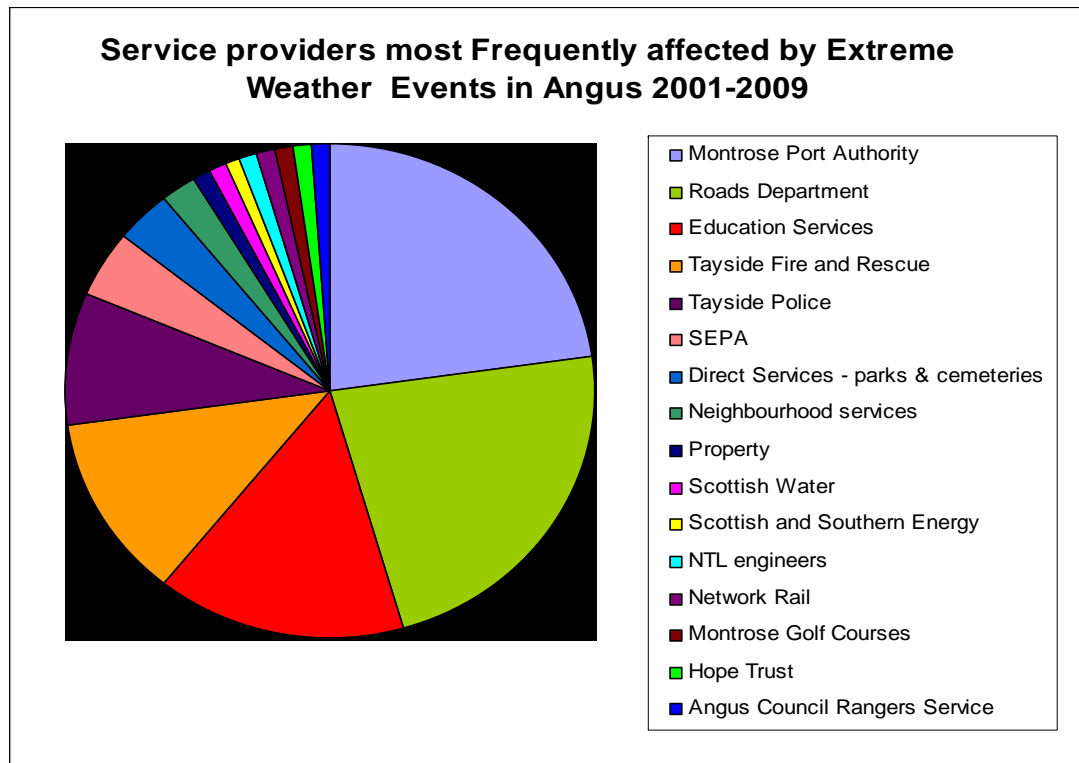
Figure 5. The breakdown of how extreme weather affects Angus.

Each of the 100 weather events recorded were given a significance indicator level i.e. low, medium or high impact, see figure 4. It is clear that medium level impacts occur most commonly and have steadily increased since 2005. This trend is for the Angus area as a whole and could be further broken down for individual areas. Low impacts are classified mainly as cancelled events, slight property damage, some surface flooding and damage to vegetation. Medium impacts include school closures, power failure, closure of Montrose Port, blocked roads and some surface flooding etc. High Impacts include serious riverine flooding, drought and unfortunately fatalities.

Infrastructure i.e. Montrose Port, roads and structures throughout the area are affected most frequently by extreme weather events. School closures generally occur every year at a wide range of locations and result in children missing classes, parents having to take additional days off work and changes to transport systems on these days.

The ecology of Angus is also affected, rivers experience flooding, increased sediment transfer and riverbank erosion. These factors also affect the flora and fauna in the rivers i.e. fresh water pearl mussel and Atlantic salmon. Riverbank erosion can also hasten the spread of invasive weed species. Coastal erosion occurs at points along the Angus coastline particularly at Montrose where public access is now limited at certain areas of the beachfront and the championship golf course has had to be realigned in some areas as the dune are being washed away in very stormy weather.

Transport is affected frequently for individuals in their own cars on major and minor roads, to rails services which link Angus to the rest of the east coast and beyond and even at sea where Montrose Port can be closed to boat traffic. On one occasion a ship was run aground at the mouth of Montrose harbour on a large sand bank, the Annat bank which could have been disastrous for the coastline if there had been any type of fuel leakage.



Based on all of the information collected including media trawl results it is apparent that infrastructure i.e. Montrose Port and Angus roads along with education services are affected most frequently by extreme weather events. Many other Angus Council departments such as Property, Neighbourhood services and even the Rangers service are affected. Tayside Fire and Rescue and Tayside Police are involved in many wide ranging incidents throughout the study period, mainly of a reactive emergency nature. Service providers deal with power failure, flooding and drought. At times more than one service can be involved in an incident with each carrying out its own specific role. This approach may work well on the ground but there may be a lack of data which can be shared amongst services which could aid in future events.

Figure 6. Service providers in Angus affected most frequently by extreme weather events.

Case study: Extreme flooding – Angus

Taken from: Angus Council Roads Committee 23 January 2003
Flooding events of Oct/Nov/Dec 2002
Report by the Director of Roads

Abstract - The Report details the flooding events in the Angus area during October/November/December 2002, and the budgetary implications arising from the associated emergency response and subsequent remedial works.

20 November 2002

- Heavy rain throughout the day led to repeat problems and the B9127 was again closed at Seggieden. The River South Esk was put on Flood Watch.

21-22 November 2002

- The continuing heavy rain resulted in further problems, with the River South Esk Floodline status moving to “Flood Warning” and later to “Severe Flood Warning” at 18:40 hours. Protection works had started at 18:00 hours in accordance with the emergency plan. These works were complete by 22:00 hours. However despite these efforts the defenses were overtopped shortly after midnight and local residents were evacuated by the emergency services and the Council’s emergency response teams between 03:00 a.m. and 05:00 a.m. on the morning of the 22 November 2002. River Street was formally closed at 06:00 a.m. and remained closed until approximately 3:00 p.m.
- The water level peaked halfway up the railings at River Street and even the press photographs later on 22 November 2002 showed the water level well above the sandbag defenses. During the spate large trees were washed downstream along with some 30 round bales of straw.
- As the water levels increased downstream the inshore lifeboat rescued two families and their pets in the Bridge of Dun area and sandbags were provided to protect other properties in the area threatened by the rising water levels.
- A landslip at Hunthill Lodge, Glen Lethnot left the unclassified road (U422) in a dangerous condition with a 70m drop off the edge. An emergency road closure was put into effect, isolating property further up the Glen and affecting three local residents.

- The River North Esk burst its banks again overnight, at the location of the previous repair, flooding houses at Logie for the second time in three weeks.
- SEPA reported that the water levels in the River South Esk were the highest they have ever recorded in over 100 years of records at their measuring station at Gella Bridge. With the forecast of more heavy rain due the following week, the sandbags at River Street Brechin were reinstated and kept in place until the threat receded. In the days following, the Roads Department's stock of filled sandbags was replenished. Repairs were again made to the breached embankment at the River North Esk.

Rainfall Records

SEPA have provided information on the rainfall statistics for November 2002. The figures indicate that the rainfall for the month varied from between 60% to 97% above the long-term average for November, depending on the location.

For Brechin and Tannadice measuring stations the figures were 81% and 88% above average respectively. (Tannadice is in the upper catchment of the River South Esk).

- On the 2nd November 2002 the rainfall at Brechin was 27.5mm
- On the 14th November 2002 the rainfall at Forfar was 28.4mm
- On the 14th November 2002 the rainfall at Tannadice was 29.1mm
- Over the 20th – 22nd November 2002 the rainfall at Brechin was 64.4mm
- Over the 20th – 22nd November 2002 the rainfall at Forfar was 63.2mm
- Over the 20th – 22nd November 2002 the rainfall at Tannadice was 68.9mm

Whilst each individual rainfall event was not in itself extraordinary, the accumulation of rainfall over the period resulted in saturated ground conditions throughout the area.

Other parts of the north-east of Scotland were similarly affected. For example during a 27 hour period over 14th – 15th November 2002, 85mm of rain fell in Elgin resulting in floods requiring some 2000 people to be evacuated. The floods were some 750mm higher than the floods which occurred in the area in 1997.

Effect on Resources

The events of the period placed excessive demands on the limited Roads Department resources and those of Tayside Contracts. Substantial resources were focused at River Street Brechin during the major flood event of the 21/22 November and the previous event of 2nd November, with the full assistance of the emergency services, the Council's Emergency Planning Unit, and other Council Services. However the demand on these resources during the whole period from late October to early December cannot be overstated. Due to the diversity of locations of flooding throughout the Council area, the demands on the limited workforce came from all over the area necessitating prioritisation of requests for assistance. Using all available standby crews, working in pairs for operators' safety, the area was covered by six teams out with normal working hours. During normal working hours all of Tayside 5 Contracts available resources for the Angus area were fully deployed, and some hired plant was utilised where necessary.

During and shortly after the events detailed above the ACCESS Line recorded numerous calls regarding flooding.

- **21-22 October = 30 calls**
- **2 November (Saturday) = 7 calls**
- **14 November = 45 calls**
- **20-22 November = 38 calls (only 1 from Brechin area - staff onsite)**
- **2 December = 48 calls**

Direct telephone calls were also received by Roads Department staff during working hours and on the out-of-hours emergency line.

Following each event there was a need for clean up operations to make the roads safe, remove mud and debris, and repair potholes where water had damaged the carriageway. Road drainage systems had to be cleared of mud/debris which had washed off adjacent fields. Given the threat of further flooding events, which repeatedly materialised throughout the period, there was an urgent need to undertake these works. In addition negotiations with farmers/landowners and discussions with owners of flooded properties to seek longer-term solutions had to be initiated. In the longer term considerable resources will be required to reduce the risk of repeat flooding, in terms of staff time and physical works with associated funding implications.

Financial Implications

The cost of responding to the emergency situations and threat to properties over this 7 week period is estimated at £200,000. This can be broken down as follows;

Response	Cost
Sand bagging, etc at River Street, Brechin	£10,000
Repairs to embankment at Logie	£7,000
Repairs to U422 at Hunthill, Glen Lethnot	£80,000
Immediate response to flooding incidents	£60,000
Subsequent clean-up and remedial works	£43,000
Total	£200,000

LCLIP Interview findings

Angus Council Local Climate Impacts Profile (LCLIP)

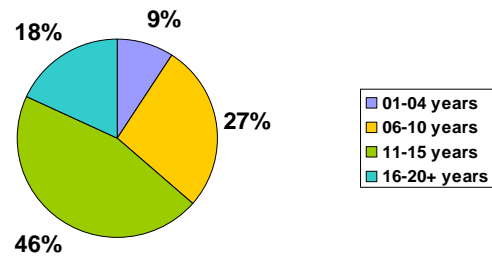
Questionnaire 2009

DATE	WEATHER TYPE	LOCATION	IMPACTS	RESPONSE	IMPACTS FOR ANGUS COUNCIL	SOURCE
e.g. 22.11.02	Heavy rain/flooding	Angus	Severe flooding of areas surrounding major rivers	SEPA issued a severe flood warning for 3 rivers in the Angus area,	?	News.scotsman.com 03.07.10

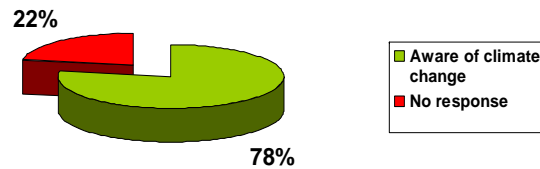
LCLIP Interview findings - data summary

Below is some summary data of the responses given in the service interviews to gauge participant's views on climate change, data recording, severe weather and its impacts. Detailed responses can be found further on in the section.

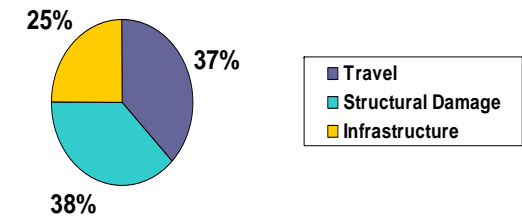
Staff Length of Service



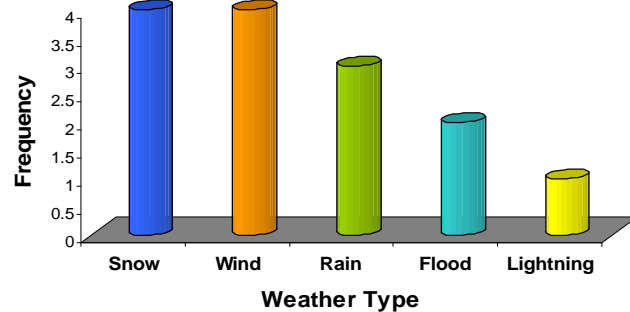
Participants aware of Climate Change Through Experience



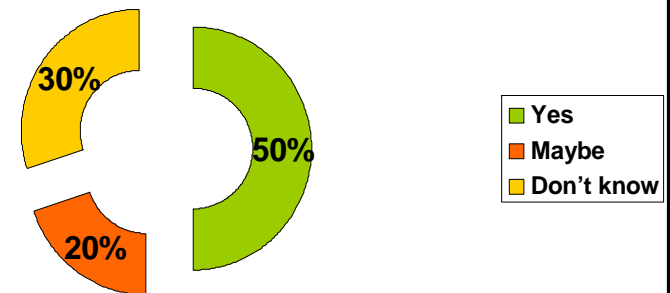
Perceived Impact to Participants



Weather Events Recalled by Participants



Participants response as to whether they should develop an Adaptation Policy



LCLIP Interview findings

To ascertain exactly how Angus Council and partner agencies understood the affects of extreme weather events on their organisation, how they managed data relating to these extreme events e.g. call outs, financial costs, man power costs and future climate change adaptation strategies the following questions were asked. Responses are listed below and responders included;

Angus Council Roads Division	Angus Council Rangers Service
Angus Council Education Department	Forestry Commission Scotland
Angus Council Emergency Planning	Scottish Environmental Protection Agency (SEPA)
Angus Council Fleet Manager	NHS Tayside
Angus Council Finance Division	Scottish Natural Heritage (SNH)

1. Responder Length of service

54% of the individuals who responded had more than 10 years service in their organisation so had a good working memory of the decade's weather events.

2. What data do you collect on weather related events in Angus?

54% of responders collect no data relating to the extreme weather events which may have affected their organisation. Of those who did, information collected fell into the following categories;

- **Crombie Country Park** - Daily rainfall, temperatures, humidity which is all recorded and sent to the Met Office daily.
- **Roads Division**- winter weather, some flooding, emergency call outs.
- **SEPA** - collects rainfall data and flow data from watercourses.
- **Education Department** - School closure details.

3. How does adverse weather impact on your services?

All organisations could comment on the impact on their services in varying degrees but very few had records of the financial implications that were faced. The following responses were recorded;

- **Fleet Services Manager**
- “If the roads are too bad a decision is made to pull the vehicles off causing late bin collections”
- **Angus Council Ranger Service**
- Less people use the Country Parks in adverse weather, this resulted in a 6% drop in visitors in 2008.
- Wear and tear of outside furnishings due to wet and cold weather.
- **NHS Tayside**
- Heavy snow on occasion that has meant canceling meetings.
- **SEPA**
- Locally delay in staff getting into office. H&S issues in regards to going near watercourses.
- Nationally SEPA operates the flood warning scheme.
- **Roads Maintenance Manager**
- Roads services are usually dealing with minor flooding on a regular basis.
- Roads have records of all of this as they record it for biennial reports.
- **Forestry Commission Scotland**
- Serious implications for our forest roads and heavy cost of clearing windblown trees.
- **Finance Division**
- Structural damage to council properties, the amounts below were claimed by Angus Council.
- High winds, Angus, 28.01.02 - Financial payment of insurance claims - QLAS claims database- 567 claims - cost £182k.
- High winds, Angus, 07.01.05 - Financial payment of insurance claims - QLAS claims database- 182 claims - cost £74k.
- High winds, Angus, 09.01.08 - Financial payment of insurance claims - QLAS claims database- 80 claims - cost £21k.

- **Emergency Planning**

- The impact is one of an operational nature, with staff responding to events as part of their day to day role. A number of services are impacted; roads staff, social work and health, housing, emergency planning, leisure etc, most of this due to having to call staff out of hours to respond to an emergency. .

- There have been a number of severe weather events, particularly heavy rain. Significant flooding events occurred in 2002, in the Brechin area, there have also been other subsequent flooding events, in and around the Angus area, caused by heavy downpours, drainage not coping, and run off fields etc.

- Rain is the biggest issue that we have dealt with; we have had some disruption due to high winds and snow, but not as severe as rain fall.

- **SNH**

- Minimal impact - having to shut the office early on occasion to ensure staff gets home safely, working from home on occasion, meaning no-one in office to answer phones etc.

- **Education Department**

- Lost teaching experiences for pupils.

4. How did you respond to this event?

Very little response could be given on exactly how the organisations responded to events, with only the following responses being noted;

- **Angus Council Rangers Service** - Since 2001 major works have been carried out on the Crombie and Monikie Country Parks reservoir infrastructure to enable better management of water during periods of heavy consistent rainfall and flooding.

- **Finance Division** - Financial payment of insurance claims

- **Education Department** - Min. closure periods advice staff pupils of recommencements

5. What measures are being taken within your service to respond to weather events and climate change?

Information was available of how organisations were practicing mitigation measures which would help minimise the possible affects of severe weather and climate change. These included;

- **Angus Council Rangers Service**
- Major reservoir works.
- Angus Council policy – people report to nearest location to work there for the period.
- Home working possible for some.
- **Angus Council Roads Division**
- Continual consideration to winter service and drainage issues. Climate issues being considered at present.
- **NHS Tayside**
- We take all sensible precautions to mitigate risks to staff and patients when there are severe weather events. This may include canceling unnecessary journeys and providing updates to staff via the intranet/email.
- **SEPA**
- SEPA provides flood warnings and will have new powers under the Flood Bill, SEPA also advises on flood risk via the planning process and has a flood risk map available via our website.
- SEPA has a key role in helping Scotland limit and adapt to Climate Change. SEPA itself must also adapt to climate change and reduce its own emissions.
- SEPA's five year climate change Plan sets out SEPA's role in climate change and actions for the next five years to further integrate climate change across the organisation. The actions fall into six key areas: Monitoring and analysis, Regulation, Advice to operators , Greening SEPA, Informing and influencing , Communicating information. SEPA's Climate Change Plan was subject to a Strategic Environmental Assessment (SEA) as part of its preparation. This was required under the Environmental Assessment (Scotland) Act 2005.

- The SEA helped SEPA to understand the environmental effects of the plan and allowed for improvements to be made throughout the preparation process. The Environmental Report explains in detail the findings of the SEA. As the plan has now been formally adopted, SEPA is required to explain how it has taken account of the SEA process in a “SEA Statement”.

- **Forestry Commission Scotland**

- Roads and culverts are being redesigned to cope with more peak flows.

- **Emergency Planning**

- Severe weather and flooding are two of the key risks identified within Scotland and as such we require to ensure that we have appropriate plans in place to respond to any type of incident or emergency in relation to this within the Angus area.

- In addition we horizon scan for up to date information, and receive updates from Scottish Government, Met office, SEPA etc.

- **SNH**

- Helping to understand and publicise the effects and consequences of climate change for the natural heritage.

- Advising on infrastructure and land management practices which help to mitigate climate change.

- Guiding adaptation so that nature can, as far as possible, adapt to a changing climate and so that people can make best use of natural processes in preparing for climate change.

- Promoting action by organisations and individuals by setting an example in the management of SNH’s own operations, and through our wider environmental education work. Our Climate Change Action Plan (July 2009) sets out in some detail the actions we intend to take over the next five years.

- **Education Department**

- Improved flood defences for new school building projects, improved advanced weather warning to parents and staff to minimise disruption as well as new and improved communication lines including direct contact with parents by electronic measures.

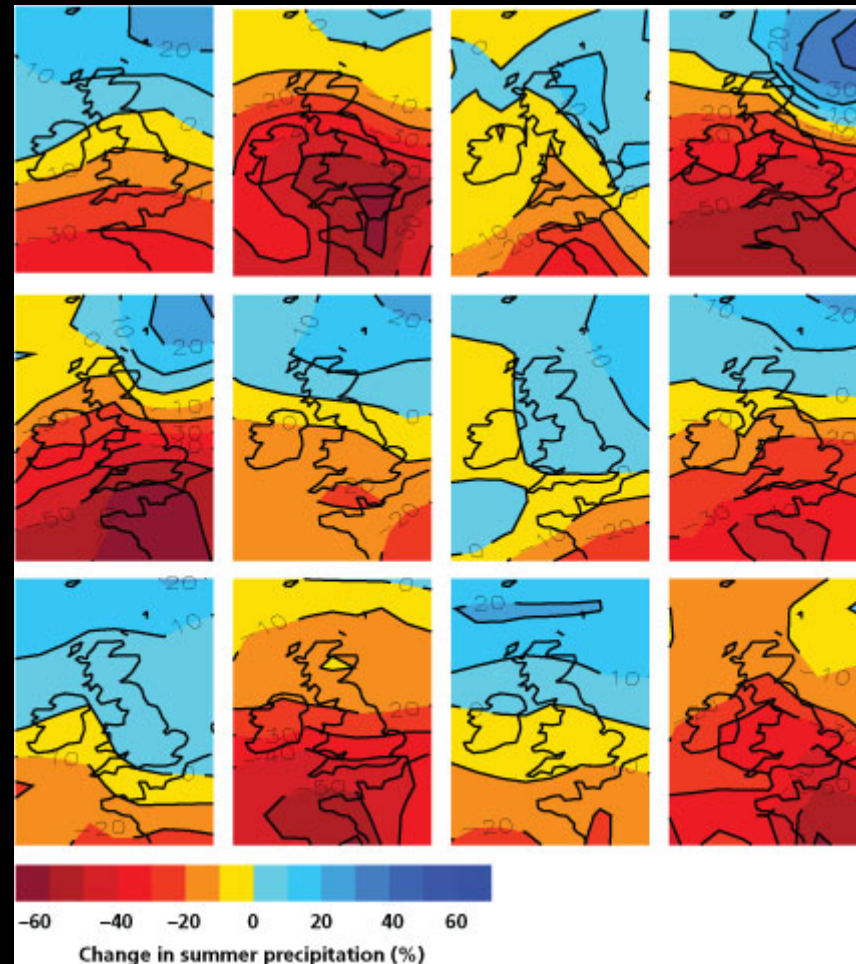
6. Do you think we should develop an adaptation/mitigation strategy? What do you think it should cover?

When asked of thoughts on an adaptation / mitigation strategy it became apparent that most organisations do not have one in place at the moment and that individual departments may have very different ideas of priorities for this strategy. Responses included;

- **Angus Council Rangers Service**
- Yes. More needs to be done in terms of educating the public on 'Good Practice'.
- A list should be compiled of areas most likely to be affected by climate change.
- Once this list has been compiled 'Risk Assessments' need to be completed and the list prioritised.
- Financial implications need to be assessed and an action plan developed.
- Results need to be communicated to the public in a sensible manner and a developed plan put into action.
- **Angus Council Roads Division**
- Currently considering.
- **NHS Tayside**
- We should all definitely have business continuity plans which set out how we will continue to function despite severe weather events.
- **Forestry Commission Scotland**
- Review of roadside drainage and culvert sizes.
- Quick response teams to emergency road incidents.
- Warnings to farmers about soil loss and siltation.
- **Emergency Planning**
- Possibly – would need to address what we can mitigate against and what would prove more difficult.
- **Angus Council Education Department**
- We have to instill a culture where business is as usual despite the weather in much the same way as the Scandinavians have.
- We have to concentrate resources on front line services to ensure these operate rather than back office.

- **SNH**
- Yes - preferably one for all of Angus rather than just for local authority services such a strategy should:
- For mitigation: Set out Angus's contribution to the Scottish Government's emissions reduction targets, and particularly to the priorities set out in the Scottish Government Delivery Plan which cover aspects such as energy generation, energy efficiency, transport, and land use including protection of carbon-rich soils and increasing the cover of woodland.
- For adaptation: Set out the current understanding of the likely change to the climate affecting Angus, from the recently published.
- UK Climate Projections 09.
- Identify the key risks from these changes to different sectors including infrastructure, industry, housing, natural heritage, agriculture, forestry, water industry etc.
- Identify key actions to build resilience to climate change and adaptive capacity amongst local communities, businesses, public services, and in the natural environment where building ecological resilience will not only help nature but also people to adapt to climate change.
- SNH can help in future with looking at the effects of climate change on the natural heritage and its enjoyment, and the ways that the natural environment can help mitigation or adaptation, e.g. through protecting peat soils, through considering landscape, using natural flood management measures or managed coastal retreat.

Key Findings & the Way Forward



Key Findings

The LCLIP process helps to highlight local vulnerabilities to extreme or changing weather and can be used to raise awareness of the consequences of weather that we might expect in our locality in the future. At present we have the Community Risk Register 2008-11 in place (see p45) but it does not encourage the day to day collection of event data and financial costs. The LCLIP provided the opportunity to engage other departments and services highlighting the importance of the climate change agenda and it is hoped that it will be used in the future along side documents such as the Community Risk Register and each departments Business Continuity Plan once complete, to develop a risk assessment for adaptation action.

The LCLIP process can be useful in encouraging partners to monitor and record the affects to their service of events which occur through out the year, perhaps not reaching the emergency scale contained in this register, but happening none the less, so that a useful record of the actual costs to the Angus area can be calculated and used in future mitigation measures.

The most significant findings to arise from the LCLIP process were;

- During this process it was straightforward in collecting data of the number of events, incidents and impacts and responses from the media trawl but data on costs, responses and attitudes from departments and agencies proved was more difficult.
- Organisational support for the data gathering process with high profile senior management support is critical.
- It proved difficult to contact appropriate personnel within some organisations which caused delays and in some cases information was never submitted and interviews never carried out due to lack of knowledge or recording systems within certain organisations.
- Most weather events, impacts and costs were not recorded by organisations in any consistent manner.
- The scale of an LCLIP project is potentially huge and community partners should consider carrying out their own LCLIP to create some organisational awareness of the need for adaptation. This could then strengthen the adaptation response throughout the whole Angus area.

Throughout this process it has proved extremely difficult to obtain details of the financial costs to Angus Council and its partners, on an annual basis and over the entire study period. This figure will possibly have run into millions of pounds. Kent County Council's LCLIP gives a figure of in excess of £440m for the Kent community and £25m to the council alone. These figures were obtained from detailed records that council departments kept. In

Angus, committee reports such as in case study 1 are the only means of collating any definite costing for extreme weather events, in this case flooding. There has been no amalgamation of these costing in departments or throughout the entire council. It has been recognised during the interview process that to pull together this information would be an additional burden and that resources may be stretched. Perhaps this report will encourage departments to begin recording the impact of severe weather events on their services including financial costs so that in the future, we will have concise records of the true cost of extreme weather events so that appropriate adaptation can be instigated.

Community Risk Register 2008 -2011

The Tayside Strategic Co-coordinating Group (Tayside SCG) comprises those agencies having primary responsibility for responding to any serious emergency, major incident or disaster in the area. The Civil Contingencies Act 2004 places a duty on emergency responders including Police, Fire Service, Ambulance Service, NHS, and Local Authorities etc. to co-operate in planning for and dealing with emergencies. This is done through the Strategic Coordinating Group (SCG) set up in each police force area.

The Act also places a duty on the SCG to compile, maintain and publish a Community Risk Register. This register has been created to provide information regarding the hazards which exist within the Tayside. It is a tool which helps emergency responders to ensure plans are in place to mitigate against the potential impact of the hazards and to identify gaps in planning. The public register is published on the Tayside Fire and Rescue Service website and is reviewed on an annual basis by Tayside emergency responders (Tayside SCG 2010)

There are 11 weather related events included in this register including storms and gales, low temperatures and heavy snow, heat waves and tidal flooding, fluvial flooding and flash flooding on different scales. An assessment has been made of the **Likelihood** and **Impact** of an event occurring, using historical and empirical evidence and projected occurrence data over a five year period, to give a **Risk Rating**.

The **Likelihood** has been assessed following consideration of data of local, regional and nationally occurring events, the potential **Impact** has been considered against each event and its likely impact. The likelihood and impact assessments have been combined to develop a **Risk Rating** of Low, Medium, High or Very High. There are five events rated as of high risk and six as medium risk. Rated most likely to occur are low temperatures and heavy snow, significant local coastal/tidal flooding and major local fluvial flooding affecting 100-1000 properties.

The Scottish Environmental Protection Agency (SEPA) is the lead agency for assessment with regards to most of these events with a range of partner agencies having controls in place to deal with the impacts.

The Way Forward

There are a number of statutory and non statutory drivers and initiatives which highlight the need for action on adaptation work on climate change.

In 2007 all of Scotland's 32 local authorities signed up to **Scotland's Climate Change Declaration**.

Signatories to **Scotland's Climate Change Declaration** acknowledge the reality and importance of climate change and are committed to:

1. Mitigating their impact on climate change through reducing greenhouse gas emissions
2. Taking steps to adapt to the unavoidable impacts of a changing climate
3. Working in partnership with their communities to respond to climate change

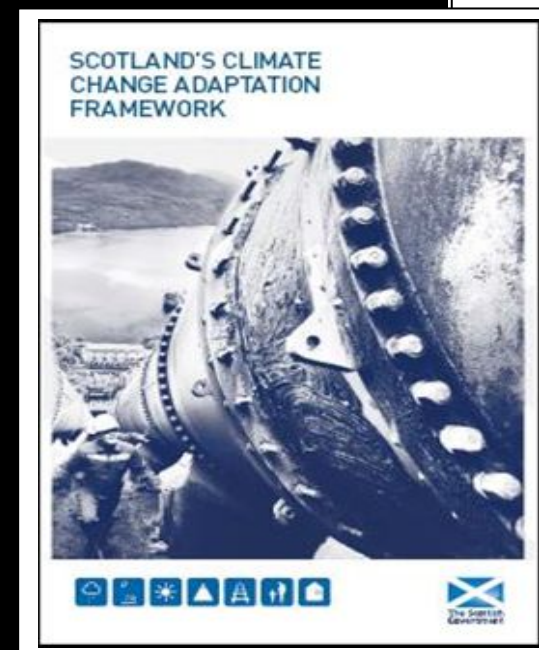
The Declaration recognises that Scottish local authorities play a key role in our collective response to the Challenge of climate change, and publicly demonstrates their commitment to action.

Scotland's Climate Change Act 2009 has created the statutory framework for greenhouse gas emissions reductions in Scotland by setting an interim 42 per cent reduction target for 2020, with the power for this to be varied based on expert advice, and an 80 per cent reduction target for 2050. To help ensure the delivery of these targets, this part of the Act also requires that the Scottish Ministers set annual targets, in secondary legislation, for Scottish emissions from 2010 to 2050.

Scotland's Climate Change Adaptation Framework was published on December 8, 2009.

It will play a vital role in building Scotland's resilience to the changing climate.

The Framework sets the strategic direction for Scottish Government actions but, because many adaptation decisions are taken at a local level by individual organisations, action from across all sectors is needed.



The LCLIP can help inform some of the many pieces of legislation or projects that Angus Council services and partners are in the process of implementing e.g.

- Flood Risk Management Act 2009
- Angus Council Shoreline Management Plan (2004)
- Tayside Biodiversity Action Plan (2002)
- Nature Conservation (Scotland) Act 2004
- Angus Local Plan Review 2009 / future Angus Local Development Plan

Adaptation planning

Adaptation planning within Angus Council and some partners is a relatively new process and our main objectives should be to:

- Highlight the possible impacts of climate change through out the Angus area.
- Assess the vulnerability of communities to climate impacts.
- Encourage council departments and partners to keep detailed information of severe weather events that have had an impact on their service.
- Raise the awareness of cost implications and encourage services to keep separate records relating to weather event impacts.
- Investigate the possibility of partners combining records to create a concise database of weather and climate impacts throughout Angus.
- Produce an Adaptation Strategy for Angus Council.

Means of promoting the LCLIP could include;

- **LCLIP Report**
 - The main report, which includes weather event records and data analysis, can be used to inform policy development.
- **LCLIP Power point presentation**
 - This medium can include a summary of the main report sections and key messages and can be used to present the information to a wider audience e.g. on internet
- **LCLIP Webpage**
 - Perhaps reaching out to the largest audience of all, having a dedicated web section or even the report online as a PDF means that a large audience can access the report at all times. Web pages can be updated so the existing report can be supplemented regularly with current information.

- **Press Releases**
- Press releases can be issued periodically. Perhaps timed with weather events, to broad or targeted audiences, raising community awareness of the LCLIP project and how climate change may affect them.

- **Committee Reports**
- A summarised report which can be used to raise councillors' awareness of the LCLIP report on which educated decisions on climate adaptation can be made.

- **LCLIP Presentations**
- The LCLIP report and power point can be combined and used as tool to provide short, informative presentations to introduce and highlight the uses of the report at specific meeting including, community groups, sustainability committees and working groups.

- **Workshops**
- Workshops can be provided for services to discuss the LCLIP project further and to raise awareness of the importance of adaptation planning. This gives participants the opportunity to help shape the process

The LCLIP concept is new and its possibilities for use in exploring data on future climate in Angus, counting financial costs, for monitoring impacts, and for informing adaptation decision- making, is a new concept and until the benefits to an organisation are recognised the LCLIP could be under utilised. It should not be viewed as a 'stand-alone' report, but as the Defra guidance suggests, it should form an important, early stage of work on climate change adaptation - an introduction for the local authority and a means to build knowledge, interest and commitment in the climate issues which affect it.

Angus Council Local Climate Impacts Profile (LCLIP) Questionnaire 2009



A **Local Climate Impacts Profile (LCLIP)** is a resource that Local Authorities can compile so that they better understand their exposure to weather and climate. It is based on evidence of a locality's vulnerability to severe weather events and in particular how these events affected a local community as well as the authority's assets and capacity to deliver services. In July 2009 Angus Council elected to participate in the **LCLIP project**.

By completing this questionnaire, you are contributing valuable information to the main body of the report and towards future planning efforts which will help Angus Council assist the Angus community in responding to unpredictable weather scenarios. Things to note can be:

lightning strikes, school closures, flooding, road accidents, road closures, power cuts black ice – gritting, fire, wind, drought, algal blooms, boat strandings, crop failure, drownings, drifting top soil and erosion, fallen trees.

Please complete the questions below as fully as possible.

1. How long have you been with your organisation and in which roles?

Name & organisation:

Contact no:

email

Please feel free to answer the next four questions in the table provided below. This can be edited, making it easier to add more events etc.

2. What data do you collect on weather related events in Angus?
3. Are there any particular severe weather events in Angus that you recall since 2001
4. How did this impact on your organisations services?
5. How did your organisation respond to this event?

DATE	WEATHER TYPE	LOCATION	IMPACTS	RESPONSE	IMPACTS FOR ANGUS COUNCIL	SOURCE
e.g. 22.11.02	Heavy rain/flooding	Angus	Severe flooding of areas surrounding major rivers	SEPA issued a severe flood warning for 3 rivers in the Angus area,	?	News.scotsman.com 03.07.10

6. What measures are being taken within your service to respond to weather events and climate change?
7. Do you think Angus Council should develop an adaptation/mitigation strategy? What do you think it should cover?
8. What is your perspective on climate change?

Thank you

References

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