

Climate Ready Scotland: Scottish Climate Change Adaptation Programme



**Laid before the Scottish Parliament under Section 53
of the Climate Change (Scotland) Act 2009**

May 2014

SG/2014/83

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MINISTERIAL FOREWORD

We know our climate is already changing. We see it all around – record rainfall and flooding, droughts and wildfires, and worrying reports of shrinking ice shelves breaking up in Greenland. The Intergovernmental Panel on Climate Change has made clear that global average sea levels may rise by as much as 0.83m by 2100 – placing ever greater pressure on our coastal heritage and communities affected by coastal flooding.



Although the aggregate impacts of climate change in Scotland might be less severe than in many other parts of the world, the impacts for individuals, businesses and communities can be distressing and damaging and it is important that Scotland is well prepared and resilient to change.

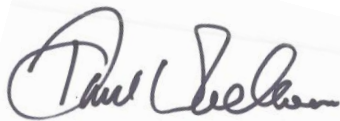
That is why taking action on climate change is a very high priority for me and the Scottish Government. This means adapting to the impacts of climate change that we are already experiencing and will experience in the future, while also contributing to global efforts to cut greenhouse gas emissions to prevent much greater change.

Preparing effectively for unavoidable climate change and reducing emissions are both essential actions if we are to ensure sustainable economic growth in Scotland – the overarching purpose of the Scottish Government – and to best protect our much valued ecosystems and species.

Climate change is not just an environmental issue – the impacts are also felt by businesses, communities and individuals. Our climate affects people's health, our road and rail services, water supplies, energy demands, tourism – the list is almost endless. Adapting to these changes is not something that governments can do alone. It depends on organisations, businesses, communities and individuals understanding the impacts of the changing climate and taking action to prepare for its effects.

Regrettably, given the impact of cumulative greenhouse gas emissions to date, we cannot eliminate all the risks we face from a changing climate. There is already considerable uncertainty regarding the extent of the impacts of climate change that is underway. Many of the factors likely to affect the degree of future climate change are, at this time, uncertain – for example the extent of future population growth and technological developments. But uncertainty is not an excuse for inaction. The challenge is to ensure that the actions we take to adapt are flexible and can be adjusted as our understanding improves.

I am grateful to all those who have engaged with us as we developed Scotland's first statutory Climate Change Adaptation Programme. Success will depend on everyone across Scotland accepting responsibility for their share of action and working in partnership. Clear leadership, advice and guidance from government is vital and I am committed to ensuring that existing and future Scottish Government policy, as far as possible, helps Scotland adapt to the effects of climate change to create a more resilient country for us to live and work in, and to help protect Scotland's much loved natural environment. This first Scottish Climate Change Adaptation Programme is a key part of that commitment.

A handwritten signature in black ink, appearing to read "Paul Wheelhouse", is centered on a light-colored rectangular background.

Paul Wheelhouse
Minister for Environment and Climate Change

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Executive Summary

This is the first Scottish Climate Change Adaptation Programme as required by section 53 of the Climate Change (Scotland) Act 2009.

It addresses the impacts identified for Scotland in the UK Climate Change Risk Assessment (CCRA) published under section 56 of the UK Climate Change Act 2008. It sets out Scottish Ministers objectives in relation to adaptation to climate change, their proposals and policies for meeting those objectives, and the period within which those proposals and policies will be introduced.

The Programme also sets out the arrangements for wider engagement in meeting those objectives.

The final Programme has been informed by the views from the public consultation which ran between June and September 2013¹, and the Scottish Parliament's Rural Affairs, Climate Change and Environment Committee scrutiny of the draft Programme.

¹ <http://www.scotland.gov.uk/Publications/2014/01/1643>

PART ONE – Setting the Scene

Introduction

The aim of the Programme is to increase the resilience of Scotland's people, environment and economy to the impacts of a changing climate.

Scotland's climate is already changing. The climate will continue to change in the future and this will present a wide range of threats and opportunities to the environment, infrastructure, economy and people of Scotland. By planning and preparing for change now, Scotland will be better placed to take advantage of any opportunities, and can build resilience to the potential negative consequences that this change is bringing.

Adaptation - The adjustment in economic, social or natural systems in response to actual or expected climatic change, to limit harmful consequences and exploit beneficial opportunities.

Context

Section 56 of the Climate Change Act 2008² requires the UK Government to publish 5-yearly assessments of risk to the UK. The first UK Climate Change Risk Assessment (CCRA) was published in January 2012 and provides an assessment of the current and predicted threats and opportunities to the UK from climate change. It includes a Climate Change Risk Assessment for Scotland³.

Following these assessments, section 53 of the Climate Change (Scotland) Act 2009 (hereafter referred to as "the Act")⁴ requires Scottish Ministers to lay a programme before the Scottish Parliament, setting out:

- their objectives in relation to adaptation to climate change;
- their proposals and policies for meeting those objectives;
- the period within which those proposals and policies will be introduced; and
- otherwise addressing the risks identified in the report under section 56 of the Climate Change Act 2008.

The Act also requires the Programme to set out the arrangements for involving employers, trade unions and other stakeholders in meeting Scottish Ministers objectives; and the mechanisms for ensuring public engagement in meeting those objectives.

² www.legislation.gov.uk/ukpga/2008/27/contents

³ http://randd.defra.gov.uk/Document.aspx?Document=10069_CCRAforScotland16July2012.pdf

⁴ www.legislation.gov.uk/asp/2009/12/contents

Publication of the first Scottish Climate Change Adaptation Programme brings into force the adaptation requirement of the public bodies climate change duties introduced by section 44 of the Act which requires that a public body within the definition of the Act, must, in exercising its functions, act in the way best calculated to help deliver the Programme.

The UK Climate Change Risk Assessment

The Climate Change Risk Assessment for Scotland (CCRA) describes, and where possible quantifies, the impacts from climate change facing Scotland up until 2100. The assessment is based primarily on the UK Climate Projections which were published in 2009 (UKCP09)⁵. UKCP09 provides projections of future climate from the present to 2100, and represents the most authoritative evidence of potential changes in climate for Scotland.

Over 130 impacts for Scotland have been identified, and while the majority of these represent potential threats for Scotland, some present potential opportunities. The impacts vary in character and whilst some have been quantified, others have had to rely on expert elicitation or a narrative based on literature. To allow some comparison of different risks, they have been categorised into classes of 'high', 'medium' and 'low' magnitude consequences and 'high', 'medium' and 'low' confidence. The overall confidence is generally 'low' to 'medium', with only impacts that are already experienced and those related to increased temperatures classified with 'high' confidence. Some impacts are identified as 'too uncertain', either because the science is not sufficiently well advanced to understand the scale of the consequences or the inherent uncertainty is too great.

This information, and other information where available, has been used to inform those impacts that the Scottish Government considers to require early adaptation action as highlighted in the Technical Annex to this Programme.

⁵ <http://ukclimateprojections.defra.gov.uk/21678>

The Scottish Climate Change Adaptation Programme

This Scottish Climate Change Adaptation Programme (hereafter referred to as “the Programme”) addresses the impacts identified for Scotland in the CCRA. The Programme does not directly address matters which are expressly reserved to the UK Government⁶. Reserved matters are dealt with under the UK Government’s National Adaptation Programme.

Due to the inherent uncertainty in some aspects of climate change, adaptation policies need to be flexible and adjusted as and when new information becomes available. The Programme is part of an iterative process and subsequent programmes are required to address impacts and opportunities identified in progressive CCRAs due every 5 years.

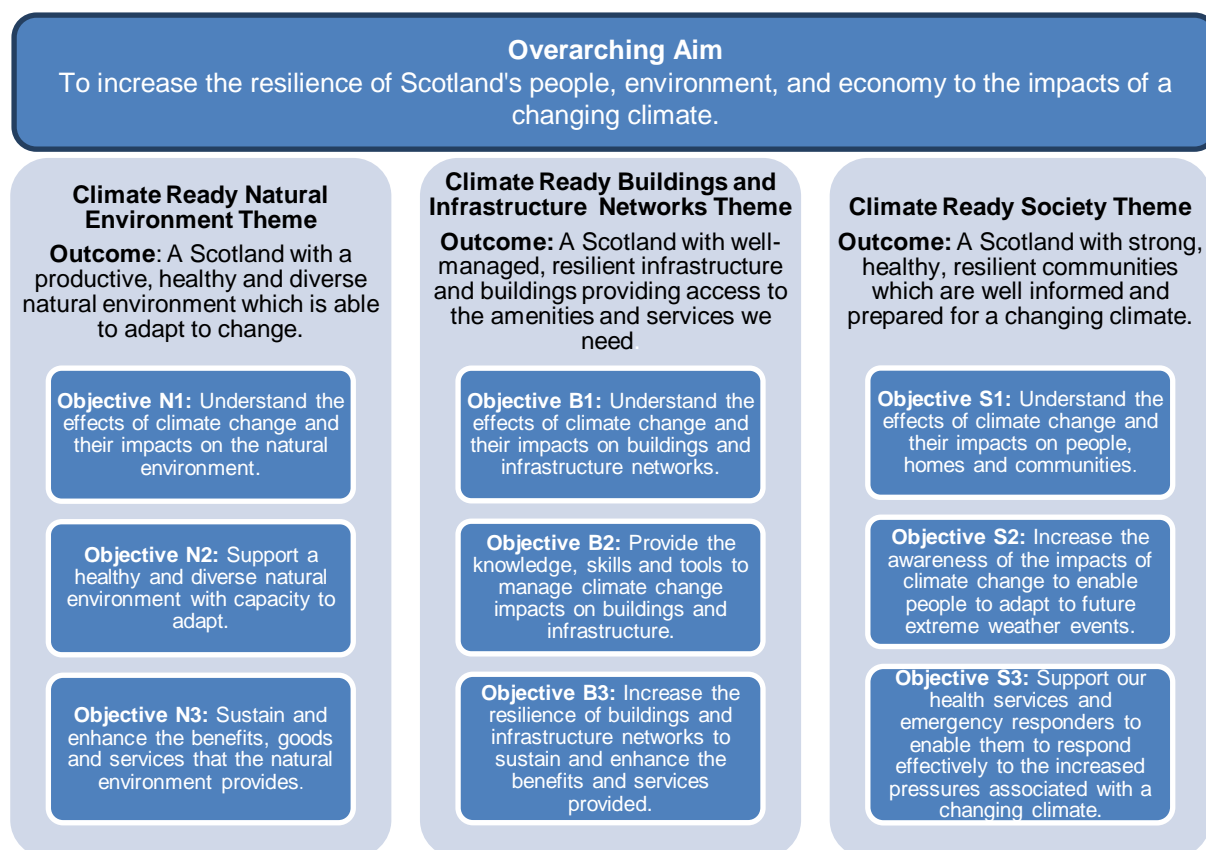
The Programme is structured around an overarching aim and three themes. There will inevitably be interactions between each theme and they should not be viewed in isolation. For example, the health and productivity of ecosystems underpins agriculture which is essential for livelihood and food security. Reducing vulnerability and building resilience in the natural environment will therefore help to reduce vulnerability and build resilience for society. And adapting our buildings can bring additional public health benefits for society by reducing heat and cold-related mortality, indoor air pollution and mould growth.

Each theme has an outcome that the Programme is seeking to deliver in the long term (up to 2050), and within each theme are three objectives (referenced by Theme as N1-N3, B1-B3 and S1-S3). This sets the long term framework for future Programmes (Figure 1).

Each Programme will set out the proposals and policies that provide the focus for the lifetime of that Programme in order to progress towards the long term objective. These will evolve and develop with each Programme, providing flexibility to adjust to new understanding and information.

⁶ Reserved matters are those which the UK Government has control over and are set out in Schedule 5 of the Scotland Act 1998. Examples include immigration, tax, national security, energy policy and telecommunications.

Figure 1: Overarching Aim, Themes and Objectives



National policy supporting wider action

Action to adapt to the changing climate is required across society. Many actions are most appropriately undertaken at a local level, where impacts will primarily be felt.

The long-term sustainability of Scotland in a changing climate will depend on businesses, government, organisations, communities and the individuals in them accepting responsibility for their share of action and working collaboratively. In some cases it will require a behaviour change - in others a continuation or adaptation of their efforts. But this needs to be supported by national policy and the Scottish Government must lead by example. This approach will help to address barriers for adapting at a local level and encourage appropriate action.

Planning for the changing climate is being comprehensively embedded into Scottish Government policy. For example - the Land Use Strategy; Biodiversity Strategy; National Planning Framework; National Marine Plan; National Flooding Policy; Scotland Rural Development Programme; Critical National Infrastructure Strategy; Resilience Planning; and research funding – all reflect the need for Scotland to prepare for the changing climate.

However, it will not be enough to act alone as a nation. Scotland will need to co-operate with its EU neighbours and countries further afield to harness their collective efforts and expertise.

Working with our UK and international partners

The UK Government, Welsh Assembly Government and Northern Ireland Assembly are all pursuing climate change adaptation in their respective jurisdictions. The Scottish Government is working closely with other UK Administrations to ensure the sharing of best practice and cross-border cooperation. This includes development of the next UK Climate Change Risk Assessment of the current and future risks from climate change, due by 2017.

Climate change is a global challenge and Scotland will not be immune to the effects of impacts felt in other regions. Similarly, decisions and actions within Scotland may also affect societies and environments outside Scottish borders. The Programme will implement policy to adapt to climate change at a domestic level, however, the UK and international developments will affect our domestic policies.

The Scottish Government is committed to the creation of a modern, inclusive Scotland which protects, respects and realises international human rights standards. Climate change impacts on human rights, particularly the rights contained within the International Covenant on Economic, Social and Cultural Rights. Scotland's National Action Plan for Human Rights⁷, launched on 10 December 2013, outlines the Scottish Government's commitment to promoting climate justice at home and abroad.

Scottish Ministers have actively participated in international climate change conferences and are championing climate justice, a key issue for human rights in the 21st Century that is rising up the UN agenda. In line with aims of the Scottish Government's International Framework, we will share our experiences, values and expertise in areas such as justice, education, and climate change with a view to seeing the human rights of people across the world fully realised.

Evidence shows that developing countries are most at risk from current and future impacts of climate change and least able to adapt to increased risk of drought, disease, flooding, heat waves, rising sea levels and other impacts of climate change⁸. The Scottish Government has launched an innovative Climate Justice Fund providing support to some of the poorest communities in the world to develop resilience to the worst impacts of climate change.

The UK Government commissioned research by Price Waterhouse Coopers (PWC) on the international threats and opportunities to the UK. Some of the main findings are set out below.

⁷ <http://www.scottishhumanrights.com/application/resources/documents/SNAP/SNAPpdfWeb.pdf>

⁸ The Stern Review of the Economics of Climate Change, www.sternreview.org.uk

PWC Report on International Threats and Opportunities from Climate Change

- The threats associated with climate change internationally can be an “order of magnitude” larger than domestic threats for some thematic areas, in particular business (trade and investment) and food (imports).
- Certain foodstuffs and energy are concentrated in relatively few countries. Climate change is highly likely to exacerbate volatility of import prices and cause disruptions of supply, over the short-term (to 2020s). Over the longer term (2050s to 2080s) the increasing impacts of climate change could lead to more pervasive systemic changes to trade in food and other physical commodities, with knock-on effects in other areas such as health, conflict and global governance.
- The UK has its strongest links with industrialised countries, generally considered to be less vulnerable to climate change. However recent climatic events in such countries, for example drought in the American south-west, show that our exposure to these costs can be high.

IMPRESSIONS (Impacts and Risks from High-End Scenarios: Strategies for Innovative Solutions)

This project aims to increase our understanding of the consequences of high-end climate change. The project will help decision-makers apply this knowledge within integrated adaptation and mitigation strategies.

Scotland is an important case study in this 5-year €9 million EU-funded project that involves an international team from 27 research institutions from 18 countries. Researchers from The University of Edinburgh and ClimateXChange will develop the Scottish case study with other project partners. Adaptation Scotland will play a key role in making sure that policy makers from across Scotland are involved and benefit from the work. This project will build on another completed EU project – CLIMSAVE - which created an interactive web-based tool for citizens and policy makers to simulate climate change impacts across multiple sectors. Scotland was the regional case study for this project, with the creation of a customised Scottish version of the tool.

Who is the Scottish Climate Change Adaptation Programme for?

The Programme is the Scottish Government's first step towards ensuring that existing and future Scottish Government policy helps drive and support adaptation activity in Scotland. In taking forward this adaptation agenda, the Scottish Government will work collaboratively with a range of local, national and international partners, and with strategic partners including organisations that deliver public services, that manage Scotland's natural environment, that develop social and economic policy and that work in our communities.

Sustainable adaptation to the impacts of climate change will require a mixture of actions at local, national and international levels. No one organisation can address this in isolation. There are complex interactions between and within sectors. Therefore, success will depend on organisations, businesses and communities across Scotland accepting responsibility and working in partnership if we are to create a Scotland which is increasingly recognised as an attractive, environmentally-conscious and climate resilient place in which to live, work and invest.

How is our Climate Changing?

Weather and Climate Change

To understand climate change, it is important to understand the difference between weather and climate. Weather is the temperature, precipitation (rain, hail, sleet and snow) and wind, which change hour by hour and day by day. Climate is the average weather we expect over a long period of time, typically 30 years or longer. Infrequent spells of extreme cold weather regionally does not mean that climate change is not happening.

The Changing Climate

There is unequivocal evidence that the global climate is already warming and the continued emissions of greenhouse gases will cause further warming and changes in the climate system. The extent of future change will depend on global efforts to reduce greenhouse gas emissions, with a stark contrast evident by the end of the 21st century.

The Intergovernmental Panel on Climate Change's Fifth Assessment Report⁹ (IPCC AR5) on the state of the climate is the most comprehensive report on the subject ever written. The scientific evidence is clear: warming of the climate system since the 19th century is unequivocal and global temperatures have risen by 0.9°C. It is extremely likely that greenhouse gas emissions as a result of human activity have caused more than half the warming seen since the middle of the 20th century.

Regardless of how successful the global mitigation effort proves to be, the legacy of past and current greenhouse gas emissions means that climate change over the next few decades is now unavoidable.

IPCC AR5:

"Since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased." (IPCC AR5, 2013)

"Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions." (IPCC AR5, 2013)

⁹ <http://www.ipcc.ch/>

Scotland's Climate

We are already seeing evidence of Scotland's climate changing¹⁰. Over the last few decades our climate has warmed, sea-levels have risen, rainfall patterns have changed and we have been impacted by extreme weather events. Temperatures have been increasing, with the last decade the warmest since records began¹¹. Rainfall has been increasing in Scotland over the last thirty years, with more heavy downpours.

Climate projections for the next century¹² indicate that the climate trends observed over the last century will continue and intensify over the coming decades.

We can expect future changes in climate to be far greater than anything we have seen in the past. The UK Climate Projections 2009 (UKCP09) indicate that our average climate will become warmer throughout the year, with this few degrees of temperature creating conditions unlike anything in Scotland today. The projections also indicate that rainfall is likely to become even more seasonal, with an average summer becoming drier, while autumn and winter become wetter.

The key climate trends for Scotland are:

- **Hotter, drier summers; and**
- **Milder, wetter autumns and winters**

We need to recognise that climate averages alone do not tell us the whole climate story. The weather from year to year is determined both by the long-term trend of climate change and the short-term natural variability, including natural cycles. It is possible that in our future we will see conditions that are increasingly variable and unpredictable, season-to-season and year-to-year. This could lead to fluctuating temperatures and more frequent and/or prolonged periods of drought or above average rainfall. It is also likely that extreme weather events, like heat waves or heavy rainfall, will become more common. This means that not all future summers will be hot and dry, nor all winters warm and wet even though this is the general trend expected in future. This will present a wide range of threats and opportunities to the environment, infrastructure, economy and people in Scotland.

¹⁰ <http://scotland.gov.uk/Publications/2013/08/1634>

¹¹ www.scotland.gov.uk/Publications/2012/08/2023

¹² <http://ukclimateprojections.defra.gov.uk>

The Changing Climate: What does this mean for Scotland?

The experience of recent years has shown us that climate change and extreme weather events have already impacted many aspects of our natural environment and our society, including buildings and property, health, agriculture, forestry, transport, water resources and energy demand.

These changes have already had a widespread impact. For example, warmer springs in recent decades have caused a trend towards many biological events, such as flowering, budbreak, laying and hatching of eggs, occurring earlier in the year. Scotland's trees and forests are facing major threats from pests and diseases established in Scotland as well as pests from Europe, and climate change is likely to create conditions that could make this worse. In 2010, phytophthora ramorum (sudden oak death) was found in Dumfries and Galloway and recent surveys have found it is now widespread in the region.

Some of the key consequences¹³ for Scotland that may occur from the impacts of climate change are presented below and explored in more detail in Section Two of the Programme:

The productivity of our agriculture and forests

A warming climate has the potential to improve growing conditions in Scotland and increase the productivity of our agriculture and forestry. However, climate change will also pose a number of threats, from more variable and extreme weather to the spread of pests and diseases, which may limit this potential.

The occurrence of pests and disease

As our climate changes, it will create new conditions that may allow existing pests and disease to spread and new threats to become established in Scotland. This may impact on the health of our people, animals, plants and ecosystems if risks are not properly managed.

The quality of our soils

We rely on soils to sustain biodiversity, support agriculture and forestry, regulate the water cycle and store carbon. Soils also have an historic environment value, as a proxy record of environmental change and for the preservation of archaeological deposits and artefacts. Soils and vegetation may be altered by changes to rainfall patterns and increased temperatures - as well as the way we use the land.

The health of our natural environment

Climate change may affect the delicate balance of Scotland's ecosystems and transform Scotland's habitats and biodiversity, adding to existing pressures. Some distinctive Scottish species may struggle and could be lost, invasive non-native species may thrive, while a degraded environment may not be able to sustain productive land or water supply.

¹³ Based on the threats and opportunities identified for Scotland in the Climate Change Risk Assessment and other credible evidence sources to identify the key consequences for Scotland.

The security of our food supply

Climate change may have an impact on global food production. Although Scotland may be able to grow more food, this will not offset the impact global disruption has on us. The effects of increased volatility in the global commodity market due to exposure to extreme climatic events has an impact on supply and cost of food.

The availability and quality of water

As our climate warms and rainfall patterns change, there may be increased competition for water between households, agriculture, industry and the needs of the natural environment. Summer droughts may become more frequent and more severe causing problems for water quality and supply.

The increased risk of flooding

Flooding can already have a devastating effect on those affected. With climate change likely to alter rainfall patterns and bring more heavy downpours, we expect flood risk to increase in the future. This could impact on properties and infrastructure – with serious consequences for our people, heritage, businesses and communities.

The change at our coast

Sea level rise is already having a widespread impact on parts of Scotland's coast. With this set to accelerate over the coming decades, we can expect to see more coastal flooding, erosion and coastline retreat – with consequences for our coastal communities and supporting infrastructure.

The health of our marine environment

Our marine ecosystems – from plankton through to fish, mammals and seabirds – are already being affected by climate change alongside other pressures, particularly fishing. Changes will continue, with rising temperatures likely to change species and their distributions. The changes will present both threats and opportunities to our commercial fisheries and aquaculture.

The resilience of our businesses

Climate change and associated extreme weather may disrupt transport, energy and communication networks in Scotland and around the world. This could impact on markets, affect supply chains and raise insurance costs.

The health and wellbeing of our people

A warming climate may provide more opportunity to be outdoors and enjoy a healthy and active lifestyle, while reducing mortality in winter. However, it could affect patterns of disease and other health issues. Climate change and associated extreme weather may disrupt the lives of individuals and communities, limiting access to vital services and impacting on people's physical and mental health.

Our cultural heritage and identity

The changing climate is already altering our unique Scottish landscape and threatening our historic environment through coastal erosion, flooding and wetter, warmer conditions. The increased pace of climate change presents challenges to all those involved in the care, protection and promotion of the historic environment.

The security and efficiency of our energy supply

Climate change may influence Scotland's capacity to generate weather-dependent renewable energy. For example, varying water availability will affect hydro generation schemes. Climate change can also impact power distribution, with impacts ranging from damage caused by extreme weather events, to reduced transmission efficiency occurring as a result of temperature fluctuations. Impacts on global energy markets may also affect energy supplies in Scotland and consequently our overall energy security.

The performance of our buildings

Climate change will have an impact on the design, construction, management and use of our buildings and surroundings. Whether retrofitting existing or building new, it is likely that there will be issues with water management (in flood and drought), weather resistance and overheating.

Infrastructure – network connectivity and interdependencies

Our energy, transport, water, and ICT networks support services are vital to our health and wellbeing and economic prosperity. The effect of climate change on these infrastructure systems will be varied. They are likely to be impacted by an increase in disruptive events such as flooding, landslides, drought, and heatwaves. Our infrastructure is closely inter-linked and failure in any area can lead to wider disruption across these networks.

Adapting to Scotland's Changing Climate

Planning for, and managing the risks posed by the impacts of climate change supports the Scottish Government purpose of increasing sustainable economic growth.

Adaptation is an on-going process. It involves the on-going integration of options, costs and risks by private and public decision makers in different locations and over different timescales. There is value in developing an approach to climate adaptation that can guide the many decision making processes over time. This approach should be one of sustainability that builds the resilience of our communities and the long-term prosperity of our environment and our economy.

Strategic Principles for Climate Change Adaptation

A sustainable approach to climate change adaptation should be underpinned by the following principles:

1. Adaptation must be addressed alongside actions to reduce greenhouse gas emissions and environmental impacts:

Actions to adapt for a changing climate should, where possible, avoid negative impacts on the environment or society. It is important to understand the interactions between potential mitigation actions and potential adaptation actions and take advantage of synergies and address any negative relationships where necessary. Without mitigation and the move to a low carbon economy, the scale of adaptation challenges will increase significantly.

2. Adaptation should build broader resilience:

Changes in Scotland's climate will bring both short and long-term challenges. In addressing immediate impacts of climate change, opportunities for developing broader benefits of strong communities, sustainable economic growth and a healthy environment should be considered, as this will make Scotland more resilient to future change.

3. Adaptation should be informed by a cycle of review and action:

Actions to adapt must account for inherent uncertainty of climate projections and related factors through monitoring and reviewing systematically. This improves the knowledge base by identifying those responses which have been successful and providing the flexibility needed in order to adjust to new understanding and information as it becomes available.¹⁴

¹⁴ http://www.climatechange.org.uk/files/9713/7365/7868/Flexible_adaptation_pathways.pdf

4. Adaptation should be integrated into existing development and implementation practices:

Preparing for a changing climate should be integrated into existing risk management and planning processes and decisions, as an extension of good development practice. Decisions and actions should be flexible and adaptable, and informed by a cycle of review, based on on-going monitoring and latest evidence.

5. Adaptation should be integrated at an appropriate scale:

Adaptation to the impacts of climate change should be implemented at the most appropriate scale. Some policy action will be needed at the national scale however implementation at a local level may be most effective, as the impacts and consequences may vary considerably by area or community. A local approach will be enhanced through broader support for capacity building, sharing of best practice and supporting policy.

6. Adaptation should be developed in partnership with interested parties and avoid restricting others from adapting:

Climate change will impact on many resources, such as water, that are vital to a number of individuals and organisations from across sectors. In developing adaptation actions, the interests of others and other sectors should be considered. Seeking a more joined-up, strategic approach that builds collective responsibility and ownership can avoid potential conflicts, and enhance the effectiveness and sustainability of the planned adaptation.

Taking a planned approach

It is vital to plan for the changes to our climate. Some climate impacts are being felt now and others will not be experienced in some parts of Scotland for decades. There will be negative impacts to overcome and new opportunities which we can benefit from. In some areas immediate, practical action is needed now whereas for others flexible, long-term strategic planning is required.

Failure to adapt and manage risks could lead to the collapse of a system, service, or asset. Action without informed and co-ordinated planning, will result in adaptation occurring spontaneously and action is more likely to be responsive and lead to less optimal, or possibly adverse, outcomes. In some cases, it could even lead to unintended negative consequences.

Taking a planned approach, which follows adaptation principles and guidelines is also needed to avoid maladaptation or unintended consequences of actions. For example, dredging a river to avoid flooding in one location may result in unintended flooding downstream.

There is a range of effective actions that can be taken now to prepare for the changing climate and build resilience to climate change impacts. Many of these actions can be characterised as being *no-regret*, *low-regret*, or *win-win* actions. These types of action can be described as follows:

- **No-regret actions** are cost-effective under current climate conditions and are consistent with addressing risks of climate change. They do not involve any hard trade-offs with other policy objectives. Examples include, use of resilient building materials and surface water run-off measures in new buildings.
- **Low-regret actions** are relatively low cost and provide relatively large benefits under a range of predicted future climates. Examples include incorporating greenspace, permeable paving and sustainable drainage systems into urban developments.
- **Win-win actions** contribute to adaptation whilst also having other social, economic and environmental benefits. Examples include natural flood management techniques, such as tree planting, that reduce flood risk and support biodiversity conservation and habitat connectivity; and green roofs which reduce building temperature and rainfall runoff at the same time as reducing energy use for heating and cooling.

Identifying no-regret, low-regret and win-win actions enables organisations to start taking concrete steps to adapt to climate change, rather than adopting a 'wait and see' approach. Standard techniques such as cost-benefit and cost-effectiveness analysis can be used to identify no- and low-regret options. Planning actions which provide win-wins or multiple benefits can help to justify limited spending. For example, providing high quality urban greenspace can be good for nature, reduce flooding, and improve mental and physical health.

Building in flexibility is also important. Due to the inherent uncertainty in some aspects of climate change, adaptation policies need to be flexible and adjusted as and when new information becomes available. This flexibility provides the opportunity to learn from others and to learn from our own experiences, allowing us to choose more sustainable planning, design or investment options where the risks and opportunities associated with changes in our climate have been properly assessed and understood.

Flexible actions can be described as those which allow for sound adjustments to be made over time, based on our improving understanding of the risks and the effectiveness of the action. They can be undertaken in parallel with building understanding and reducing uncertainty to help develop longer-term actions.

There is also the need to take action for reasons of moral responsibility. For example, to help the most vulnerable members of society, or to support wildlife and the natural environment – which is suffering from climate impacts caused by human action.

Managing climate risk

Climate risk needs to be managed just like any other risk. By assessing the impacts of present-day weather and climate, we can understand existing vulnerabilities and how we might reduce existing risks. Reducing those risks, especially those that are projected to increase with future climate change, can have multiple and immediate benefits.

To fully assess the potential risks and opportunities of a changing climate in Scotland, we must not only understand the likelihood and degree of change, we must also understand the consequences of that change and the costs of prevention. The direct and indirect impacts of a changing climate on our environment, economy and society must be better understood as well as how people can be motivated to adapt appropriately.

Managing climate uncertainty and probability

Uncertainty should not act as a barrier to adapting to future change. Many other issues and risks are highly uncertain, such as global commodity prices and demographic change, but these do not prevent decisions being taken now that will be affected by future change – it is a question of managing these risks and the uncertainty surrounding them.

Decision making under uncertainty

Although the evidence about how the climate is likely to change in the future is strong, the amount of change is uncertain.

Even with the latest advances in climate modelling¹⁵, we cannot be entirely certain about how much change we can expect in the future. This means we should take a flexible approach to planning and decision making in order to avoid wasted investments, unnecessary costs and increasing risks to people and assets.

Adaptation policies need to be flexible and adjusted as and when new information becomes available. By adopting a flexible approach, recognising that our understanding of the risks and the adequacy of a given adaptation action will change over time, we are able to allow for systematic changes to be made in order to respond to new information and changing circumstances.

¹⁵ <http://ukclimateprojections.defra.gov.uk>

Funding Adaptation

Climate change adaptation will come at a cost. But failing to adapt will cost us more. Crucially, adaptation is not just about Scottish Government expenditure - costs will fall across the public sector, organisations, business and individuals. Adaptation demands the efficient and targeted use of existing resources.

Where restructuring is occurring anyway, it is an opportunity to plan for a future in which the climate is not the same as it has been in the past – a future which will not only have a different climate but also a low carbon economy. If incorporated early enough in development, adaptive measures may be less costly. The key is to be alert to the impacts of climate change and see opportunities to adapt as and when they arise. Early adaptation through design for climate change, including retrofit, is more cost effective and sustainable than taking no action.

Preventative Spend

The most obvious reason for taking action to prepare and adapt to the changing climate is to minimise the disruption or damage – and associated cost – caused by the changing climate.

While it may not be appropriate or feasible to adapt immediately in every specific case, actions to adapt should be pursued where costs are determined to be less than the likely future losses caused by climate change. The estimation of costs and losses should reflect environmental, social and financial considerations. However, not all adaptation actions will stand up to strict cost benefit analysis – these actions may need to be taken because they are the right thing to do.

The consequences of many decisions being taken now will be with us for many decades, so it is important to consider the costs and benefits of adaptation actions over an appropriate period of time. In some cases, such as reducing flood risk, this may require a significant capital investment in the short-term which is followed by long-term savings as loss to property and disruption to communities is reduced or avoided altogether.

The Scottish Government acknowledges that a shift to target investment in preventative approaches (not just on climate change) will deliver better outcomes and value for money. It is therefore important that the Scottish Government leads the way and provides support and funding in areas that are the responsibility of the Scottish Government.

The Scottish Government already provides support and funding for adaptation through:

- the development of a robust evidence base, including annual funding to the ClimateXChange adaptation research programme;
- programmes to develop adaptive capacity, including funding Adaptation Scotland to help organisations, business and communities, and;
- policy-specific actions, including annual funding of the Scottish Flood Forum to help enhance their support to promoting flood risk and supporting those who have been affected by flood events.

Building Resilience to the Impacts of Climate Change

Improving Understanding

The Scottish Government relies on widely accepted evidence informing the international response to climate change. This includes the Intergovernmental Panel on Climate Change whose Fifth Assessment Report (AR5)¹⁶ sends a stronger warning than ever that human activity is changing the global climate and that adaptation is essential to deal with the risks of climate change alongside urgent action to reduce emissions. The United Nation's World Meteorological Organization¹⁷ provides evidence on the state and behaviour of the Earth's atmosphere and climate, including an annual statement on the status of the global climate which provides a snapshot of global and regional trends in weather and climate and the most significant extreme events. Evidence from the UK's Met Office Hadley Centre¹⁸, a recognised leader in climate change prediction and impact assessment, contributes to understanding of the changing climate.

We have a solid evidence base for understanding the impacts of climate change in Scotland. The UK Climate Projections (UKCP09) and the Climate Change Risk Assessment (CCRA), in particular, provide a robust basis for adaptation planning. However, we need to continue to build the evidence base to improve our understanding of the impacts of climate change, and how we can best adapt to deal with threats and seize opportunities. The evidence base will be improved as we learn by implementing adaptation actions.

Building Skills and Knowledge

Improving the evidence must be accompanied by awareness raising of the consequences of the changing climate and the provision of information and support to help organisations, businesses and communities adapt.

Public Engagement

The support of communities, organisations and individuals will be required to successfully achieve the objectives set out in the Programme. To gain this support, there must be a general awareness of why it is important that Scotland is prepared for a changing climate and what the costs of inaction may be. Communities have immense potential for developing innovative, grass-root responses to the challenges of climate change.

¹⁶ <http://www.ipcc.ch/>

¹⁷ http://www.wmo.int/pages/index_en.html

¹⁸ <http://www.metoffice.gov.uk/climate-change/resources/hadleycentre>

Working Together

Adapting to the challenge of climate change cannot be delivered by one agency, one organisation, or through one action. It will not be addressed in a week, a month or even a year. This is a long term issue that requires an on-going commitment from organisations, businesses and communities across Scotland.

The impacts of climate change will affect Scotland as a whole; we all have a role to play in ensuring Scotland is well prepared and resilient to change.

Engaging Others

This section sets out the arrangements for involving employers, trade unions and other stakeholders in meeting Scottish Ministers objectives; and the mechanisms for ensuring public engagement in meeting those objectives, as required by Section 53(2)(a)(iii) and (iv) of the Act.

1. The role of the Scottish Government

It is vital that the Scottish Government provides clear leadership in promoting a sustainable approach to climate change adaptation. The Programme is the Scottish Government's first step towards ensuring that existing and future Scottish Government policy helps drive and support adaptation activity in Scotland. In taking forward this adaptation agenda, the Scottish Government will work collaboratively with a range of local, national and international partners.

Advice and Guidance

Effective leadership requires government to provide clear advice and guidance, helping sectors across society to better understand their role in addressing climate change and ensuring easy access to necessary information and tools. The Scottish Government incorporates advice and guidance in its own publications where appropriate, some of which are highlighted in this section.

In addition, the Scottish Government funds the Adaptation Scotland¹⁹ programme to provide guidance and support to help organisations, businesses and communities in Scotland prepare for, and build resilience to, the impacts of climate change. See Annex A for guidance, practical tools and web based resources available through the Adaptation Scotland programme.

Providing Evidence

It is important that advice and guidance is based on the best available evidence. The Scottish Government works with a number of partners to develop the evidence base for Scotland.

ClimateXChange is Scotland's Centre of Expertise on Climate Change²⁰. It is funded by the Scottish Government and provides research to inform climate change policy making in Scotland. ClimateXChange has a programme of research projects that support adaptation decision-making across sectors in Scotland. ClimateXChange also responds to particular policy-relevant questions as these arise, and is working with a range of sector stakeholders on projects that address particular issues.

¹⁹ www.adaptationscotland.org.uk

²⁰ <http://www.climatexchange.org.uk/>

ClimateXChange

The ClimateXChange programme addresses three key adaptation challenges:

Measuring adaptation progress

ClimateXChange is developing indicators that will allow us to measure climate change adaptation. The project is establishing baseline information that gives us a picture of where we are starting from. It also provides tools to assess trends over time and to understand the nature, extent and effectiveness of adaptation responses.

Understanding adaptation costs and benefits

Adaptation economics considers the costs, benefits and trade-offs associated with particular adaptation actions. These include impacts on people's well-being.

Demonstrating adaptation in practice

ClimateXChange is working with 'on the ground' specialists and practitioners such as farmers and foresters to provide knowledge on emerging adaptation issues. ClimateXChange is establishing a range of case studies, demonstration sites and networks, which cover sectors including: farming; woodlands and forestry; housing; and river catchments.

The Scottish Government also works with the Met Office, to reduce, mitigate and prepare for the effects of climate change. With a dedicated Edinburgh office and forecasting centre in Aberdeen, the Met Office covers a range of services which help deliver against Scottish Government objectives²¹.

Working with the UK Government and other devolved administrations, the Scottish Government supported the development of the UK Climate Projections 2009 (UKCP09). These projections show the changes that can be expected across the UK, including Scotland, during the rest of this century. Working with Sniffer²² and other partners, the Scottish Government also supported work to assess historic climate trends across Scotland.²³

The Scottish Government is one of the partners in the Living with Environmental Change (LWEC) Partnership²⁴ which aims to ensure that decision makers in government, business and society have the knowledge, foresight and tools to mitigate, adapt to and benefit from environmental change.

²¹ <http://www.metoffice.gov.uk/publicsector/devolved>

²² Scottish and Northern Ireland Forum For Environmental Research

²³ For further information, see Adaptation Scotland website at <http://www.adaptationscotland.org.uk/>

²⁴ <http://www.lwec.org.uk/>

Marine Scotland supports the work of the Marine Climate Change Impacts Partnership (MCCIP) in its production of evidence of climate change impacts in the marine environment. MCCIP synthesises broad based evidence on how climate change is affecting our coast and seas and communicates its findings through an annual report card and special topic report cards²⁵.

Knowledge Transfer

The Scottish Government's rural and environment strategic research programme contains work to improve our understanding of the impact of climate change on the environment and appropriate land management options – including knowledge transfer of the relevant findings. In addition, knowledge transfer is being taken forward by Scotland's research institutes including through ClimateXChange.

Building Partnerships

No single organisation, business or community can adapt to climate change alone. We are all dependent on and influenced by the decisions of others and need to work together to adapt. The Scottish Government is building partnerships to co-ordinate action across boundaries of organisations' responsibilities, through:

- establishment of forums such as the Public Sector Climate Leaders Forum, and the Scottish Flood Forum;
- creating research partnerships including ClimateXChange²⁶, involving researchers across 15 Scottish research and higher education institutions; and CREW²⁷, a partnership between the James Hutton Institute and all Scottish Higher Education Institutes;
- support for Adaptation Scotland to encourage partnership working across sectors. Examples include place based adaptation in Glasgow and the Clyde Valley and working with spatial planners to embed adaptation at the heart of regional and local planning processes. (see Annex A for Adaptation Scotland information and resources to support collaborative working), and;
- support for working partnerships such as the Scottish Flood Forecasting Service (SFFS), a joint initiative between the Scottish Environment Protection Agency (SEPA) and the Met Office so that both organisations can share their expertise to improve the accuracy of flood forecast for the whole of Scotland.

²⁵ <http://www.mccip.org.uk/>

²⁶ <http://www.climatexchange.org.uk/>

²⁷ Centre of Expertise for Waters, <http://www.crew.ac.uk/>

2. Public sector

The Climate Change (Scotland) Act 2009 places duties on Scottish Ministers and public bodies to act in the way best calculated to help deliver this Programme. Guidance²⁸ to assist public bodies comply with the duties has been published by the Scottish Government which includes advice on monitoring and reporting. More detailed advice on monitoring and reporting for local authorities is contained in Scotland's Climate Change Declaration guidance and reporting template²⁹, produced by the Sustainable Scotland Network, and the Sustainability Reporting Guidance³⁰ produced by Scottish Government provides a more detailed reporting framework for the wider public sector.

In addition to being major employers in Scotland, public bodies have a key role in building a resilient Scotland prepared for the challenges of the changing climate through the development of evidence and research, provision of guidance and services, delivery of adaptation measures, and through direct management of built and natural estates. Several of Scotland's key public agencies have already published their own climate change action plans³¹.

Public bodies will have varying degrees of influence in relation to adaptation in Scotland depending on their particular role, functions and responsibilities. A number of public bodies are directly involved in delivering policies in this Programme but all public bodies need to be resilient to the future climate and to plan for business continuity in relation to delivery of their functions and the services they deliver to the wider community.

Another key role for public bodies will be in influencing and supporting the resilience of individuals and communities to the impacts of climate change, for example, by building adaptive capacity through raising awareness of impacts, and community consultation as part of the adaptation planning process.

Public bodies are encouraged to work together through existing mechanisms - for example, Community Planning Partnerships - or through devising new partnerships, and to explore opportunities for building capacity and sharing best practice. The Adaptation Scotland website presents a useful portal for sharing best practice between public sector organisations and broader private and community sectors, but direct engagement is also needed.

²⁸ www.scotland.gov.uk/Publications/2011/02/04093254/0

²⁹ <http://www.keepsotlandbeautiful.org/sustainability-climate-change/sustainable-scotland-network/climate-change/scotlands-climate-change-declaration/>

³⁰ <http://www.scotland.gov.uk/Publications/2013/07/4721/downloads#res427782>

³¹ Including the Scottish Environment Protection Agency, Forestry Commission Scotland, Historic Scotland and Scottish Natural Heritage who have developed climate change actions plans and have worked together to identify synergies for taking action forward.

Public bodies are impacted upon by a changing climate and will need to:

a) Be resilient in a changing climate

Impacts of the changing climate will be felt by organisations irrespective of their size, location, activities and services. Public bodies depend on secure supply chains, resource supplies (energy, water, materials) and infrastructure and these could be at risk from the changes in the climate - for example, increased flood risk. It is important that to operate effectively, public bodies are resilient in the face of climate change. Understanding the changes and how these changes could impact on the day to day running of the organisation is a useful starting place. For example, public bodies could put in place Sustainable Drainage Systems (SUDS) on their own estates.

b) Help Scotland prepare for a changing climate

Through carrying out their functions, some public bodies will play a central role in preparing Scotland for a changing climate. For example, a planning authority taking account of flood risk in decisions on the location of developments. Public bodies can also influence Scotland's resilience by, for example, protecting ecosystem services such as natural flood management.

Another key role for public bodies will be in influencing and supporting the resilience of individuals and communities to the impacts of climate change, for example, by building adaptive capacity through raising awareness of impacts and community consultation as part of the adaptation planning process.

Public bodies' functions vary significantly, and include undertaking statutory roles and providing essential services to people living and working in Scotland. These activities need to be maintained and remain affordable in the face of a move towards a low-carbon future and a changing climate.

Public Bodies Climate Change Duties: Putting Them Into Practice, Scottish Government, February 2011

3. Local Authorities

Scotland's communities will often be in the front line in responding to the impacts of climate change and local authorities and their Community Planning Partnerships are ideally placed to lead the community response to climate change. With knowledge of local values, industries and landscapes, local government allows adaptation actions to be tailored effectively to localised impacts of climate change.

Local authorities can also work in partnership with their broader community of local estate managers, employers, community leaders and planning partners in preparing for a changing climate. Local authorities can also work in partnership with their broader community of local estate managers, employers, community leaders and planning partners in preparing for a changing climate. Local authorities across Scotland are working hard to build capacity and take action in response to the risks and opportunities that they face as a result of changes in climate.

In 2007, all 32 Scottish local authorities showed their commitment to acting on climate change by signing Scotland's Climate Change Declaration³². This represented a voluntary commitment to take action and report annually on work to reduce emissions and adapt to the unavoidable impacts of climate change. In their work on climate change adaptation, local authorities have shown their leadership on strategic and targeted action across all themes in Section Two of the Programme and examples of this are illustrated within case studies in the Programme.

Given the important role of local authorities in supporting communities to adapt to the impacts of climate change, the Scottish Government is committed to developing their adaptive capacity.

Public Sector Climate Leaders' Forum

As the central part of governance arrangements to help drive the climate change mitigation and adaptation agenda forward across the public sector to deliver the requirements of the Climate Change (Scotland) Act 2009, Scottish Ministers have established a high-level Public Sector Climate Leaders Forum (PSCLF)³³ with broad representation from the public sector. The group is chaired by the Minister for Environment and Climate Change, and the COSLA Spokesperson for Development, Economy and Sustainability acts as Vice-Chair. The Forum is supported by an Officials Group, which includes representation from the Adaptation Scotland programme, and is underpinned by a network of Climate Change Champions in key strategic roles across the sector.

³² <http://www.keepsotlandbeautiful.org/sustainability-climate-change/sustainable-scotland-network/climate-change/scotlands-climate-change-declaration/>

³³ <http://www.scotland.gov.uk/Topics/Environment/climatechange/howyoucanhelp/publicbodies/pscag>

Sustainable Scotland Network

The Scottish Government funds the Sustainable Scotland Network³⁴ to support public sector action on sustainable development, focusing on climate change and sustainable procurement, by:

- coordinating programmes on climate change and sustainable procurement including Scotland's Climate Change Declaration;
- sharing good practice and supporting collaboration;
- researching and promoting better solutions;
- connecting with national and international policy-makers, and;
- providing access to up-to-date news, advice and guidance.

4. Private Sector

Climate change implications for business, through failure to assess and manage climate risks, are significant. Impacts will be felt by every business irrespective of their size, location, markets, products or services, and will affect investors, customers and the business workforce itself. These impacts are wide ranging, and will include such diverse implications as security of supply chains and natural resources for raw materials to implications for workforces and the operational performance of assets. Business relies on a range of infrastructure and associated services including water supplies, waste disposal, energy supplies, supply chain and Information and Communications Technology (ICT). Disruption to any of these services has a direct impact on business.

Flooding has the potential to disrupt UK businesses' supply chains by causing distribution delays. Flooding is also a factor in the market demand for goods. If extreme flood events affect key suppliers, and no alternate supply is available, then supply chains are severely interrupted. Each of these risks is likely to increase as the climate changes. Clearly there is also a very strong international dimension to this risk and therefore UK or non-UK supply chain disruptions can cause significant harm to business operations. They can raise costs, cause inventory overstocks, and lower the market share of a business. Broken supply chains jeopardise production and distribution, reducing revenue when goods can't be manufactured or delivered. Disruptions can also affect credibility with customers, investors and other stakeholders.³⁵

We know that change is essential, and that business, through engaging its workforce and by influencing its customers, has a huge role to play in being a catalyst for this change. Businesses should be thinking about 'outward-facing adaptation' (relating to business risk and opportunities) as well as 'inward-facing adaptation' (relating to employees' skills or health and safety). Businesses thrive on opportunity, and the climate change challenge we face offers opportunities for new markets, to strengthen supplier relations (and their resilience to climate change) and to increase brand loyalty to name a few.

³⁴ <http://www.keepsotlandbeautiful.org/ssn>

³⁵ Extract from *Climate Change Risk Assessment for Scotland*.

Opportunity in turn leads to innovation, and there is no doubt that the business sector is best placed to both lead and capitalise on new and innovative technologies. This in turn will support Scotland in reaching the ambitious climate change objectives set by the Scottish Government and will provide economic growth in a developing sector. It will also limit Scotland's environmental impact and provide the support and infrastructure needed to adapt to the inevitable climatic changes that will occur in the next 50 years.

2020 Climate Group

In December 2009 a Group initiated by Ian Marchant, (at that time Chief Executive of SSE), with support from the Scottish Government was set up to ensure that all sectors of Scotland's economy and civic society contribute fully to achieving Scotland's ambitious climate change targets.

The 2020 Climate Group has membership of approximately 140 individuals from 100 different organisations across Scotland. This membership is comprised of some of the largest businesses in Scotland, the Scottish Government, local authorities, universities, charities and SMEs.

Many businesses are assessing their vulnerability to climate change and are seeking to develop appropriate adaptation strategies.

Renewable sources of energy, such as wind, solar and wave power, are particularly dependent on changing weather patterns, with the potential for both positive and negative impacts. Energy infrastructure is vulnerable to extreme weather events (floods, storms). Developers, including those engaged in renewables, may need to take into account in their future siting decisions the risk of climate change, not only in terms of local impacts such as weather events, flooding and subsidence, but possible impacts on global supply chains. The Scottish Government will consider carefully how to raise awareness of potential risks, including through engagement with Scottish Renewables and other industry stakeholders.

The Scottish Government also recognises that broadband infrastructure providers have to take into account the risk of climate change along with the visual, noise and other impacts on the environment when designing networks and siting structures. The Scottish Government supports close working between infrastructure providers and relevant authorities to minimise negative impacts of deployment and maximise the reach of broadband enabling infrastructure.

Keeping Scotland Running (KSR) Guidance is being developed and is aimed at government, business and industry and the emergency responder communities. KSR will encourage enhanced resilience and business continuity planning to keep Scotland running in spite of disruptive events. KSR will comprise a number of separate guides on issues relevant to critical infrastructure resilience, including natural hazards and climate change adaptation. KSR is expected to be published by the end of 2014.

A functioning transport network is critical to the vitality and sustainability of Scotland's economy. Everyone that uses this network or relies on it for their business will need to incorporate climate change risk into their day to day plans. Climate change is likely to increase the frequency of and the impact of severe weather, flooding and landslides. Traffic Scotland's website, Twitter, mobile applications, radio and infomercials provide regular traffic reports allowing business and transport users to access accurate and up-to-date information. The Scottish Environment Protection Agency (SEPA) also provide live flood warnings via their Floodline service. Raising awareness of climate risks ('outward-facing adaptation') has already started with the likes of the Adaptation Scotland 'Adapting to Climate Change' guide for businesses and the 'Freight Best Practice Scotland: Winter Preparedness' advice note which both provide succinct guidance for transport infrastructure business users on how to prepare for climate change.

The Scottish Government has invested in a number of initiatives to encourage agricultural businesses to work collectively to adapt to the impacts of a changing climate. Through programmes such as Farming For a Better Climate, Future Proofing Scotland's Farming, and Cheviot Futures, farmers are provided with on-going technical advice and supported by industry experts to strengthen their businesses to make them more resilient to climate change.

Case Study

Cheviot Futures

The Cheviot Futures project is a simple, practical approach to the development of long term resilience measures for the environment, economy and local community against the impacts of a changing climate. It is a cross-border project, focused on working with the rural communities of the Cheviot Hills and the surrounding Tweed Catchment area, formed from representatives of agencies and organisations working in both North Northumberland and the Scottish Borders.

The project is funded through a grant provided by SRDP LEADER and aims to work with farmers to develop and trial new sustainable solutions to the impacts of climate change and demonstrate benefits that would encourage other farmers and land managers to invest in the adaptation methods. It brings together all interested parties who have a stake in the countryside and best practice is shared to support a more co-ordinated and streamlined approach thus also delivering wider community and economic resilience.

One of the concepts developed by Cheviot Futures is Farm Resilience Planning. Completing a Farm Resilience Plan (FRP) involves working with the Cheviot Futures Project Officer to identify the challenges and opportunities presented to individual farms. The approach then seeks to identify what adaptations or resilience works may be suitable in addressing challenges and making the most of opportunities arising from a changing climate. The FRP will comprise a full report and detailed maps, with identified impacts and potential solutions marked up, as well as relevant additional information, drawing upon suitable advice and guidance. Where applicable, additional plans can be produced, for example detailed farm flood and fire plans.

Cheviot Futures

Scottish Borders LEADER

5. Trade Unions

The Scottish Government and the STUC agreed a joint Communiqué on Climate Change on 27 May 2009³⁶. The joint communiqué outlines shared aims and objectives, and a commitment to work in partnership to ensure the creation of high quality jobs through Scotland's transition to a low carbon economy and states that: *"Addressing the economic, employment and social impacts of the transition to the low-carbon economy and adapting to climate change will be vital to building stakeholder support and delivering the necessary programmes of action."* It agrees to jointly *"Promote the importance of education, training, skills and workforce development in delivering effective action on climate change"*.

Adaptation Scotland provides support to trade union members through access to public sector training and online resources including 'Five Steps to Managing Your Climate Risks' and the Climate Risk Management Template.

6. Communities

Community support will be required to implement many adaptation activities and there must be a general awareness of why it is so important that Scotland prepares for a changing climate and what the costs of inaction may be. Communities also present immense potential for the development of innovative, grass root responses to the challenges of climate change.

The Scottish Government is committed to our communities being supported to do things for themselves (community empowerment) and to people having their voices heard in the planning and delivery of services through community engagement and participation. The Scottish Government is taking forward action in a number of areas and is working closely with partners to help support and promote community empowerment and engagement³⁷.

The Scottish Government funds the Scottish Flood Forum to provide advice and support to communities at risk of flooding, including advice on insurance matters and protecting property.

Guidance for communities on Community Emergency Planning is available on the Scottish Government's Ready Scotland³⁸ website. This guidance identifies straightforward measures which communities can take to make themselves more resilient.

The Scottish Government works closely with local emergency service providers, the Third sector and community groups to ensure that Scotland is prepared for more frequent extreme weather events and the, often long lasting effects they can have.

³⁶ www.stuc.org.uk/news/643/stuc-and-scottish-government-issue-joint-communique-on-climate-change

³⁷ www.scotland.gov.uk/Topics/People/engage

³⁸ www.readyscotland.org/

All emergency and volunteer services play a vital role in responding to extreme weather events. The Scottish Government works closely with both sectors to develop and promulgate good practice. Preparing Scotland - Guidance on Building Community Resilience³⁹, published in April 2013, sets out good practice for Responders in working with communities and the voluntary sector.

The Resilience Advisory Board Scotland (voluntary sector) acts as a Forum for the development of further integration of voluntary and statutory sector responders. The group has representation from the voluntary sector, local authorities and other public sector responders and the Regional Resilience Partnerships.

The Scottish Government also supports a number of mechanisms which enable groups to share good practice among themselves:

- **The Ready Scotland website**⁴⁰ highlights a number of examples of good practice involving partnership working between the statutory and voluntary sectors.
- **The Voluntary Emergency Responders Guide**⁴¹ raises the profile of the services which national voluntary response organisations provide, includes contact details, and specific guidance on cross-sector engagement.

Behaviour Change

Encouraging behavioural change, such as increasing the uptake of property flood protection measures for households and businesses most at risk of flooding, can play a role in increasing resilience.

The Low Carbon Scotland: Behaviours Framework⁴² sets out the Scottish Government's strategic approach to encourage low carbon lifestyles amongst Scotland's individuals and households. While the focus of this Framework is supporting behaviours to reduce greenhouse gas emissions, engagement on these issues can also provide opportunities to engage on adapting to the changing climate.

For example:

- **Climate Challenge Fund**⁴³ - projects which improve the resilience of communities to the impacts of climate change, that are delivered in a way that is demonstrably low carbon, and contribute to wider community action on climate change are eligible for funding through the normal Climate Challenge Fund route.
- **A Low Carbon Vision for Scotland** – the Scottish Government will publish a vision of a low carbon Scotland in 2030. This project, which will bring together adaptation and mitigation measures, will translate our policy ambitions for a

³⁹ <http://www.scotland.gov.uk/Publications/2013/04/2901>

⁴⁰ <http://www.readyscotland.org/>

⁴¹ <http://www.readyscotland.org/voluntary-response/>

⁴² www.scotland.gov.uk/Publications/2013/03/8172

⁴³ www.scotland.gov.uk/Topics/Environment/climatechange/howyoucanhelp/communities/ClimateChallengeFund

low carbon future into an accessible vision which is meaningful at a household level. Through this vision we will aim to engage communities and individuals on what a low carbon future might mean for their daily lives.

- **Low Carbon Networks** - including Eco-congregations, Sustainable Scotland Network, Eco-schools and the Scottish Communities Climate Action Network, raise awareness of climate change and the impacts of this.

Over recent years, governments across the UK have been applying insights from behavioural science to policy problems. Traditional behavioural interventions have tended to focus on either the Individual, or on the Material contexts, and sometimes on both of these. However, this is often insufficient to lead to the change in behaviour that practitioners are expecting. The ISM⁴⁴ tool considers all of the contexts that shape people's behaviours – the Individual, the Social and the Material. By understanding these different contexts and the multiple factors within them that influence the way people act every day, more effective policies and interventions can be developed.

The Scottish Government will consider how the Individual, Social and Material (ISM) tool can be applied to encouraging key adaptation behaviours amongst populations most at risk of the impacts of climate change.

7. Third Sector

The Scottish Government recognises the pivotal role the Third sector has in achieving its aim of building Scotland's resilience to the impacts of climate change. The sector has immense potential to link up grassroots community action, communicate policy initiatives, and run training programmes – connecting with the people in Scotland who turn to an environmental group or charity in the first instance to provide them with information on climate change. The Third sector is often best placed to connect with individuals that the public sector finds hardest to reach, working with the most vulnerable in our society and helping tackle the 'equality gap' which could be widened by the impacts of climate change. The Third sector also provides a valuable contribution to the collection of data, through their networks of staff and volunteers who observe wildlife and undertake research, as well as providing advice about managing protected areas and other valuable habitats.

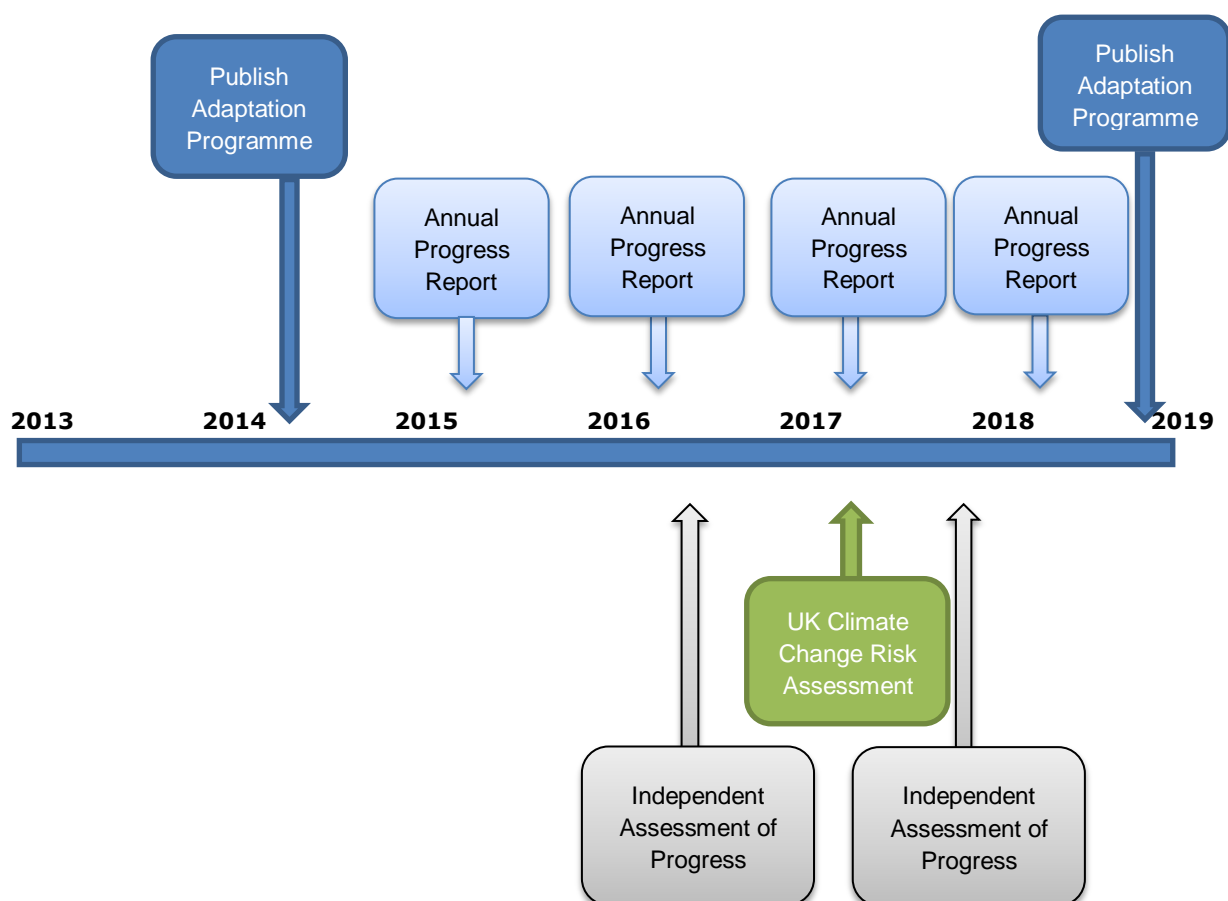
The Scottish Government will support and work with the Third sector to offer targeted support to those most impacted by climate change. We will look to the Third sector to help develop our understanding of how the impacts of climate change are already being felt by Scotland's communities and the natural environment, and in the development of sustainable methods to adapt to this change.

⁴⁴ <http://www.scotland.gov.uk/Resource/0042/00423436.pdf>

Measuring and Reporting Progress

Appropriate measurement and reporting of the Scottish Government's progress towards achieving the aim of the Scottish Climate Change Adaptation Programme is necessary for transparency and accountability. Related assessments and progress reports are illustrated below.

Reporting on the Scottish Climate Change Adaptation Programme



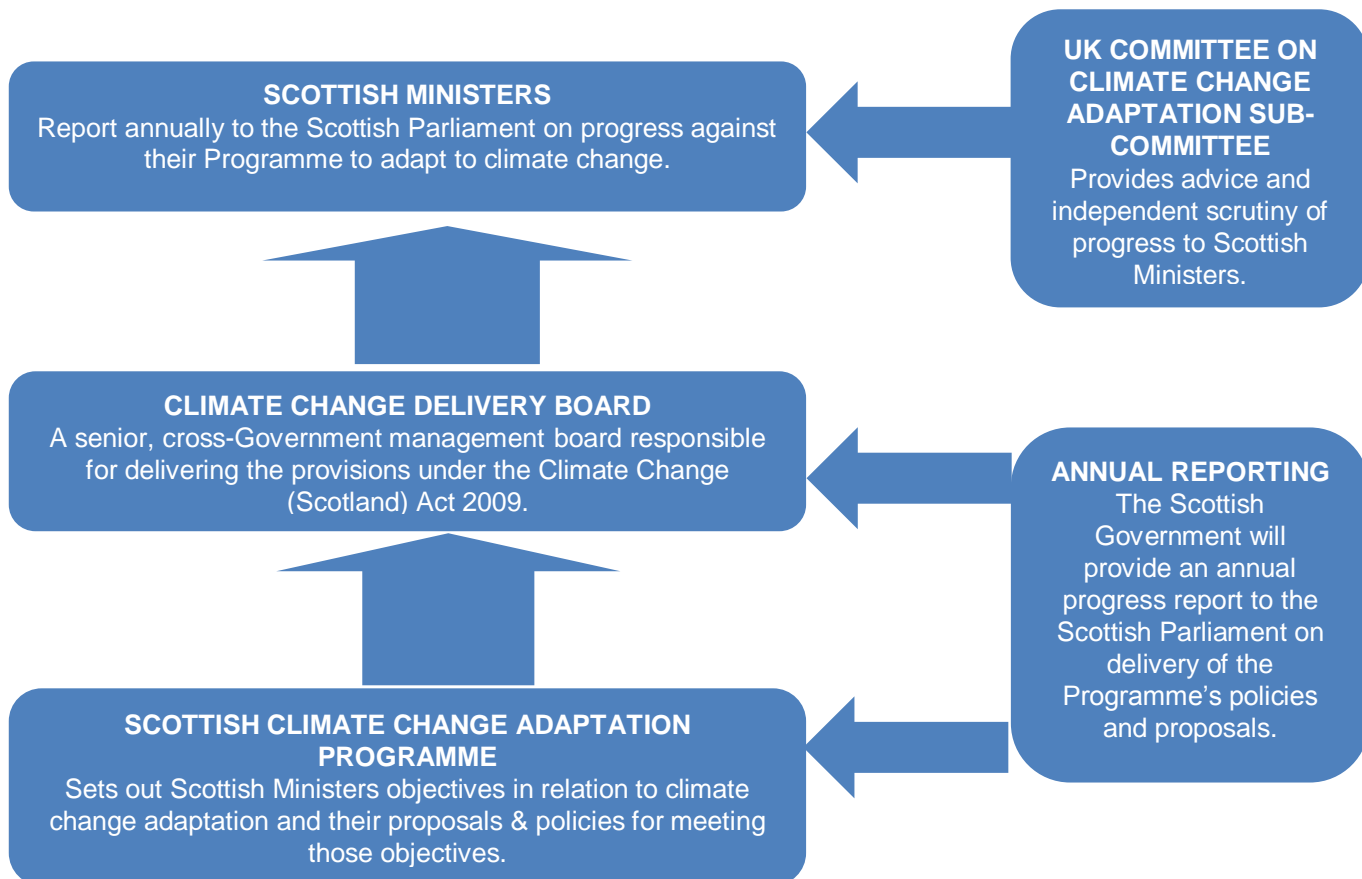
The Act requires Scottish Ministers to provide an annual report on progress towards achieving the objectives and implementing the proposals and policies set out in the Programme.

The Act also establishes the requirement for the relevant body to independently assess the Scottish Government's progress towards achieving the objectives and implementing the proposals and policies set out in the Programme. An independent assessment must be commissioned within two years of the Programme being laid before the Scottish Parliament. The Adaptation Sub-Committee of the Committee on Climate Change is currently designated as the relevant body. In the event of a Scottish climate change advisory body being established, this function would revert to the Scottish body.

Scottish Governance of Climate Change Adaptation

The Scottish Government must lead by example, integrating adaptation into its development processes.

The Governance structure to integrate climate change adaptation in to the Scottish Government is outlined below.



Delivery of the Programme will be overseen by the Climate Change Delivery Board.

The Board was established by the Scottish Government to oversee delivery of the statutory annual emissions reduction targets required by the Climate Change (Scotland) Act 2009. The Board meets quarterly and is chaired by the Director General Enterprise, Environment and Innovation. Membership covers Directors from the key areas within the Scottish Government involved with delivering emissions reductions.

The Board's scope will be expanded to include a new governance and reporting role for the Programme. For adaptation, its purpose will be to ensure delivery of the proposals and policies in this Programme, and subsequent Programmes, to ensure Scotland is well prepared and resilient to the impacts of climate change.

Membership will be reviewed to ensure that Directors with responsibility for delivering of proposals and policies in the Programme are appropriately represented.

PART 2 – THE ADAPTATION PROGRAMME

OBJECTIVES, POLICIES AND PROPOSALS

This section sets out Scottish Ministers objectives in relation to adaptation to climate change, and their proposals and policies for meeting those objectives, as required by Section 53(2)(a)(i) and (ii) of the Act. These address the risks identified in the report under section 56 of the Climate Change Act 2008 (the UK Climate Change Risk Assessment), as required by Section 53(2)(b) of the Act.

As required by Section 53(2)(a)(v) of the Act, the period within which the proposals and policies will be introduced is as follows:

Proposals: Some proposals are likely to become firm policies once development work is complete and/or financial resources allow; other proposals may be options to consider over the course of the Programme or for introduction in future Programmes.

Policies: Policies will have either been introduced or will be introduced over the lifetime of the Programme.

Objectives

Each of the following theme Chapters contain objectives describing what is aimed to be achieved in the long-term (up to 2050). There are 9 objectives for the Programme spread across three themes (Figure 1).

Policies and Proposals

Attached to each objective are the policies and proposals that provide the focus for the lifetime of this Programme⁴⁵ in order to progress towards the long term objective.

For the purpose of the Programme, a 'policy' is considered to be a course of action which has been wholly or largely decided upon. In many cases, policies will have committed funding and/or legislation and timescales. A 'proposal' is considered to be a suggested course of action, the details of which might change as the course of action is explored and evidence is gathered.

⁴⁵ A new Programme will be produced to address impacts identified for Scotland in progressive CCRA's due every 5 years.

Climate Ready Natural Environment

A Scotland with a productive, healthy and diverse natural environment which is able to adapt to change.

Introduction

This Chapter considers the most important impacts of the changing climate on the natural environment and sets out the Scottish Government's related objectives associated with the identified climate risks.

The following issues are considered in this chapter:

- Biodiversity and ecosystem services – Scotland's habitats and species and the goods and services provided by its plants, soils, rivers and lochs and other natural capital.
- The health of the seas around Scotland and the species that live in them.
- The role of land management and marine planning in protecting and enhancing habitats and biodiversity.
- The productivity of our land and seas and what this means for Scotland's land-based and fishing industries.

How is the changing climate likely to affect our natural environment?

Climate change will have important consequences for nature in Scotland.

Agriculture –Scottish agriculture may experience positive change in some areas and negative change in others.

Primary producers in Scotland may benefit from both improved growing and grazing conditions and higher global food prices. However, these positive impacts could be largely or partially offset by negative impacts. These include an increased risk of extreme weather events such as droughts or floods, resulting in a decline in agricultural productivity and damage to farm buildings and infrastructure. An alteration in the prevalence and spread of pests and diseases affecting either livestock or crops may also occur, lowering yields. Intense rainfall events may lead to crop damage, soil compaction and erosion and inflict longer term damage to agricultural land.

The variability in weather conditions is already making farming more of a challenge. Farmers have always had to work with the weather and adapting to climate change is already becoming part of routine farming business. By taking steps now, such as

securing water supplies for irrigation or reducing soil erosion risks, farming businesses are reducing the threats from the impacts of climate change.

Land based businesses are also well placed to help wider society adapt to climate change. For example, working with land managers to consider natural flood management measures to reduce surface water runoff rates have a positive effect by decreasing water levels and increasing resilience to damage. Additional benefits include the prevention of soil poaching by livestock and the control of livestock parasites, such as the snail that causes liver fluke, that thrive in waterlogged soil. Many adaptation measures that can be implemented on farm also provide cross-cutting benefits to water and air quality and biodiversity. For example, the use of cover crops to improve soil structure by increasing soil organic matter has benefits for biodiversity. They provide a habitat for many different species above ground as well as improving the activity of microbes in the soil.

Forestry - In Scotland the key risks and opportunities for the forestry sector and woodlands from climate change appear to be increased problems of windthrow and drought, wildfire, pests and diseases. An increase in productivity in tree species that are matched to the new conditions could also be observed.

A programme of related research is currently underway to improve our understanding of climate change impacts on woodlands and forestry and how resilience to threats, such as extreme weather events and pests and disease affecting trees and forests, can be improved in future. We need a move towards planned adaptation in woodland creation and management, as well-structured and diverse forests that can better withstand change and extreme events.

Agroforestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops or animals. This land use is based on long-term planning to create more diverse, productive, profitable, healthy, and sustainable land-use systems. Online guidance has been developed to assist land managers in making decisions on appropriate adaptation strategies for the longer term.

Biodiversity and Ecosystems – Changes to soil biodiversity and function brought about by the changing climate could have severe implications for the wider ecosystem – reducing its ability to provide nutrients and water to sustain plant growth, and therefore leading to a decline in biodiversity and ecosystem function. In addition, an increase in flooding and erosion is likely to affect water quality, as potential pollutants, such as sediment and nutrients, are transported into water courses.

The pattern of land use may also change, for example the expansion of land used for agriculture – and potential displacement of other land uses to new areas – could have a potentially negative impact on biodiversity. Efforts to increase agricultural yields could have damaging effects on soils, contributing to ecosystem degradation. Increased demand for water by the agricultural sector may lead to over abstraction – reducing water flow and quality which is detrimental to habitats. Drying of soils and peat bogs could limit their ability to regulate and purify water, leading to a decline in water quality.

Our ecosystems could also be disrupted by invasive non-native species, pests and diseases, with species being displaced or even becoming locally extinct. Warmer temperatures may also cause species to move north or higher up hills to follow their preferred 'climate space'⁴⁶.

This all points to the need to maintain and enhance our ecosystems so that they are more resilient to the pressures of a changing climate and more able to withstand both extreme events and long term change. A healthy ecosystem will be able to adapt over time whilst still maintaining its core functions and thus continuing to provide the ecosystem services we need.

Marine Environment – Coastal flooding resulting from sea level rise and storm surges may damage coastal habitats through saltwater intrusion. Over the next century sea level around Scotland is going to rise. This is mostly due to the global heating and resulting expansion of ocean water, with a smaller contribution from the melting of ice-caps and glaciers. In Scotland, some of this rise will be mitigated by vertical changes in the level of the land.

We may see the arrival of new commercial fish species into Scottish waters and/or the loss of existing species, as the climate warms. The reduced ability for marine species to make shells and skeletons as the oceans become more acidic could impact heavily on Scotland's important shellfish industry. The disruption to or loss of marine ecosystem services, for example if there is increased occurrence of harmful algal blooms, could have a significant impact on Scotland's economy, of which a large contribution comes from the fishing and aquaculture industries. Future temperature increases could provide enhanced opportunities for non-native species at each stage of the invasion process.

Coastal Erosion - Coastal erosion is a naturally occurring process which affects, periodically, most soft coastlines in Scotland. It is important for the creation, conservation and integrity of many unique coastal habitats and landscapes. However, the consequences of erosion can be significant in economic and personal terms and therefore, it is important to intervene only where erosion directly threatens homes or businesses. This is because flood and coastal erosion risk management projects often have substantial impacts on the coastal environment, leading to hydrographic changes which can change sedimentation pattern and may lead to erosion / sedimentation processes in adjacent areas. Defences may also lead to accelerated erosion of the coast.

Tourism and the Natural Environment – Warmer weather could result in increased tourism, although flooding may cause the loss of, or damage to, natural and man-made economically important coastal assets and visitor attractions - such as beaches, ancient monuments and golf courses. The loss of particular habitats and species could damage Scotland's tourism industry, which is heavily reliant on our natural environment. Increased occurrences of harmful algal blooms⁴⁷ could also have significant economic consequences when access is restricted during periods of high visitor numbers.

⁴⁶ The area of land which is climatically suitable for a particular species or habitat.

⁴⁷ Flooding results in the washing of nutrients into freshwater and shallow marine environments, causing algal blooms

Objectives, Policies and Proposals

This Chapter contains the objectives and the policies and proposals to drive the progress towards meeting the objectives. The objectives describe what is hoped will be achieved in the long-term (up to 2050), and the policies and proposals set out the priorities for this Programme.

The following objectives, policies and proposals address the relevant risks identified for Agriculture, Biodiversity and Ecosystem Services, Flooding and Coastal Erosion, Forestry and, Marine and Fisheries by the CCRA. The objectives are inter-related and are being addressed in a coherent way, recognising that they are mutually reinforcing with strong synergies across them.

What is already being done?

The impacts of climate change on Scotland's natural environment are being addressed through actions under the Scottish Biodiversity Strategy, the Land Use Strategy, River Basin Management Plans, the developing framework of marine planning at a national and regional level and a wide range of environmental legislation. The Scottish Biodiversity Strategy has been updated to meet new international targets for 2020. Climate change impacts will be explicitly taken into account.

A key priority is protecting and enhancing Scotland's peatlands. Over 40% of Scotland's land cover has peaty soils. These store vast amounts of carbon and we need to ensure that that carbon remains locked up in the soil. Climate change will affect the way that peatlands take up and store carbon. We are therefore already acting to take climate change into account in peatland management practices. Healthy peatlands will also be more resilient to climate change: for instance they will absorb heavy rainfall or will be less prone to drying out.

Case Study

Peatland Restoration by The Royal Society for the Protection of Birds (RSPB)

Adaptation means increasing resilience to current or future change in order to moderate harm. Unfortunately, many of Scotland's peatland habitats are not resilient to climate change because they are in a degraded state. Degraded peatland is more likely to dry out with higher temperatures and lower rainfall, and further erode in increased heavy rainfall events. Both these processes lead to a poor habitat for wildlife and increased CO₂ emissions from further damaged peatland. The more degraded a peatland the lower its adaptive capacity and the greater its carbon losses.

Peatland habitats are more resilient to climate change impacts if they are in a healthy condition. Restoration of damaged peatland back to a healthy condition is important if it is to fully provide a habitat for wildlife and a steady flow of services to people, including wildlife to enjoy, carbon storage, a source of clean water, recreation and employment.

Many peatlands are damaged and therefore are vulnerable to a changing climate. RSPB Scotland is actively involved in the restoration of damaged blanket bog at its Forsinard Flows nature reserve.

Drains and ditches have been blocked across Forsinard to raise the water table, enable the bog surface to re-vegetate and new peat to form. Trees in forestry plantation have also been removed. The work has attracted wading birds, such as golden plovers, and breeding birds like hen harriers, short-eared owl and meadow pipits are returning to the areas previously covered by trees. Restoration has increased the resilience of the habitat and ensured it can withstand periods of dry weather and warmer temperatures.



Royal Society for the Protection of Birds

Scotland's coastal and marine ecosystems also store carbon. Through Marine Planning and the Marine Protected Area (MPA) network we can safeguard habitats such as saltmarshes, seagrass beds and kelp forests protecting and enhancing these long-term carbon sinks.

The following table sets out what is currently being done by Scottish Government and key public bodies at a national level to help build resilience and deliver the objectives for the natural environment. It includes a wide range of existing and planned policies, legislation and on-going action.

Objective N1 - Understand the effects resulting from climate change and their impacts on the natural environment			
No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
N1-1	Raising awareness of the implications of climate change for nature.	Supporting the use of long-term datasets and publication and promotion of information describing the implications of climate change for nature by Scottish Natural Heritage (SNH) and Scottish Environment Protection Agency (SEPA) through Scotland's Environment Website, public information and SNH Trend Notes.	Scottish Natural Heritage, Scottish Environment Protection Agency, ClimateXChange
N1-2	Increase understanding of the implications of climate change for nature through data gathering, analysis and research.	Continuing research and data gathering is needed to detect, quantify and understand the impacts of climate change on nature to inform adaptation policy and management.	Scottish Government, ClimateXChange, BICCO-Net, Universities, Scottish Natural Heritage, Forestry Commission Scotland, Scottish Environment Protection Agency.
N1-3	Undertake spatial modelling, based around different scenarios, of potential risks to existing forests in order to evaluate the impacts that climate change could have on different forest types.	Will provide forestry-specific interpretation of climate impacts so that forest managers are clear on what changes are happening and can be expected and can plan in the long-term accordingly.	Forestry Commission Scotland
N1-4	Improve understanding on how we can develop more resilient forests, identify adaptation strategies for all types of woodlands, and demonstrate these in forest settings.	Will allow forest managers to make the required changes. Much of this will be taken forward through the new Research Forest in Queen Elizabeth Forest Park which will be trialling and demonstrating adaptation actions.	Forestry Commission Scotland
N1-5	Enhance collaborative research into tree pests and diseases to develop understanding of the etiology, pathology, epidemiology and management of pests/diseases in a changing climate.	Will ensure that we are as prepared as possible for managing forests and other ecosystems in the presence of pests and diseases.	Forestry Commission Scotland

<p>N1-6</p>	<p>Marine Scotland will use marine research strategies and monitoring programmes to gather data on the impact climate change is having on the seas.</p>	<p>Research and monitoring findings from various initiatives will help inform decision making on adaptation across all sectors. For example –</p> <ul style="list-style-type: none"> • The UK Marine Science Strategy (2010-2025) and Scottish Marine Science Strategy (2010-2015) set out high level marine science priorities and objectives. These are designed to ensure that marine science delivers both our vision for the seas (clean, healthy, safe, productive and biologically diverse oceans and seas) and sustainable economic growth. Research findings from projects identified in the strategies will be used to identify gaps in knowledge and inform decision making on climate change adaptation. Some specific examples include: <ul style="list-style-type: none"> - monitoring carbon chemistry in our seas (including ocean acidification and potential impact on aquaculture); - a project studying pelagic foodwebs to predict the impact of climate change on marine top predators; - the development of a hydrodynamic model of Scottish shelf waters (the “Scottish Shelf Model”), which will help characterise the marine physical environment, against which changes in future conditions can be identified and potentially forecasted; - develop a better understanding of the effect of algal blooms on aquaculture through research to increase knowledge and understanding of possible solutions; - developing a better understanding of the role of blue carbon ecosystems in carbon sequestration and the role of Marine Planning and Marine Protected Areas in protecting these ecosystems. 	<p>Scottish Government (Marine Scotland) with support from others e.g. Scottish Natural Heritage, Joint Nature Conservation Committee, Marine users, ClimateXChange</p>
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		<ul style="list-style-type: none"> • Collaborative research and monitoring approaches across the UK and Europe via, e.g. UK Marine Monitoring & Assessment Strategy (UKMMAS), International Council for the Exploration of the Seas (ICES) and Oslo Paris Convention for the Protection of the North East Atlantic (OSPAR), as well as the implementation of EU Directives such as the Marine Strategy Framework will assist in the monitoring of impacts on, e.g. biodiversity and marine litter. • We will build on existing work to improve our understanding of the links between climate change and fish stock location and health. We already have an evidence base, for example a MCCIP report from 2012 on 'Fish, Fisheries and Aquaculture'. We also undertake a programme of annual surveys to cover major commercial fish stocks. This survey data along with a range of other data (e.g. landings, observer data on discards) is reviewed by ICES scientists and used for fisheries assessment models. ICES take into account a wide range of environmental, biological and management factors when doing stock assessment, including climate change. 	
N1-7	Continue support for the Marine Climate Change Impacts Partnership (MCCIP) .	<p>MCCIP develops high quality evidence - e.g. Annual Report Card, Climate Smart Working Report - on the impacts of climate change on the marine environment that inform policy and decision making.</p> <p>The Report Card explores the issues, challenges, opportunities and achievements in putting climate change adaptation into practice.</p>	Scottish Government (Marine Scotland)
N1-8	Understand the risks associated with coastal flooding through development and implementation of local flood risk plans .	Through development of local flood risk plans SEPA, local authorities and other responsible authorities will identify potential causes and consequences of flood risk and prioritise appropriate mitigation measures.	Scottish Environment Protection Agency, Local Authorities, Scottish Water

<p>N1-9</p>	<p>Supporting citizen science and voluntary environmental monitoring.</p>	<p>Biological records are a powerful tool in assessing the impact of climate change and are highly valued by research scientists. Vast amounts of environmental data can be collected over a wide range of environments over a long period of time. The data collected for the annual 'Big Garden Birdwatch' helps NGOs and agencies monitor the effects of climate on bird populations. Nature's Calendar is a Citizen Science project in collaboration with the Woodland Trust and the Centre for Ecology and Hydrology (CEH). Volunteers are shown what and when to look for and asked to record the signs of the seasons where they live. The results inform us of how climate change is affecting the natural cycle. Citizen science also helps encourage an interest and responsibility for the natural environment.</p>	<p>Scottish Government, Scottish Natural Heritage, Scottish Environment Protection Agency, The Conservation Volunteers, Education Scotland</p>
<p>N1-10</p>	<p>Developing datasets to support flood risk, river and coastal management. A requirement of the Flood Risk Management (Scotland) Act is to develop a programme to integrate necessary data.</p>	<p>Datasets of flood risk and coastal change information available to all flood risk management practitioners to inform effective flood risk, river and coastal management practitioners, including a programme of data capture using Light Detection and Ranging (LiDAR) and Scottish Detailed River Network (SDRN), will inform effective decision making.</p>	<p>Scottish Government, OS, Scottish Water, Scottish Environment Protection Agency, Local Authorities and other public and private sector bodies</p>
<p>N1-11</p>	<p>Continue to fund the Strategic Research Portfolio in Rural and Environmental Science to improve the evidence base on the likely impacts of climate change on Scottish agriculture and ensure effective knowledge transfer of research outputs.</p>	<p>Research results will reduce uncertainty and provide the basis of future policy development and advisory activity for the agricultural sector.</p>	<p>Scottish Government, ClimateXChange, Main Research Providers: Scotland's Rural College, James Hutton Institute, Rowett Institute of Nutrition and Health, Moredun Research Institute, Biomathematics and Statistics Scotland, Royal Botanic Garden Edinburgh</p>
<p>N1-12</p>	<p>Deliver the current programme of research work on the effects of climate change on Scottish food security.</p>	<p>Research will assess the impacts of climate change on agriculture and food production in Scotland and ways in which impacts can be mitigated against and or adapted to.</p>	<p>Scottish Government, Scotland's Rural College, Rowett Institute of Nutrition and Health, ClimateXChange</p>

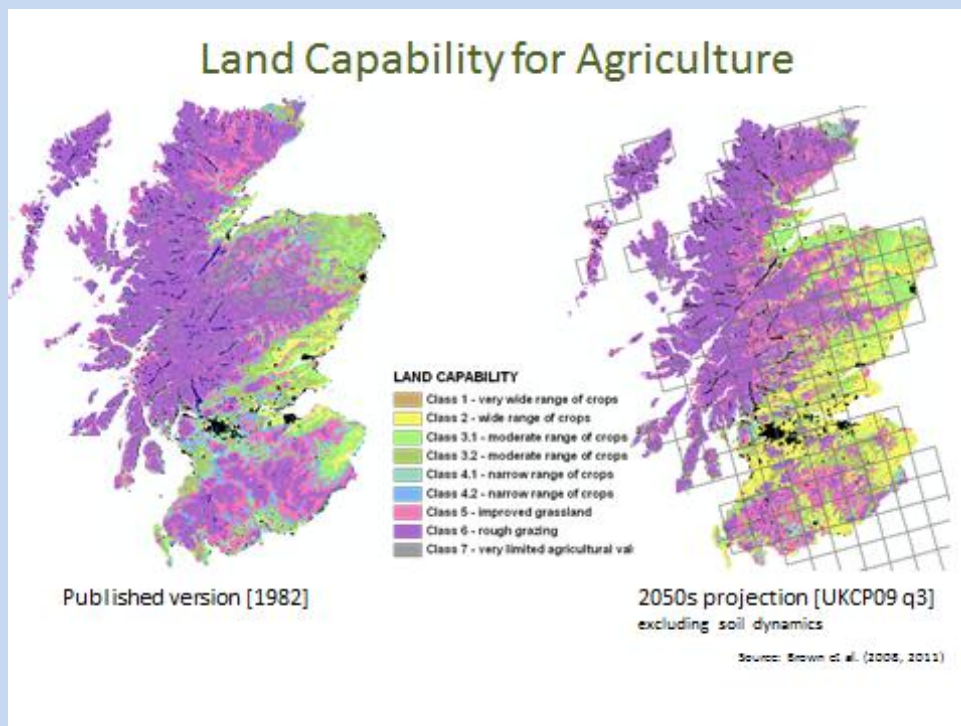
N1-13	Manage and monitor changes to Scotland's transport infrastructure environment to detect impacts and changes on biodiversity and vegetation growing cycles through: <ul style="list-style-type: none"> • Transport Scotland Biodiversity action plan; • Transport Scotland Cost Effective Landscaping, and; • Network Rail Standard - Management of Lineside Vegetation. 	Use transport network auditing regimes under these policies to monitor new biodiversity impacts and detectable alterations in vegetation growing season cycles.	Transport Scotland
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Case Study

Drought risk and impacts of climate change on land capability

In updating the Land Capability for Agriculture (LCA), the James Hutton Institute have been looking at how to incorporate climate change into these guidelines. The Institute have looked into drought risk and how it is linked to the expected additional irrigation demand for particular crop types.

During this process, certain catchments were identified as having unsustainable use of water resources which will be further exacerbated by climate change. As land use has a key role in managing climate change, a preliminary assessment of changes in water supply and demand has been produced. This assessment could be further developed to provide additional guidance on sustainable abstraction levels.



James Hutton Institute

Objective N2 - Support a healthy and diverse natural environment with the capacity to adapt

No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
N2-1	<p>Review objectives and priorities for action in Scotland's Wild Deer: a National Approach (WDNA)</p> <p>Prepare best practice guidance for deer management groups to support the code of practice on deer management under the Deer (Scotland) Act 1996 as amended.</p>	Will support sustainable deer management and minimise adverse impacts from deer on ecosystems and landscapes, such as excessive grazing and trampling causing erosion of carbon rich soils.	Scottish Natural Heritage, other public bodies and land managers
N2-2	<p>The Scottish Planning Policy includes green networks, green space, street trees and other vegetation, green roofs, wetlands and other water features, and coastal habitats in helping Scotland to mitigate and adapt to climate change.</p>	Green infrastructure can help nature to adapt to climate change by strengthening habitat networks, reducing habitat fragmentation and providing opportunities for species to migrate. It also helps people to adapt by providing other benefits like sustainable drainage, flood alleviation, coast protection, cooling in urban areas, and places for people to walk and cycle.	Scottish Government, Scottish Natural Heritage, Forestry Commission Scotland, Local Authorities, other public bodies, and land managers
N2-3	<p>Demonstrate adaptive management in National Nature Reserves to help explain the implications of climate change for nature and demonstrate management that takes account of these implications.</p>	This work will contribute to adaptation by raising awareness and understanding amongst managers of protected sites and wider land.	Scottish Natural Heritage and partners
N2-4	<p>Manage designated sites for land based biodiversity.</p>	Identify the consequences of climate change for protected places and the Natura network and put in place adaptive measures.	Scottish Natural Heritage and partners
N2-5	<p>Pilot the use of the Scottish Natural Heritage (SNH) Wildlife Management Framework to integrate climate change risks into wildlife management decisions (including deer).</p> <p>The Framework includes questions around the impact of management actions on the ability of the species to adapt to climate change and on woodland expansion. It will be tested within SNH and then rolled out for use by others, including land managers.</p>	This is a tool to support decisions around wildlife management issues such as controlling non-native species, managing conflicts between species, or ensuring sustainable use of species as a resource for food or sport. This should help make such decisions more robust in the face of climate change, and so contribute to adaptation.	Scottish Natural Heritage

N2-6	Develop the ecosystem approach into a usable set of tools for use by decision makers including through the Scottish Biodiversity Strategy 2020 Challenge, and the Land Use Strategy.	The ecosystems approach promotes a holistic approach to land management which will help to build resilience to climate change and ensure that wider benefits from nature are taken into account in decisions.	Scottish Government, Scottish Natural Heritage, Scottish Environment Protection Agency, James Hutton Institute and partners.
N2-7	Reduce the pressure on ecosystems from invasive non-native species (INNS).	<p>A co-ordinated approach will be used for managing non-native species, using new regulatory powers under the WANE Act and more accessible advice and promotion to support the Code of Practice, will help build resilience to climate impacts. Priority will be given to preventing the establishment and spread of INNS but priorities will also be developed for restoring ecosystems degraded by INNS where it is feasible and appropriate to do so.</p> <p>This approach will help to enhance the resilience of ecosystems by reducing the pressure from INNS. Much of this work will be taken forward under the 2020 Challenge for Scotland's Biodiversity and River Basin Management Plans. Preventing the establishment of INNS includes identifying the pathways by which they spread and putting in place biosecurity measures to address these, as well as contingency planning, early detection and rapid response. There are strong links to policy N2-16 on INNS in the marine environment.</p>	Scottish Government, Forestry Commission Scotland, Scottish Natural Heritage, Scottish Environment Protection Agency, NGOs, land managers and other members of the public (such as water users).

N2-8	<p>Implement the Land Use Strategy (LUS) and associated action plan - incorporates principles for sustainable land use and includes a commitment to investigate the relationship between land use change and ecosystems processes to identify adaptation priorities.</p>	<p>The Land Use Strategy (LUS) incorporates Principles for the sustainable use of Scotland's land and actions which will aid the achievement of a long term future Vision for Scotland's land resources.</p> <p>The LUS regional pilots in Scottish Borders and Aberdeenshire will be utilising the LUS Principles and taking an ecosystems approach to consider land use and land use change in their area.</p> <p>In addition, the LUS Action Plan Proposals contain a number of specific milestones which relate to climate change adaptation such as the publication of Achieving Diversity in Scotland's Forest Landscapes which provides guidance on planning future forests in a changing climate. The Action Plan also contains strong sharing knowledge and learning from research, demonstration projects and good practice.</p>	<p>Scottish Government, Scottish Natural Heritage, Forestry Commission Scotland, Scottish Environment Protection Agency</p>
N2-9	<p>Implement the Scottish Biodiversity Strategy which promotes action to enhance the health & resilience of the terrestrial and marine environments, and the benefits they provide to people, taking account of climate risk & principles for helping nature adapt (Scottish Natural Heritage "<i>Climate Change and Nature in Scotland</i>").</p>	<p>Climate risk is fully integrated into the Scottish Biodiversity Strategy. Research under the strategy will contribute knowledge regarding the priority risks for biodiversity that need to be managed.</p>	<p>Scottish Government, Scottish Natural Heritage, Forestry Commission Scotland</p>
N2-10	<p>Promote the UK Forestry Standard and Climate Change guidelines.</p>	<p>The guidelines help raise awareness of the Standard to build the resilience of forests to the impacts of climate change.</p>	<p>Forestry Commission Scotland, forest managers</p>
N2-11	<p>Embed climate change adaptation considerations, and potential responses such as habitat networks and green networks, into wider land use planning decisions through the use of Forestry and Woodland Strategies, regional land use strategies, and Strategic and Local Development Plans and development master-plans.</p>	<p>Habitat Network information will be used to inform land use plans so that the creation and management of woodland and other habitats can be targeted to further strengthen these networks and increase their resilience to climate impacts.</p>	<p>Scottish Government, Forestry Commission Scotland, Scottish Natural Heritage, Local authorities, others.</p>

N2-12	<p>Improve the condition and connectivity of native woodlands; promote natural regeneration as a means of increasing resilience to climate change, and take other steps to increase adaptive capacity in woodlands.</p>	<p>More native woodlands in favourable condition will increase their capacity to adapt to climate impacts.</p>	<p>Forestry Commission Scotland, Forest Enterprise Scotland, Scottish Natural Heritage, Private sector forest managers</p>
N2-13	<p>The National Marine Plan (NMP) will set out objectives and policies for sustainable development of Scotland's seas; promoting economic growth while ensuring growth occurs in balance with the protection of natural and historic heritage.</p>	<p>In accordance with the Marine (Scotland) Act 2010, Scottish Ministers and public bodies must act in a way best calculated to mitigate, and adapt to, climate change so far as is consistent with the purpose of the function concerned – as such the NMP includes objectives and policies for climate change mitigation and adaptation.</p> <p>Objectives and policies relating to the mitigation of, and adaptation to, climate change are embedded throughout the sectoral chapters of the National Marine Plan. Future regional marine plans, sectoral plans, licensing and consenting decisions which affect the sea will have to be taken in accordance with the National Marine Plan.</p> <p>The NMP will be reviewed after 5 years to take account of new information on climate change impacts and ecosystem services.</p>	<p>Scottish Government (Marine Scotland), Marine Scotland Science, Regional Marine Planning Partnerships</p>
N2-14	<p>Regional Marine Plans (RMPs) will be developed from 2014 and will shape regional objectives and policies for coastal and marine management and include policies relating to climate change adaptation (and mitigation).</p>	<p>RMPs will be required to include objectives and policies for climate change mitigation and adaptation, ensuring that development and activity in the marine environment planned for at a regional level will mitigate, and be adaptive to climate change where appropriate. An adaptive approach will be taken to marine planning at a regional level, meaning that up to date information on climate change and how best to mitigate or adapt will be taken into account.</p> <p>Like the NMP, RMPs will also be reviewed after 5 years.</p>	<p>Scottish Government (Marine Scotland), Regional Marine Planning Partnerships</p>

<p>N2-15</p>	<p>Manage designated sites for the marine environment.</p>	<p>Protection of the marine environment helps maintain a healthy ecosystem that in turn supports the natural services that help mitigate climate change.</p> <p>For example:</p> <ul style="list-style-type: none"> • Protection of inshore and offshore reefs that act as natural barriers from storms to help protect coastal communities; • Protecting important areas for marine biodiversity helps maintain the abundance of flora and fauna which act as carbon sinks; • Protection for native species in MPAs may help maintain resilience against non-native species; • Identifying the consequences of climate change for the Natura network and put in place adaptive measures. 	<p>Scottish Natural Heritage, Scottish Government (Marine Scotland), Scottish Environment Protection Agency</p>
<p>N2-16</p>	<p>Develop mechanisms to minimise the introduction and establishment of invasive non-native species into Scottish waters.</p>	<p>Early detection of non-native species and putting in place biosecurity measures to limit their impact and spread are important ways of reducing the pressures on the marine environment in a changing climate. For example:</p> <ul style="list-style-type: none"> • Help control the spread of the invasive <i>Didemnum vexillum</i> (DV) (Carpet sea squirt). • Continued monitoring of DV in Largs and other sites in Scotland for further spread. 	<p>Scottish Government (Marine Scotland) and partners</p>
<p>N2-17</p>	<p>Implement River Basin Management Plans (RBMP). The RBMPs set out how we can enhance the environmental quality of rivers, lochs and seas, delivering greater benefits for the environment, and safeguarding them for future generations.</p>	<p>These will help ensure resilience to climate impacts in terms of maintaining and improving water quality.</p>	<p>Scottish Environment Protection Agency, responsible authorities and land managers</p>

<p>N2-18</p>	<p>Support the development of Local Flood Risk Management Plans. This will manage waters and coasts at a river catchment level and include local flood risk management plans.</p> <p>Some aspects of this plan-led approach are innovative, particularly the heightened approach to sustainable flood risk management. This work will include research demonstration projects to assess the benefits of working with nature to lower flood risk.</p>	<p>Local plans will include opportunities to slow or store flood water by enhancing, altering or restoring natural features and characteristics across catchments (natural flood management). By working with nature these measures will also often have benefits for biodiversity and water quality.</p> <p>This will give us robust evidence to encourage local authorities to implement natural flood management and build in a level of protection that over the years could mitigate the future impacts of climate change. It also raises awareness among landowners of their role in adapting to climate change.</p>	<p>Scottish Government, Scottish Environment Protection Agency, responsible authorities and land managers</p>
<p>N2-19</p>	<p>Improve the condition of rivers Special Areas of Conservation as part of River Basin Management Plans.</p>	<p>Implementing river basin management plans will be critical in ensuring that inland water bodies achieve good or better status. Special Areas of Conservation are a mechanism for helping nature adapt.</p>	<p>Scottish Environment Protection Agency, Scottish Government, Scottish Natural Heritage, Forestry Commission Scotland (Natural Scotland)</p>
<p>N2-20</p>	<p>Assess and manage coasts, promoting adaptive coastal management that works with natural processes.</p>	<p>This will be done through:</p> <ul style="list-style-type: none"> • Implementing the Scottish Biodiversity Strategy by addressing the risks to species and habitats due to coastal evolution. • Development of the National Marine Plan and Regional Marine Plans which will set out policies to ensure marine environment activity doesn't have an unacceptable effect on coastal processes and flooding. • Development of the Flood Risk Management Strategies and Plans and understand the risks associated with coastal flooding across Scotland. • Use the Coastal Erosion Susceptibility Model for Scotland to inform Flood Risk Management Plans and other regional and local plans. • Identify locations where habitats are most vulnerable to coastal erosion and sea level rise. 	<p>Scottish Government, Scottish Natural Heritage, Scottish Environment Protection Agency, Local Authorities</p>

<p>N2-21</p>	<p>Promote the Farming For A Better Climate Programme. This is an advisory programme for land managers to help them mitigate climate change and adapt to the impacts of climate change which includes web-based advice & guidance, demonstration farms, farm events, seminars, conferences and raising awareness through publications in farming press.</p>	<p>Raising awareness of the challenges and opportunities that climate change will bring to land managers.</p> <p>Transfer knowledge and practical skills to increase adaptive capacity of Scottish farming, as well as developing greater business resilience across the sector.</p> <p>Topics covered include soil aeration and drainage maintenance, sheep health and breed choice, better use of water for irrigation and opportunities for natural flood management.</p>	<p>Scottish Government, Scottish Rural College</p>
<p>N2-22</p>	<p>Support the projects Future Proofing Scotland's Farming, Scotland's Farming Innovation Network and Planning for Profit.</p> <p>These are skills development programmes that aim to prepare agricultural businesses for the impacts, opportunities and risks that both climate and economic change present.</p>	<p>Raising awareness of the challenges and opportunities that climate change will bring to land managers.</p> <p>Transfer knowledge and practical skills to increase adaptive capacity of Scottish farming, as well as developing greater business resilience across the sector.</p> <p>Topics covered include building soil fertility, effective field drainage, reducing flood risk and improving soil performance and planting trees for shelter belts and to protect water courses.</p>	<p>Soil Association Scotland, Quality Meat Scotland, National Farmers Union Scotland, Scottish Agricultural Organisations Society, Zero Waste Scotland, Forestry Commission Scotland.</p>

Case Study

Implementation of Restoration and Natural Flood Management (NFM) measures and liaison with land managers

The Eddleston Water is a sub catchment of the River Tweed measuring 69 square km with the main stream measuring 12km. It covers a large area of hill and improved grassland, north of Peebles in the Scottish Borders. Tweed Forum is working with 12 farmers and land owners in the valley to facilitate a co-ordinated approach to Natural Flood Management (NFM).

NFM can be identified as those techniques that aim to work with natural hydrological and morphological processes, features and characteristics to manage the sources and pathways of run-off to reduce the damaging effects of flood waters.

In the Eddleston Water, work to 'slow the flow' and 'increase storage of flood waters' is on-going at 20 separate sites. The techniques being utilised include: Planting of native woodland on floodplains and in hill cleuchs. The trees and coarse grass generated will help slow the surface flow rate which will help take the peak off the flood water. New water retention ponds have been created to capture flood water. Re-meandering of canalised ditches and watercourses will encourage a more natural watercourse ecosystem to develop. The installation of log-jams in the headwaters to slow down run-off, will benefit water quality, wildlife and the fishery, to name but a few.

Promoting all the benefits that these measures have is called 'The Ecosystem Services Approach'. It is through land managers working together that real progress can be made. The benefits to the farm, the environment and the local community can be significant.

This is a partnership project involving: Private land-owners, Tweed Forum , Scottish Government, Scottish Borders Council, SEPA, Dundee University, Forestry Commission Scotland and British Geological Survey.



**Eddleston Water Project
Tweed Forum**

Objective N3 - Sustain and enhance the benefits, goods and services that the natural environment provides

No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
N3-1	<p>Implement the EU reform of the Common Agricultural Policy post 2014 to ensure that climate change adaptation objectives are considered.</p>	<p>EU Common Agricultural Policy provides a level of income security to farmers as well as incentives for measures aimed at supporting rural businesses and communities to develop and diversify as well as environmental protection and conservation measures.</p> <p>The EU has agreed the shape of the CAP support system until 2020 and Scottish Government is continuing to work with stakeholders on prioritising the details of the final programme, which is due to commence in 2015. Public consultations on both Pillar 1 (Direct Payments) and Pillar 2 (Rural Development) have taken place in 2013-2014 to ensure stakeholders views are considered.</p> <p>There are a number of options that could be used to support adaptation in agriculture including, capital grants for resilience measures such as improved farm infrastructure and buildings, funding for skills initiatives that provide training and guidance on adaptation and financial incentives to support the uptake of adaptation measures on farm to encourage uptake and improve farm business performance.</p>	EU, Scottish Government
N3-2	<p>Support Scotland's Animal Health Regime to help prevent the introduction and spread of harmful organisms.</p>	<p>Climate change may lead to the introduction and spread of livestock diseases and threats to public health.</p> <p>Animal Health Regime Veterinary Surveillance programme has an important role for early detection of new and emerging diseases in livestock.</p> <p>Contingency plans set out actions to be taken in the event of a serious outbreak of an animal pest or disease.</p>	<p>Scottish Government and Veterinary Surveillance Partners: Scottish Rural College, Moredun Research Institute, Animal Health and Veterinary Laboratories Agency</p>

N3-3	Support Scotland's Plant Health Service to help prevent the introduction and spread of harmful organisms.	Climate change may lead to the introduction and spread of plant diseases and threats to public health. Inspection, monitoring and surveillance activities under Scotland's Plant Health Service is vital to ensure Scotland's high plant health status is maintained. Contingency plans set out actions to be taken in the event of a serious outbreak of a plant pest or disease.	Scottish Government, Scottish Environment Protection Agency, Scottish Natural Heritage, Science and Advice for Scottish Agriculture
N3-4	Promote the use of Ecological Site Classification, Forest GALES and other decision support systems to help forest managers to determine appropriate species and silvicultural systems in a changing climate.	Forest managers will have access to existing decision support systems to help decide on species suitability in a changing climate.	Forestry Commission Scotland
N3-5	Implement the Scottish Windthrow Contingency Plan to help minimise the financial impact of wind damage to commercial forests.	Will help minimise the financial impact of wind damage to commercial forests.	Forestry Commission Scotland
N3-6	Support the Scottish Wildfire Forum to help ensure that land managers and the emergency services work together to prevent and manage wildfires.	Enhance preparedness for forest fires through partnership working.	Scottish Wildfire Forum members
N3-7	Publish resources for managers of productive forests to help them develop more resilient forests in a changing climate and in the face of tree health threats. Promote these resources, and provide support to forest managers.	Will help forestry management practices adapt and will help reduce the impact of tree pests and diseases on forests, woodland and related open ground habitats.	Forestry Commission Scotland with input from partners Forest Enterprise Scotland, Scottish Government, Scottish Natural Heritage, Scottish Environment Protection Agency, private forestry sector and the third sector.
N3-8	Promote tree health response contingency planning to enable rapid on-the-ground action to deal with new tree health threats and to enable targeted deployment of emergency measures.	Will ensure that forest managers make the most effective response to tree health threats.	Forestry Commission Scotland, Scottish Government, Scottish Natural Heritage, private forest managers
N3-9	Develop Operational Guidance for managing incidents of wildfire for fire and rescue service managers and personnel.	Guidance for fire and rescue service managers and personnel.	Scottish Government

N3-10	Enhance operational capacity to enable earlier detection and subsequent management of tree pests and diseases.	Will ensure that forest managers make the most effective response to tree health threats.	Forestry Commission Scotland, Scottish Government, Scottish Natural Heritage, private forest managers
N3-11	Common Fisheries Policy (CFP). Influence the EU reform of the CFP to ensure that it recognises the impacts of climate change and is flexible to environmental change.	Achieve a CFP that is flexible to environmental change.	EU, Scottish Government
N3-12	Improve targeting of species by using selective fishing gear and reducing discards through conservation credits and TR2 schemes.	Selective gear and fewer discards will improve sustainability of fisheries management.	Scottish Government (Marine Scotland)
N3-13	Manage the impacts of climate change to help fishing industries achieve Maximum Sustainable Yield (MSY) by 2015 , where possible, and by 2020 for all stocks at the latest.	MSY should be set at a level that takes into account the impacts of climate change.	EU, Scottish Government
N3-14	Introduce new Technical Standards for containment by Scottish fish farms. Enabling provisions for Technical Standards are included in the Aquaculture and Fisheries (Scotland) Act 2013.	All finfish farms operating in Scotland will have equipment, appropriate for conditions in which they operate, to contain fish.	Scottish Government (Marine Scotland)
N3-15	Fishing and aquaculture industries to develop and introduce new technologies for environmentally sustainable commercial fishing and aquaculture.	The Aquaculture and Fisheries (Scotland) Act 2013 includes powers to prescribe technical requirements for equipment (nets, pens and mooring systems and training to: (1) ensure installation and deployment of equipment that is well maintained and appropriate for the site conditions; (2) impose a duty for adequate training to use prescribed equipment, and requirements on operators to keep records in relation to training and equipment. These powers will require adherence to Scottish Technical Standards (STS) which are currently in development. STS covers open pen, land-based facilities, ponds, raceways and hatcheries - nets, pens, mooring systems and screens; and sets standards for design, construction, materials, manufacture, installation, maintenance and size of equipment.	Scottish Environment Protection Agency, Marine Science Scotland

		<p>They will take account of site specific environmental conditions e.g. wave height, wind and current speeds; and flood risk assessments for land-based, pond and raceway sites; and future-proofed for technological developments, novel farming approaches, and moves further offshore or climatic changes.</p> <p>Technical Requirements for fish farm equipment will reduce the risk of storm damage and fish loss, minimise escapes, and limit the risk of spread of fish disease.</p>	
N3-16	<p>Sourcing For Growth Initiative A knowledge hub to match food manufacturing companies with producers of quality Scottish produce has been set up to build on the nation's growing gourmet reputation.</p>	<p>The Sourcing for Growth initiative will help Scottish producers prepare to meet manufacturers' demands for raw materials. It will enable manufacturers and farmers to work together to take advantage of the opportunities of Scotland's growing food industry.</p> <p>This will encourage local businesses to work together therefore reducing supply chains and help protect Scotland's food producing markets.</p>	Scottish Government

Case Study

Creating Resilient Forests II

Changing climate could result in catastrophic pest, disease and wind events for some species. With uncertain climate impact predictions and diverse views on adaptation methods, using a range of management and stocking strategies should help to increase resilience. Examples include the use of Continuous Cover Forestry, different thinning and spacing regimes and diversified plantings. Any emerging threats (e.g. pests) may then only affect a smaller proportion of the total forest investment.



**Queen Elizabeth Forest Park
Forestry Commission Scotland**

Research

The Scottish Government is funding research into the resilience of Scotland's biodiversity to climate change and land-use change. The research will deliver findings in five areas:

- Assessment of the roles of biodiversity in ecosystem function, to inform our understanding of the place of biodiversity within The Ecosystem Approach.
- Identification of the interactions between the changing climate and Scotland's species, habitats and ecosystems, including the main risks to Scotland's biodiversity which need to be managed, and the main contributions of Scotland's biodiversity to mitigation and adaptation to climate change.
- Identification of the potential consequences of land use changes for Scotland's biodiversity.
- Measurement and prediction of the responses of selected species, habitats and ecosystems to changes in the climate and in land use.
- Identification and development of management strategies and practices to address anticipated impacts and increase the resilience of Scotland's biodiversity to climate change and land use change.

Other research programmes on climate impacts and adaptation in the natural environment include:

- **Invasive non-native species (INNS) data gathering** in the marine environment, managed by Marine Scotland and SNH. Gathering data regarding the presence of INNS in the marine environment will allow the threat posed to be properly assessed.
- **Marine monitoring programmes**, managed by Marine Scotland and MSS. The programmes will allow marine plan and/or atlas information to be updated, and updated overall assessments of the seas to be undertaken.
- **Research vessel monitoring**, is being managed by Marine Scotland with support from partners such as SNH and SEPA. Research vessels will gather data to assist with assessment of ocean acidification in Scottish seas. Data used for other monitoring requirements e.g. the Marine Strategy Framework Directive, will also be used to establish how climate change may be influencing Scottish seas.
- **The Forest adaptation research programme**, run by Forest Research, will evaluate future climate impacts, identify adaptation strategies and understand how we can develop 'resilient forests'.
- **The Scottish Research Forest**, managed by Forest Research. Forest management approaches to enhance resilience can be trialled and demonstrated in the context of a working forest. Plans for the research forest include trials and demonstration of species, provenance and management system suitability; and how to enhance resilience to, plan for and deal with extreme events.

What else needs to be done?

In some cases, existing and planned action may be enough to achieve the objective. The following tables set out other possible additional courses of action. Some or all of these may become firm policies once development work is complete and/or financial resources allow.

Objective N1 – Understand the effects resulting from climate change and their impacts on the natural environment			
No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
N1-14	Establishment of a co-ordinated Energy Sector Climate Change impacts research programme which would consider the impacts of changing energy generation on biodiversity and ecosystem services.	The research programme could include consideration of the impacts of changing energy generation on biodiversity and ecosystem services.	Scottish Government

Objective N2 – Support a healthy and diverse natural environment with the capacity to adapt			
No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
N2-23	Encourage the consideration of climate change impacts (and how they will be addressed) in Forest Plans , and support this with grants and regulations so as to ensure that forest plans support ecosystems and habitat resilience and allow resilience-building measures to be trialled by forest managers.	This will be important in ensuring that forest plans support ecosystem and habitat resilience.	Forestry Commission Scotland

Objective N3 – Sustain and enhance the benefits, goods and services that the natural environment provides			
No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
N3-17	Greater recognition of the role of integrated land management in tackling climate change (as opposed to sector-based responses) and this being backed up by Scottish Government policy and support mechanisms.	Land Use Strategy Regional Land Use Framework pilots will be utilising the LUS principles and taking an ecosystem approach to consider land use and land use change in their area in an integrated manner.	Scottish Government, Scottish Natural Heritage, Forestry Commission Scotland, Scottish Environment Protection Agency

Climate Ready Buildings and Infrastructure Networks

A Scotland with well-managed, resilient infrastructure and buildings providing access to the amenities and services we need.

Introduction

This Chapter considers the most important impacts of the changing climate on buildings and infrastructure networks and sets out the Scottish Government's related objectives.

The following issues are considered in this chapter:

- 'Buildings' – existing and newly constructed buildings, including historic and traditionally constructed buildings, and man-made surroundings such as green and blue spaces.
- 'Infrastructure' – road (trunk and local) network, rail network, ports, harbours, ferries, canals and airports; energy transmission and generation; energy efficiency; water collection, and supply demand and treatment.
- Planning policy – both on land and at sea – which affects where man-made structures and surroundings are located.

The location, design, development and size of buildings and other structures can affect the surrounding natural environment. Equally, the provision of clean water is reliant on our lochs and rivers, so this theme has important links with the Natural Environment theme. The impacts of the changing climate on buildings and infrastructure is also likely to affect our economy and society, so this theme also has important links with the Society theme.

How is the changing climate likely to affect our buildings and infrastructure?

Businesses, individuals and key services rely on infrastructure on a daily basis – for energy, for water, for heating and for transport. Disruption to these assets will likely have a knock-on effect for our economy and society. Put simply, the changing climate will generate positive and negative impacts and challenges across the infrastructure and the built environment that we rely on.

Infrastructure: Disruptive impacts to road and railway infrastructure from severe weather, especially flooding, landslides and high winds are likely to occur with the changing climate. Climatic impacts to our transport networks will invariably result in stresses across other sectors; for example, flooding of transport networks will cause disruption to emergency services at a time when their services are likely to be in particular demand.

Case Study

How climate change impacts could affect First ScotRail's ability to run normal rail services

In recent years First ScotRail has had to respond to increasingly disruptive weather events. This prompted the company to look at current and future weather and climate risks in more detail, with support from Adaptation Scotland. The project, led internally by ScotRail's Environmental Sustainability and Climate Change Manager, benefited from managerial input from facilities, performance, communications and health and safety units. Transport Scotland and Network Rail also participated in the project.

Adaptation Scotland facilitated workshops to help participants identify existing vulnerabilities and future climate change risks for Scotland's rail network. An important part of the process was identifying how outside influences could affect ScotRail's ability to run normal rail services. The Environmental Sustainability and Climate Change Manager said "it was useful to involve other departments and stakeholders who would not normally consider how climate change might affect them or other rail users".

Adaptation Scotland recommended developing a flexible adaptation plan to enable ScotRail to take timely action in light of uncertainties and changing business needs. Adaptation Scotland supported ScotRail to test its new business adaptation plan template, and ScotRail now has a fully operational adaptation plan.

First ScotRail Adaptation Scotland

Flooding of energy infrastructure is likely to disrupt supply to households and businesses. Any increase in frequency or intensity of storms and flooding may increase the incidence and/or severity of damage to power lines and substations. Power disruption on the Scottish networks is more likely to result from wind damage than from flooding, although impacts do occur occasionally. In recent years, the networks have recovered well from periods of disruption and the distribution network operators have robust response arrangements and plans in place to minimise disruption wherever possible. However, until a storm abates and flood waters subside, access to the affected sites may not be possible and it may not be safe for repairs to be carried out. Without adaptive action, climate change impacts could lead to more frequent and prolonged disruption to electricity supplies.

Climate projections indicate that annual rainfall may remain fairly stable, however it may be variable within the year, and is subject to more uncertainty at local levels. A decline in water availability and water quality in some areas may impact on water resources. Scottish Water uses climate projections in longer term water resource planning to ensure that it can make appropriate choices to ensure resilient service.

Climate change also presents risks to water quality – the expectation for increased variability means there may be more runoff of nutrients and soil particles. A key element in managing this will be increased monitoring to understand how catchments may be changing.

A decline in water availability and water quality is likely to impact on private water supplies (PWS) which already suffer from greater challenges in terms of meeting existing quality standards. Private water supplies (PWS) are the responsibility of the owners and users of the supplies and regulated by local authorities through the enforcement of legislation relating to PWS. There are around 20,000 PWS in Scotland, providing water for 3% of Scotland's population.

Scottish Government currently has a programme of work underway to assess the issue of quantity and quality of supply by private water supplies. These include:

- A grant specifically aimed at improving the quality of private water supplies. A non means tested grant of £800 per property is available.
- A research project to review the impact of varying water quality on the effectiveness of ultraviolet treatment (this is one of the most common types of treatment for PWS).
- A research project to understand the wider impacts and risks of private water supplies to public health and economic development. It will concentrate on the larger "Type A"⁴⁸ private water supplies that supply business premises and will include a review of the options for improving them including a connection to the public supply.

Buildings – Damage to properties from rain penetration and mould/algae growth not only results in financial costs, but can also affect the health of the occupants. In Scotland the greatest threats to infrastructure and the built environment will come from water, wind and heat. Property and buildings may be threatened because they are located in areas that are at increased risk of floods or landslips. There is currently limited information on the probabilistic projection of wind speed, although, wind-driven rain is likely to become more prevalent and any increase in surface water discharge from buildings will need to be managed. Space for landscaping however, offers opportunities for mitigating the impacts of wind driven rain.

Buildings and other structures of significant historical importance may be particularly vulnerable to the impacts of climate change and special consideration must be given to how these cultural assets can best be preserved in the face of a changing climate. Increasing sea levels and the impact of coastal erosion also makes protecting Scotland's vulnerable archaeology and coastal landscapes vital.

⁴⁸ Type A are those which supply 50 or more people, supply ten or more cubic meters of water per day or supply any kind of public or commercial activity.

Planning and Green Infrastructure – The consultative draft Scottish Planning Policy of 2013 includes climate change as a Principal Policy, one which should feature in all planning activity. The draft policy aim is to strengthen resilience in relation to greater climate variability for example:

- ensuring new development is adapted to withstand more extreme weather, including prolonged wet or dry periods;
- working with natural environmental processes, for example through the development of green infrastructure and sustainable urban drainage systems to reduce flood risk; and
- promoting landscaping and natural shading that cool spaces in built areas during hotter periods.

Objectives, Policies and Proposals

This Chapter contains the objectives and the policies and proposals to drive the progress towards meeting the objectives. The objectives describe what is hoped will be achieved in the long-term (up to 2050) and the policies and proposals set out the priorities for this Programme.

The following objectives, policies and proposals address the relevant risks identified for the Built Environment, Energy, Transport and Water by the CCRA. The objectives are inter-related and are being addressed in a coherent way, recognising that they are mutually reinforcing with strong synergies across them.

What is already being done?

The following table sets out what is being done by Scottish Government and key public bodies at a national level to help build resilience and deliver the objectives for buildings and infrastructure networks. It includes a wide range of existing and planned policies, legislation and on-going action.

Objective B1 – Understand the effects of climate change and their impacts on buildings and infrastructure networks			
No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
B1-1	<p>Research to identify necessary resilience measures for new buildings including:</p> <ul style="list-style-type: none"> • Wind loading for small buildings; • Effects of wind driven rain on external fabric; • Ability of buildings to be adequately ventilated in the summer, and • Surface water source control from hard standings. 	By providing the design community with tools and better information on adaptation measures for climate change, this should lead to better designed buildings suited to the environment in which they will be located.	Scottish Government

<p>B1-2</p>	<p>Research to identify necessary resilience measures for existing buildings / heritage assets including:</p> <ul style="list-style-type: none"> • Thermal performance of the traditional building envelope and upgrading options available to older structures to improve energy efficiency; • Physical effects on buildings of changing weather patterns and profiles; • Quantify heritage assets affected by climate change using GIS and UKCP09; • Collate action on understanding and mapping anticipated coastal erosion/flood risk to cultural heritage. 	<p>Make buildings/heritage assets more resilient to climate change. Progress on mapping anticipated coastal erosion/flood risk will be measured by the development of a methodology for assessing climate change risk to historic sites, the creation of a climate change risk register for properties in the care of Historic Scotland and the incorporation of these into management planning and resource allocation. The results of research into climate change threats to the historic environment will be published and current guidance amended where appropriate.</p>	<p>Scottish Government, Historic Scotland</p>
<p>B1-3</p>	<p>Research to assess the benefits of property level flood protection products.</p>	<p>Property level flood protection products can improve the flood resilience of homes and businesses. The results of the research will be used to produce a 'blueprint' to help local authorities consider how these products can be most effectively installed.</p>	<p>Scottish Government Scottish Flood Forum</p>
<p>B1-4</p>	<p>Implement Secure and Resilient – A CNI Strategy for Scotland. The strategy provides the overarching vision and strategic direction for all Critical Infrastructure (CI) resilience stakeholders in Scotland, with the ultimate aim of enhancing the resilience of CI in Scotland.</p>	<p>Will enhance the resilience of energy infrastructure to flooding and other climate related risks. In particular, it will enhance the resilience of the critical national infrastructure (CNI) which is essential for keeping the country running.</p>	<p>Scottish Government, CNI Site operators, UK Government, Energy Regulator, Scottish Environment Protection Agency</p>
<p>B1-5</p>	<p>Trunk Road Customer Care Survey, Passenger focus survey (rail passenger survey every six months) and National Household Survey.</p>	<p>Stakeholder attitude surveys will produce yearly assessment of public attitude on disruption. The various surveys undertaken by Transport Scotland will ask questions on the stakeholder's perception and attitude to severe weather and climate change. It will aim to build up a picture of transport users attitudes to climate change disruption in particular.</p>	<p>Transport Scotland</p>

B1-6	National Transport Strategy (2006) Review of climate impacts on transport networks with future recommendations; Monitoring report on (visitor) demand against (transport network) capacity.	Will help to assess the suitability of existing transport routes and nodes that specifically support lifeline services when the effects of high-winds and storm disruption are taken into account between 2013 and 2018. This work will be undertaken in conjunction with the recommendations within the 'Annual Review of Life-Line Services'. It will also monitor demand against capacity across all transport modes.	Transport Scotland
B1-7	A report on risks from fog projections	Will help to determine if there will be significant effects from fog on the transport network.	Transport Scotland, Society of Chief Officers of Transportation in Scotland
B1-8	Research under the Landslide Implementation Plan (2008) Will collect and analyse information/data to determine which areas of the transport network are susceptible to landslips.	Delivery of the recommendations and findings from the Landslide Study to reduce exposure of roads to landslips.	Transport Scotland
B1-9	Support the report on " Wetter weather, public transport and traffic/congestion patterns in urban areas ".	The report will improve understanding about how wetter weather, along with an increasing emphasis on public transport, may change traffic and congestion patterns in urban areas.	Society of Chief Officers of Transportation in Scotland
B1-10	Establish a central coordinating point for information and data collection relating to climate effects on the transport network and for developing knowledge sharing activities for this sector.	Transport Scotland's Road Asset Management Plan (RAMP) will be the central coordinating point for information and data collection relating to climate effects on the trunk road network.	Transport Scotland
B1-11	Scottish Road Network Climate Change Study (2005) Continue to implement and deliver the programme of design, research and policy initiatives identified in the Scottish Road Network Climate Change Study.	Completion of actions listed in the Study will enhance the resilience of the road network.	Transport Scotland

B1-12	<p>Engagement with World Road Association and UK and European Road/Transport Authorities.</p> <p>Yearly report update published on Transport Scotland's website outlines benefits accrued from links with European transport agencies.</p>	Exchange information and share best practice experience with transport providers in other countries on coping with wetter conditions, with particular emphasis on flooding.	Transport Scotland
B1-13	<p>Flood Risk Management Plans - The Flood Risk Management (Scotland) Act 2009 requires the development of Flood Risk Management Strategies (FRMS) and Local Flood Risk Management Plans (LFRMP).</p>	Local Flood Risk Management Plans will include full consideration of properties and key energy, transport, water and ICT infrastructure which may be at risk. This work builds on the National Flood Risk Assessment published in December 2011.	Scottish Environment Protection Agency, Scottish Water, Local Authorities, other responsible authorities
B1-14	<p>River Basin Management Plans (RBMP)</p> <p>The RBMPs set out how we can enhance the environmental quality of rivers, lochs and seas, delivering greater benefits for the environment, and safeguarding them for future generations.</p>	Will ensure greater resilience in terms of water quality and quantity.	Scottish Environment Protection Agency, responsible authorities and land managers
B1-15	<p>Study of impact of flows on sewerage network.</p> <p>Study will use both rainfall and wider climate change data.</p>	Will set out how Scottish Water will take account of sewerage flows when improving and maintaining its waste water assets in future.	Scottish Water, Scottish Environment Protection Agency

Objective B2 – Provide the knowledge, skills and tools to manage climate change impacts on buildings and infrastructure

No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
B2-1	Policy to introduce, under the building regulations, a new requirement to extend non-domestic sustainability labelling to school buildings . This will increase awareness of sustainability features and continue their adoption.	This ties in with the Scottish Futures Trust Schools programme and is a pathfinder for extending sustainability to all non-domestic buildings. It will encourage the sustainable design and construction of all new buildings. For example, the introduction of measures to minimise the potential for summertime overheating. Defining higher standards to measure sustainability will enable higher quality buildings to be created and for such benefits to be formally recognised.	Scottish Government
B2-2	Sustainable Urban Drainage Systems (SUDS) Working Party National promotion of SUDS. [SUDS are water management practices and facilities designed to drain surface water in a manner that will provide a more sustainable approach than the conventional practice of routing run-off through a pipe to a watercourse.]	Guidance to inform and educate homeowners and asset managers on the control of surface water around buildings and infrastructure.	Scottish Government, Scottish Environment Protection Agency, Scottish Water, Society of Chief Officers of Transportation in Scotland, Transport Scotland.
B2-3	Water Use Efficiency To introduce under the building regulations a new mandatory standard for water efficiency provision in dwellings to reduce carbon emissions and fuel.	Providing greater resilience to households even at times of relative water shortage and saving water and energy as mitigation benefits.	Scottish Government
B2-4	Implement Historic Scotland's Climate Change Action Plan (2012-2017) This plan aims to improve the condition of the historic environment and reduce the number of historic buildings and monuments at risk from the impacts of climate change.	Risk assessment will be undertaken to evaluate which sites managed by Historic Scotland are most at threat from coastal erosion, flooding, damp and mould and rainwater penetration. This will improve decision-making for prioritising the on-going conservation and maintenance programmes, thus ensuring the long term survival of the most valuable assets. Technical reports and new guidance will reference the latest research by Historic Scotland on adaptation measures for traditional and historic buildings, including updating of Guide for Practitioners 6.	Historic Scotland

B2-5	<p>Joint agency climate action programme</p> <p>The Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH), Forestry Commission Scotland (FCS) and Historic Scotland are working towards a programme of action to help protect historic sites and property from the impacts of climate change.</p>	<p>Provision of advice on the management of historic sites, including archaeological sites, and property exposed to flooding, coastal erosion and other impacts. Reduction in flood risk through the use of natural flood management.</p>	<p>Scottish Environment Protection Agency, Historic Scotland, Scottish Natural Heritage, Forestry Commission Scotland</p>
B2-6	<p>Liase with industry on thermal generation</p> <p>(generation of electricity from sources that create heat, such as coal, gas and nuclear).</p> <p>To improve communications and promote joint working, the Scottish Government established the Thermal Generation and Carbon Capture and Storage Industry Leadership group as a joint liaison between Government and industry to steer and guide policy direction on matters relating to thermal generation.</p>	<p>Will review the efficiency of power station cooling processes in light of climate change projections and ensure that climate change adaptation is fully considered in the future development of thermal generation and CCS policy in Scotland.</p> <p>Whilst energy policy is reserved, the Scottish Government has a role to play in developing CCS and Thermal generation due to responsibilities and duties in relation to planning, consents and environmental regulation.</p>	<p>Scottish Government. Scottish Environment Protection Agency, Industry</p>
B2-7	<p>National and Regional Marine planning frameworks</p>	<p>National and Regional Marine Plan, which include clear policies for climate change mitigation and adaptation in relation to marine development and activity will be taken into account in decisions relating to infrastructures which incorporate marine and terrestrial elements.</p>	<p>Scottish Government (Marine Scotland) and Marine Planning Partnerships</p>
B2-8	<p>Transport Scotland Asset Management Strategy</p> <p>Utilise National Flood Risk Assessment (NFRA) to identify locations of potential flooding across transport network.</p>	<p>The Transport Scotland Asset Management Strategy will take account of the future climate. It will determine which areas of the transport network are susceptible to flooding, inundation, subsidence and ground water to improve knowledge on capacity and capability of these assets.</p>	<p>Transport Scotland, Society of Chief Officers of Transportation in Scotland</p>
B2-9	<p>High Winds Strategy (2009)</p> <p>Strategy for managing the impacts of high winds on the trunk road network.</p>	<p>Regular reviews of the network to identify locations where wind management procedures should be developed.</p>	<p>Transport Scotland</p>

B2-10	Third and Fourth Generation road maintenance contracts Revise/update maintenance regime procedures to prioritise subsidence and incorporate weather events into repair work programme.	Updates will help: <ul style="list-style-type: none"> • Transport networks and emergency responders react effectively to unexpected climatic events; • Road networks to be more resilient to weather events and planning repair work to take account of changes in weather patterns; • Ensure works to prevent subsidence are dealt with as a priority, and comprehensively, where financial resources allow. 	Transport Scotland
B2-11	Implement the Scottish Integrated Maritime Transport Strategy.	Will assess the vulnerability of coastal transport infrastructure to sea level rise and flood risk. Will also assess potential sea level rise risk at specific Scottish ports.	Transport Scotland, Society of Chief Officers of Transportation in Scotland
B2-12	Road Scotland Act (1984): Asset Management Plans and Network Rail Asset Management Policy Enhanced monitoring of bridges and other structures within inspection regimes for those structures known to be at risk. Further development of risk assessment for scour, debris impact & inundation as guidance and changes evident from inspections become available.	Will help manage risks to road and rail bridges.	Transport Scotland, Society of Chief Officers of Transportation in Scotland
B2-13	Road Scotland Act (1984): Implement Resilience Plans	Maintain the current level of winter preparedness across road networks.	Transport Scotland, Society of Chief Officers of Transportation in Scotland
B2-14	Local Forest Management Strategies to Tackle Slope Instability. Focused work at key locations on the National Forest Estate.	Will help combat slope instability to prevent damage to the transport network.	Forest Enterprise Scotland, Transport Scotland
B2-15	High level output specification for railways; related to the public performance measures to consider “severe disruption”.	This is about measuring the volume of trains running through a severe disruption and this is a key performance indicator for the next rail franchise.	Transport Scotland, Network Rail
B2-16	Gather data to inform Scottish Water’s investment programme from 2015 onwards which will address adaptation needs of water infrastructure.	Understand how future and existing assets and operations should be adapted to minimise the threats from climate change. Information on the programme and how the water industry operates is available from the Scottish Government website.	Scottish Water

B2-17	Integrated approach to catchment modelling	Improved monitoring of rainfall, river and surface water flows.	Scottish Water
B2-18	Manage leakage to water distribution network Annual leakage levels agreed between Scottish Water, Scottish Government and Regulators.	Reducing leakage reduces the overall demand on available water and energy supplies giving greater resilience should there be either water or energy constraints.	Scottish Water

Case Study

Use of Sustainable Urban Drainage system at Tollcross Aquatic Centre Glasgow

The original swimming pool at Tollcross, Glasgow was extended to form a new aquatic centre as part of the preparations for the Commonwealth Games 2014. The works created an opportunity to demonstrate environmental responsibility in the control of surface water. This was reflected in the use of a sustainable urban drainage system to deal with the water run-off from both the extended roof area and car park.

The car park is constructed from Tarmac Dry, a propriety permeable pavement system. Any surface water carrying hydrocarbons/pollutants is cleaned as it percolates down through the stone sub-base before infiltrating to ground. Water is also allowed to drain away via a HydroBrake to the existing surface water sewer at a 'Greenfield' flow rate of 1.26 l/sec. Water that does not drain via the HydroBrake or through infiltration is temporarily stored in the voids of the stone sub-base until it can eventually escape. Roof run-off is restricted to 'Greenfield' flow rate (1.8 l/sec) by means of a HydroBrake and then flows to an infiltration trench receiving 1 level of treatment. Surplus water is temporarily stored in a crated attenuation tank. Once capacity is available remaining surplus water drains from the tank via the HydroBrake and infiltration trench to the Tollcross Burn.



Scottish Government

Objective B3 – Increase the resilience of buildings and infrastructure networks to sustain and enhance the benefits and services provided

No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
<p>B3-1</p>	<p>Building Regulations Guidance The Building Regulations set standards for design and construction which apply to most new buildings and many alterations to existing buildings in Scotland. These standards and guidance are kept under review to allow them to reflect best practice and adapt to changes in climate.</p> <p>Current guidance is being reviewed to consider potential impacts of climate change on buildings with regards to wind driven rain and the effect of increasing air-tightness within buildings on air quality.</p>	<ul style="list-style-type: none"> • New guidance will emphasise the need for flood risk assessments and flood design strategy; • New guidance to be introduced on efficiency of water use within buildings; • Guidance within the Building Regulations Technical handbooks to be revised to reduce the risk of new buildings being affected by wind driven rain, damp, mould and insect pests. This should improve the resilience of buildings to the likely impact of climate change. 	<p>Scottish Government, Historic Scotland</p>
<p>B3-2</p>	<p>Planning Advice Notes (PAN) provides advice and information on technical planning matters. As part of the modernisation of the planning system, the planning advice notes are being reviewed and consolidated. Revised PANs are to be underpinned by the principles of sustainable flood risk management.</p>	<p>The consolidated PAN on flooding, water and drainage will provide advice and guidance for applicants, developers and local authorities on the role of sustainable flood risk management. It will highlight the role of climate change adaptation with regards to flood risk and the water environment and promote the avoidance of development in medium to high flood risk areas. It will also provide guidance on sustainable drainage systems (SUDS).</p>	<p>Scottish Government, Planning Authorities</p>

<p>B3-3</p>	<p>Scottish Planning Policy (SPP) (Climate Change) identifies that short and long term impacts of climate change should be taken into account in all decisions throughout the planning system.</p> <p>Scottish Planning Policy is the statement of the Scottish Government's policy on nationally important land use planning matters.</p>	<p>The SPP sets out how the planning system should help address climate change through mitigation and adaptation measures, providing relevant examples for planning authorities to consider.</p> <p>For example:</p> <ul style="list-style-type: none"> • To promote the benefits of open spaces the SPP advises that planning authorities should undertake an audit of the open space resource in their area and how well it meets the needs of the community and to use this to prepare an open space strategy which sets out the vision for new and improved open space and addresses any deficiencies identified. Planning authorities are also encouraged to integrate green infrastructure/networks into new development and regeneration proposals. • SPP requires development proposals that have a significant probability of being flooded, or that would increase the probability of flooding elsewhere, not to be permitted. Developers are encouraged to account for flood risk before committing to particular projects. The SPP provides policy guidance to planning authorities and developers on flood risk issues. 	<p>Scottish Government, Planning Authorities</p>
<p>B3-4</p>	<p>Raise awareness and provide access to knowledge via Sust: Sustainability in Architecture programme based at Architecture and Design Scotland.</p>	<p>Assist with the education of commissioning clients and designers on the issues and techniques relevant to sustainable design. This will help to provide the design community with tools and improved knowledge with regards to adaptation measures for climate change.</p>	<p>Scottish Government</p>
<p>B3-5</p>	<p>Commission and promote demonstration projects in association with funders/developers about the benefits of incorporating sustainable design in their projects.</p>	<p>A number of initiatives are already underway or planned. For example:</p> <ul style="list-style-type: none"> • Scotland's Housing Expo; • Scottish Sustainable Communities Initiative (SSCI); • Polnoon Housing project. 	<p>Scottish Government</p>

<p>B3-6</p>	<p>Home Energy Efficiency Programme for Scotland. Delivering heating and insulation measures across Scotland to help improve energy efficiency and reduce energy demands of existing housing stock in the most fuel poor areas.</p>	<p>Condensation, damp and mould are expected to become more usual as our climate changes. Our Home Energy Efficiency Programmes for Scotland by improving the energy efficiency of existing homes will make them warmer and easier to heat, and warmer homes are less prone to condensation. Our programmes will also help tackle fuel poverty helping reduce the effect of a changing climate on the most vulnerable in society.</p> <p>In addition, the energy efficiency improvements to homes are expected to help reduce overall energy demands on our energy infrastructure thereby helping to increase resilience.</p>	<p>Scottish Government, Local Authorities, Energy companies</p>
<p>B3-7</p>	<p>The Energy Efficiency Standard for Social Housing sets a minimum standard for energy efficiency in social housing. All social housing will be expected to meet the standard by 2020.</p>	<p>By 2020, social housing will need to meet a minimum standard of energy efficiency. This will make it easier for people to heat their homes to a comfortable level. This will help tackle fuel poverty, and also help reduce the likelihood of condensation and mould by keeping homes warmer.</p>	<p>Scottish Government, local authorities, Registered Social Landlords</p>
<p>B3-8</p>	<p>Improve Housing Quality by ensuring all houses meet the tolerable standard, and that all social housing meets the Scottish Housing Quality Standard (SHQS) by 2015.</p>	<p>The tolerable standard is a minimum condemnatory standard which all houses in Scotland must meet, and includes being substantially free from rising and penetrating damp as well as having satisfactory thermal insulation (defined as the presence of loft insulation where a property can have it).</p>	<p>Scottish Government, local authorities, Registered Social Landlords, home owners</p>
<p>B3-9</p>	<p>Develop draft regulations for consultation by 2015 which would set minimum standards for energy efficiency in private sector housing, likely to be under section 64 of the Climate Change (Scotland) Act 2009.</p>	<p>Over time, minimum standards for private sector housing will lead to improvements in energy efficiency. This will make homes warmer and easier to heat, reducing the likelihood of condensation, mould and damp. It could also encourage behaviour change in raising awareness of the need for adaptations amongst home owners.</p>	<p>Scottish Government, working group of key stakeholders, home owners</p>

B3-10	<p>Promote Keeping Scotland Running – A Guide to Critical Infrastructure Resilience</p> <p>Includes guidance to assist Government, Industry and Strategic Coordinating Groups (SCG's) in the implementation and delivery of enhancing resilience through sharing of best practice and risk/resilience analysis and assessment methodologies to support the wider 'Secure and Resilient' CNI Strategy in Scotland.</p>	<p>Will help enhance the resilience of critical infrastructure to climate change. This would ensure that the emergency planners are better sighted on risks affecting critical infrastructure and are better prepared to deal with the impacts of climate change on these sites.</p>	<p>Scottish Government</p>
B3-11	<p>Civil Contingencies Act (2004): Transport resilience community engagement</p> <p>Provide short briefing/ guidance note for businesses and transport operators on the effects of climate change.</p>	<p>Encourage transport operators to take climate change into account when developing their business continuity plans.</p>	<p>Society of Chief Officers of Transportation in Scotland, Transport Scotland, Transport Operator companies</p>
B3-12	<p>Improving driver skills in extreme weather (road and rail).</p>	<p>Development of education programmes and learner training to cover how to drive in extreme conditions through:</p> <ul style="list-style-type: none"> • Eco-driver programme in the Rail Franchise simulator to improve driving in extreme conditions; • Freight sector engagement with Road Haulage Association and Freight Transport Association. 	<p>Transport Scotland, Learning driver organisations</p>
B3-13	<p>River Basin Management Plans (RBMP)</p> <p>The RBMPs set out how we can enhance the environmental quality of rivers, lochs and seas, delivering greater benefits for the environment, and safeguarding them for future generations.</p>	<p>Will ensure greater resilience in terms of water quality and quantity.</p>	<p>Scottish Environment Protection Agency, responsible authorities and land managers</p>
B3-14	<p>Market Driven Supply Chain</p> <p>This project will support and maintain food and drink supply chains to fully exploit opportunities in the Scottish, UK and international markets, ensuring food and drink can be fully distributed.</p>	<p>Assist businesses to adapt to the future pressures on Scotland's infrastructure caused by climate change.</p>	<p>Scottish Government Scottish Enterprise</p>

Research

The following research projects are underway or are planned to help meet the Objectives under this theme:

- **A report on risks from fog projections**, led by Transport Scotland in partnership with SCOTS, will review available information on fog projections. This will help to determine if there will be significant effects from fog for the transport network.
- **Research under the Landslide Implementation Plan (2008)**, led by Transport Scotland, will collect and analyse information/data to determine which areas of the transport network are susceptible to landslips. Recommendations from the Landslide Study will continue to be implemented and delivered. Completion of actions listed in the study will reduce exposure of roads to landslides.
- **Report on 'Wetter weather, public transport and traffic/congestion patterns in urban areas'** by 2015. This will be led by SCOTS⁴⁹ and the report will improve understanding about how wetter weather, along with an increasing emphasis on public transport, may change traffic and congestion patterns in urban areas.
- **Research on evaluating occupant interaction with ventilation systems in dwellings.** Ventilation standards are set by building regulations, supported by guidance within Section 3, Environment, of the technical handbooks. This project will examine whether a reduction in uncontrolled infiltrating air to dwellings may need to be replaced by a controlled means in order to maintain indoor air quality for the building and occupants.
- **Research on proposed changes to U-values. The U-values are set by building regulations, supported by guidance within Section 6, Energy, of the technical handbooks.** Details are required to aid the understanding of the principles of limiting infiltration, linear thermal bridging, precipitation and condensation and the application of these principles to improve Scottish construction practice.

⁴⁹ Society of Chief Officers of Transportation in Scotland

What else needs to be done?

In some cases, the existing and planned action may be enough to achieve the objective. The following table sets out other possible additional courses of action. Some or all of these may become firm policies once development work is complete and/or financial resources allow.

Objective B1 - Understand the effects of climate change and their impacts on buildings and infrastructure networks			
No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
B1-16	Develop an Energy Sector Climate Change impacts research programme.	Develop an improved understanding of the climate impacts for energy, identified in the UK CCRA, where consequences or likelihood are unclear, unknown or require further evidence. This will include: <ul style="list-style-type: none"> • supporting research to identify the significance of increased energy demand and reduced energy generation efficiency which would help to quantify effects of climate change and reduce uncertainty. • identifying the potential issues associated with increased demand for water for cooling. 	Scottish Government
B1-17	Assessment of potential sea level rise risk at specific Scottish ports. Will determine risk to current operating limitations at such ports.	Will help developments at new and existing ports take account of sea level rise risk and ensure all port operations are able to function at current standards.	Transport Scotland, Scottish Environment Protection Agency have key role as statutory advisor.
B1-18	Tomorrow Railways and Climate Change Adaptation (TRACCA)	Specific for the Rail Network in Scotland, this proposal will drive the consideration of climate change issues within rail network decision making.	Transport Scotland, railway partners
B1-19	To consider a long-term approach to the management of surface water to ensure that sewer systems are resilient to climate change.	An integrated approach to the drainage of surface water arising from impermeable surfaces such as roofs and roads that takes account of all aspects of the drainage systems and produces long-term and sustainable actions that will ensure they are resilient to the changing climate.	Partnership between Scottish Water, Local Authorities, Scottish Canals, developers, homeowners

Objective B2 – Provide the knowledge, skills and tools to manage climate change impacts on buildings and infrastructure

No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
B2-19	<p>The drafting of regulations to implement Section 63 of the Climate Change (Scotland) Act 2009. This aims to reduce greenhouse gas emissions and improve the energy efficiency of existing non-domestic buildings.</p>	<p>This should ultimately lead to improvements to the internal and external fabric and building services of existing buildings. Thereby increasing their energy efficiency. This should also increase the longevity of such buildings.</p>	<p>Scottish Government</p>
B2-20	<p>To extend the requirement for sustainability labelling beyond schools to other non-domestic buildings.</p>	<p>Sustainability labelling has only been fully developed for new school buildings and dwellings, at present there is no immediate intention to develop sustainability labelling for other non-domestic buildings, this is to allow industry to familiarise themselves with recent introductions.</p>	<p>Scottish Government</p>
B2-21	<p>Establish a Scottish Government Energy Sector Flood Risk work stream (as part of the Energy Sector Resilience group).</p>	<p>Develop improved knowledge of flood risks to wider energy infrastructure based on latest data available.</p>	<p>Scottish Government, Energy site and network operators</p>
B2-22	<p>Network Rail Strategic Business Plan to demonstrate how severe disruption caused by weather will be addressed.</p>	<p>Maintain the current level of winter preparedness across rail networks.</p>	<p>Transport Scotland, railway partners</p>

Objective B3 – Increase the resilience of buildings and infrastructure networks to sustain and enhance the benefits and services provided

No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
B3-15	High Level Output Specification and Scottish Ministers Guidance to the Office of Rail Regulation.	The rail industry will contribute towards a greener Scotland and rail regulation must not act as a barrier in making the rail network and operations resilient to predicted future changes in the climate.	Transport Scotland, railway partners
B3-16	Introduce new Guidance on good public transport interchange design to cope with more extreme weather. (for bus shelter design, railway station etc.)	Passenger infrastructure will be designed and delivered to cope with more severe weather.	Society of Chief Officers of Transportation in Scotland, Transport Scotland and in conjunction with manufacturers

Climate Ready Society

A Scotland with strong, healthy, resilient communities which are well informed and prepared for a changing climate.

Introduction

This Chapter considers the most important impacts of the changing climate on Scotland's society and sets out the Scottish Government's related objectives.

The following issues are considered in this chapter:

- The resilience of communities against climate change impacts and in particular on vulnerable people.
- The impacts from a changing climate on people's health and wellbeing.
- The preparedness of the emergency and rescue services to deal with climate change impacts.
- The impacts on businesses and industry from a changing climate.

There are strong links between Climate Ready Society and the other themes in the Programme. For example, there are links with the Buildings and Infrastructure Networks theme where the impacts of climate change on buildings can affect the health of occupants if not properly managed. Our success in adapting transport and energy infrastructure to the effects of a changing climate will in turn impact on the resilience of households, communities and emergency responders.

How is the changing climate likely to affect Scottish society?

Health and wellbeing – Climate change may impact on people's health and wellbeing. For example, an increase in severe weather episodes such as flooding may result in an increase in mental ill health due to distress of displacement, loss of personal possessions and financial losses.

Wetter, warmer winters will have the potential to lead to increased algal and fungal growth in buildings, with consequential effects on those vulnerable to allergy diseases (e.g. asthma) and other respiratory diseases. Measures taken to control the spread of pests and diseases could lead to access restrictions in the countryside.

There may also be positive effects for people's health and well-being. A projected rise in mean annual temperature, coupled with a projected reduction in rainfall levels presents an opportunity for healthier lifestyles such as walking, cycling and other outdoor activities which would have a positive outcome on both physical and mental health. Higher temperatures may also lead to a reduced reliance on heating, helping to alleviate the detrimental effects of fuel poverty.

Emergency and Rescue Services – Climate change is likely to have an impact on the emergency and rescue services as severe weather events become more frequent. Responding to the consequences of climate change will present challenges and increased demands on all emergency and volunteer services.

When extreme weather events occur, the Fire and Rescue Service, the Police, Ambulance Service, Health Boards and other local responders are called on to respond. They are required under civil contingencies legislation⁵⁰ to work together to ensure the response is co-ordinated effectively.

A projected increase in the frequency of severe weather events, such as flooding, landslides and wildfires will increase the overall pressure on the emergency and rescue services which may impact on the ability of the services to respond. Pressures on the emergency services are also likely to increase due to warmer summers which could potentially lead to a greater uptake of outdoor activities, increasing the risk of accidents which the emergency services will need to respond to.

The voluntary sector also plays an important role, working alongside statutory responder organisations and communities, to plan for, respond to and recover from emergencies. There is a growing need for the voluntary sector to be increasingly integrated with broader emergency response structures and processes, for example through improved information about the sector's capabilities being available to statutory responders, memorandums of understanding between voluntary sector organisations, and joint training and exercising. The Resilience Advisory Board Scotland (Voluntary Sector) brings together statutory and voluntary sector organisations to jointly develop policy. This group runs an annual seminar which focusses on increasing the capability of the sectors to work together.

Communities – More frequent severe weather may disrupt the lives of individuals and communities. Preparing society to help with adaptation measures is key if the risk of climate change for communities and in particular, those most vulnerable, is to be reduced.

More targeted support may be required for the poorest in society, who are likely to be most vulnerable to the impacts and least able to afford protection. The Scottish Government was one of the project partners in research on *Adapting to the Differential Social Impacts of Climate Change in the UK*⁵¹. This suggests that not only are people living in the most deprived areas often more exposed to specific climate change impacts, they also find it harder to recover when they occur. The individuals and groups most likely to be affected by climate change include: children and young people; those with health problems; with poor mobility; living in places at risk; with low levels of income; who lack awareness of the risks of climate change; who lack insurance cover; and who are less well supported by family, friends and agencies.

⁵⁰ [Civil Contingencies Act 2004](#)

⁵¹ Differential Social Impacts of Climate Change in the UK: www.sniffer.org.uk

The impacts of the changing climate are also likely to be felt by rural communities in particular. Disruption of transport and communication links due to flooding will disproportionately impact on rural communities which are heavily reliant on them. Rural communities are also more reliant on private water supplies, which may be more vulnerable to the effects of climate change than public supplies, such as waterborne diseases.

To ensure existing inequalities do not widen with climate change, social impacts will need to be addressed in adaptation measures. The Scottish Government held a joint conference with the Joseph Rowntree Foundation and Adaptation Scotland on *Climate Justice: Delivering Socially Just Adaptation in Scotland* in 2012.⁵²

The Scottish Government published in October 2013 a research report *Flood disadvantage in Scotland: mapping the potential losses in wellbeing*. This report maps the communities that are most socially and spatially vulnerable to flooding and proportions of neighbourhoods in each local authority classed as being 'extremely flood disadvantaged'.

The Scottish Government's Climate Challenge Fund, which can support community adaptation projects that are also low carbon, was refreshed in 2012-13 to ensure that disadvantaged and more vulnerable communities are able to benefit from the Fund.

Case Study

Communities addressing the challenges and opportunities that their area faces as a result of climate change

The Carse of Gowrie community has been working together over the last two years to address the challenges and opportunities that the area faces as a result of climate change.

The work started in 2011 when Perth & Kinross Council and Adaptation Scotland ran a series of community engagement workshops. This helped people from across the area to find out about the changes in climate expected for the region and, discuss how these changes might impact the community.

Following on from these workshops, community members formed a sustainability group to take forward local projects to build resilience and support the region in adapting to long term climate change. The community is now involved with a wide range of projects including state of the art online mapping work to record many community features. The maps will be used to help address current risks through the creation of a 'crowdmap' for recording and monitoring the consequences of weather events or recording animal and bird sightings. The analysis of data collected will provide an evidence base which will allow them to adapt and plan for long term climate change. An increased awareness of local climate change impacts has also led the community to get involved with projects to reduce carbon emissions, improve environmental sustainability and create networks for biodiversity to make the area more resilient.

**Perth and Kinross Council
Adaptation Scotland**

⁵² <http://www.scotland.gov.uk/Resource/0042/00420490.pdf>

Businesses – The changing climate will present threats and opportunities to businesses and industries in Scotland. Some negative consequences will affect all kinds of businesses, such as: increased risk of flooding of buildings and other assets; disruption to transport and communication networks, with staff unable to get to work, and; disruptions to supply chains.

The risks of a changing climate for each individual business needs to be understood and addressed to safeguard longevity as well as potential opportunities explored.

There are also likely to be specific consequences from climate change which could have a financial impact on certain types of businesses.

Insurance Industry: The insurance industry is directly exposed to climate change risks at home and overseas through the risks to underwritten products and decisions on where to invest its assets⁵³. The cost of repairing damage to property and infrastructure from flooding and coastal erosion is likely to increase. Insurance is a reserved matter, and the UK Government has included powers in the Water Bill to implement an agreement with the insurance industry to enable people living in the most flood-prone areas to get affordable flood insurance. The industry's proposal – called Flood Re – would replace the current voluntary agreement (the Statement of Principles). Flood Re would protect many of those most at risk by in effect capping flood insurance premiums. The proposal would mean that premiums would be set according to property values and that people would know the maximum they could be asked to pay.

The Scottish Government is working with Defra, the insurance industry and the other devolved administrations, to make sure that the Scottish perspective, and the work being done in Scotland to manage flood risk, is taken into account in the development and future implementation of Flood Re.

Supply Chains: The Scottish economy may be affected by the impacts of climate change overseas. These effects may be considerable, and possibly larger than the immediate impacts of climate change in Scotland. Supply chains may be affected by restrictions in the availability of key products caused by climate impacts such as extreme events, flooding or drought. Transport disruption caused by climate change related events overseas can also affect supply chains.

At a global scale, the impacts of climate change could also lead to restrictions on food supply – leading to higher prices and lower availability in Scotland. However, food security in Scotland is unlikely to be as severely impacted as that in many other parts of the world.

⁵³ <http://www.pwc.co.uk/sustainability-climate-change/publications/international-threats-and-opportunities-of-climate-change-to-the-uk.jhtml>

Trade and Investment: Scotland's trade and investment will also be affected by climate change overseas. At present, the largest proportion of our trade and investment is with other European countries and the United States, which are relatively well equipped to manage the impacts of climate change. However, as our trading and investment patterns change, Scotland may find itself exposed to greater risks from climate change impacts overseas.

However, the risks to Scotland may be low, relative to many other countries and, together with its transition to a low-carbon economy, this may make Scottish businesses more attractive to investors, provided the risks that we do face are managed appropriately.

Objectives, Policies and Proposals

This Chapter contains the objectives and the policies and proposals to drive the progress towards meeting the objectives. The objectives describe what is hoped will be achieved in the long-term (up to 2050) and the policies and proposals set out the priorities for this Programme.

The following objectives, policies and proposals address the relevant risks identified for health and wellbeing, emergency rescue services and, businesses and services by the CCRA. The objectives are inter-related and are being addressed in a coherent way, recognising that they are mutually reinforcing with strong synergies across them.

What is already being done?

The following table sets out what is being done by the Scottish Government, NHS Scotland and other public bodies at a national level to help build resilience and deliver the objectives for Scotland's society. It includes a wide range of existing and planned policies, legislation and on-going action.

Objective S1 - Understand the effects of climate change and their impacts on people, homes and communities			
No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
S1-1	The Food Standards Agency (FSA) to continue to develop a greater understanding of the main food borne disease related pathogens in terms of their transmission routes and vectors to identify opportunities to control these.	FSA continues to conduct research relevant to high risk pathogens. For example, the recent publication of research into E. coli to identify practical ways for reducing E. Coli in cattle. This will allow the FSA to consider methods such as the use of probiotics in feed, vaccination of animals and further bio security measures on farms. The FSA food surveillance sampling database also holds all data from participating Local Authorities on the results of food samples analysed for pathogens, providing information of emerging risks.	Scottish Government, Food Standards Agency
S1-2	Research to identify and develop an understanding of communities, in particular vulnerable groups to the impacts of climate change. Building on work on Climate Change, Justice and Vulnerability by the Joseph Rowntree Foundation (2011), the Scottish Government has worked to map flood disadvantage in Scotland. This work considers how underlying social vulnerability	Develop a robust research base to support informed medium and longer term operational decision making. We are considering how this work can be updated with new data from SEPA's flood maps.	Scottish Government

	<p>can exacerbate the impact of flood events and enables a closer look at the vulnerability characteristics of flood disadvantaged neighbourhoods. A report providing a first look at flood disadvantage in Scotland was published in autumn 2013.</p>		
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Objective S2 – Increase the awareness of the impacts of climate change to enable people to adapt to future extreme weather events

No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
<p>B3-1</p>	<p>Building Regulations Guidance The Building Regulations set standards for design and construction which apply to most new buildings and many alterations to existing buildings in Scotland. These standards and guidance are kept under review which allow them to reflect best practice and adapt to changes in climate.</p> <p>Current guidance is being reviewed to consider potential impacts of climate change on buildings with regards to wind driven rain and the effect of increasing air-tightness within buildings on air quality.</p>	<ul style="list-style-type: none"> • New guidance will emphasise the need for flood risk assessments and flood design strategy; • New guidance to be introduced on efficiency of water use within buildings; • Guidance within the Building Regulations Technical handbooks to be revised to reduce the risk of new buildings being affected by wind driven rain, damp, mould and insect pests. This should improve the resilience of buildings to the likely impact of climate change. 	<p>Scottish Government</p>
<p>S2-1</p>	<p>Eradicate fuel poverty by 2016 as far as practicable. Energy efficiency is one of the three key influences on fuel poverty, along with household income and fuel costs.</p>	<p>Greater instances of extreme weather can be expected to change the demand for heat. Rising fuel prices may continue to cause fuel poverty. The main aim of this policy is to reduce fuel poverty. It is supported by other actions such as the energy efficiency elements of the Scottish Housing Quality Standard (SHQS) (which social housing must meet by 2015); the proposed Energy Efficiency Standard for Social Housing (EESH) with first milestones to be met by 2020; and our Home Energy Efficiency Programmes for Scotland (HEEPS) providing and levering in further incentives to improve energy efficiency.</p>	<p>Scottish Government</p>

S2-2	Scottish Government to continue to raise awareness and provide information to society on how best to adapt to a changing climate.	Adaptation Scotland is supporting communities vulnerable to climate change impacts. A toolkit for communities and community-facing organisations has been developed, built around a Training Module: Building Resilient Communities – preparing for the impacts of climate change.	Scottish Government, Adaptation Scotland
S2-3	The Food Standards Agency (FSA) to improve the understanding of food safety related behaviour by consumers and targeted education to assist in greater consumer knowledge and understanding of risks in the domestic sector.	The FSA conducts regular social research into consumer behaviour. Every 2 years a UK survey, which has a specific element for Scotland, provides information on consumers understanding of risks, their knowledge and their attitudes in relation to food safety and healthy eating. The FSA also holds regular citizen forums to gather the views of consumers on numerous policy matters. Both of these allow the FSA to target information to improve consumer’s knowledge via relevant channels including events, published literature, PR and media. It is anticipated that climate change will bring new risks and challenges to food safety and healthy eating, being able to identify these and assist consumers in mitigation of risks will continue to be important.	Scottish Government, Food Standards Agency
S2-4	Develop psychosocial disaster recovery guidance to support a better response to people who have experienced trauma. This is part of the Scottish Government’s Care for People guidance.	Development of areas to support a better response to people who have experienced trauma. This is part of the Scottish Government’s Preparing Scotland work on resilience.	Scottish Government
S2-5	Develop and promote resources which support capacity building in communities, to help build resilience to emergencies, including responding to severe weather events. Provide advice and information for responders, community groups and the voluntary sector to promote greater awareness amongst individuals and communities of what they can do to protect themselves, their homes and businesses from the consequences of emergencies, such as severe weather events.	This information and advice will help create more resilient communities. Resources available on Ready Scotland are used by community groups to help them work with emergency responders to develop community emergency plans.	Scottish Government in liaison with local communities and voluntary sector.

S2-6	Continue to develop the Ready Scotland website as a source of advice and information for the public about preparing for and managing the potential consequences of emergencies, including severe weather events.	Ready Scotland aims to raise awareness of the risks and consequences of a range of emergencies and to provide the public with practical advice and information to support their preparedness and resilience. In an emergency situation, Ready Scotland provides specific advice to the public on the appropriate actions to take.	Scottish Government
S2-7	Undertake all risk resilience assessments across each of the National Infrastructure (NI) sectors , including the impacts of climate change.	Improved knowledge and preparedness of exposure and vulnerability to climate change risks.	Scottish Government, CI Operators
S2-8	Promote and support SEPA flood risk awareness raising activities providing the public with advice and information about their flood risk and on potential preventative action that can be taken by individual householders in advance of a potential flood.	Increased public awareness of their flood risk and greater sign-up to SEPA's Floodline direct warnings service will increase communities' preparedness and resilience.	Scottish Government, Scottish Environment Protection Agency
S2-9	Deliver Flood Warning Dissemination Programme to enable Floodline messages to be delivered direct to all registered users. This will help provide better flood warning for members of the public in advance of an anticipated flooding event.	Better flood warning and on-going risk assessment giving as much notice is key to adaptation as it allows the emergency services and the public to prepare for and respond to potential flooding incidents.	Scottish Environment Protection Agency
S2-10	Increase awareness of flood risk and flood resilience in schools by working through the Curriculum for Excellence.	<p>Within the framework of the Curriculum for Excellence, the project will raise awareness of flood risk in schools and build the knowledge, skills and capacity of learners (and their families and communities) to develop their resilience and enable them to adapt to climate change.</p> <p>School flooding workshops run by Heriot Watt University, involving an interactive flooding model, will demonstrate the importance of making room to store and slow water in the urban environment and help change individual behaviours about slabbing over gardens etc.</p>	Scottish Government, Education Scotland, Scottish Environment Protection Agency, Heriot Watt University NERC

S2-11	<p>Ready For Emergencies resilience resource for schools. This explains the risks associated with flooding and severe weather and helps raise awareness of how to cope with such emergencies.</p>	<p>The resource covers flooding and severe weather and builds the understanding and preparedness of school pupils to the risk and coping with emergencies, including those from climate change impacts.</p>	<p>Education Scotland</p>
S2-12	<p>Improve education on flood risk management to increase awareness and understanding of the importance of community resilience.</p>	<p>Enhanced education on flood risk management for future generation of householders and flood risk managers, and help with future flood-related job recruitment. Will help encourage people to take action to protect themselves, their family and their property even in areas which have not experienced flooding before.</p>	<p>Scottish Government, Scottish Environment Protection Agency, Education Scotland</p>
S2-13	<p>Support the Scottish Flood Forum. This Group provides advice and support for communities and businesses to help build resilience and reduce their flood risk. The Group also offers assistance to individuals and communities after flooding events.</p>	<p>The independent Scottish Flood Forum (SFF) works directly with communities and businesses to reduce their flood risk. It also provides recovery support after flooding events. The SFF helps build community resilience and individual responsibility.</p>	<p>Scottish Government</p>

Case Study

Argyll and Bute Community Emergency Planning Initiative

In winter 2012, a severe gale left many parts of Argyll without power for up to 4 days. After recovery was complete the subsequent debrief identified a need for Argyll and Bute Council to work with communities to improve their resilience during weather related emergencies. The council wanted to ensure that individuals are better prepared for severe weather and to encourage them to think less about what the emergency services can do for them and more about what they can do for themselves.

The Council project team created a handbook for Argyll communities based on the guidance and toolkit from the Scottish Government's Ready Scotland website. Strathclyde Police, Strathclyde Fire and Rescue, NHS Highland, HM Coastguard, Scottish Government, British Red Cross, WRVS, Argyll Voluntary Action, Scottish Power and Scottish Southern Energy all contributed. The handbook 'A Guide to Helping Your Community Prepare an Emergency Plan' was then issued to all 54 community councils in Argyll. The handbook can be found at <http://www.argyll-bute.gov.uk/community-resilience>.

The production of the handbook has been backed by a programme of engagement by the Council, Argyll Voluntary Action and a range of partner agencies, providing support and advice to those communities which wanted to get involved. Action by communities has been very effective, with over 50% of communities in Argyll and Bute now preparing community emergency plans.

Argyll and Bute Council, with support from the Scottish Government, have also issued "emergency kits" to communities involved, which will help if they need to implement their emergency plan. The kits include things like a wind up radio, battery operated torches and foil blankets.

When severe weather hit Arran and Kintyre again in March 2013, the work done by communities proved very valuable in helping to co-ordinate the response to, and recovery from, the resulting emergency.

Further information about this and other case studies of good practice in building community resilience to emergencies can be found at www.readyscotland.org.



**Argyll and Bute
Scottish Government**

Objective S3 – Support our health service and emergency responders to enable them to respond effectively to the increased pressures associated with a changing climate

No.	Policy and description	How will this help deliver the Objective?	Who will deliver?
S3-1	NHS Scotland Boards to develop individual Climate Change Adaptation Plans in accordance with the NHS Scotland Sustainable Development Strategy.	Mandatory requirement for each NHS Board to have a Climate Change Adaptation Plan due to an increased burden on NHS emergency health care services and social and welfare services in dealing with the impact of sudden extreme weather events.	NHS Boards
S3-2	Scotland Property and Asset Management Plans to provide, maintain and develop a high quality, sustainable asset base to ensure the delivery of high quality health care.	Ensure that NHS Scotland provides, maintains and develops a high quality, sustainable asset base that supports and facilitates the provision of high quality health care and better health outcomes and, that the operational performance of assets is appropriately recorded, monitored, reported and reviewed and, where appropriate improved. In addition, there may be gains in terms of reduced vulnerability to current climate variability as well as contributing to the long term sustainability of the estate.	NHS Boards
S3-3	VTEC/E.Coli 0157 Action Plan	The Action Plan will seek to address all current gaps in responses to VTEC/E.coli infection in Scotland, and to have a beneficial effect on other diseases that may be spread via the same pathways as VTEC/ E. coli O157 (e.g. protection of private water supplies) due to an increase in temperature.	Scottish Government, VTEC/E.coli Action Group
S3-4	NHS Procurement and Estates to consider accommodation design for housing IT equipment.	Ensure that IT suites in NHS properties take account of heat generated by equipment, and that any potential overheating issues are addressed at the time of installation of equipment.	Scottish Government, National Services Scotland, National Procurement, NHS
S3-5	Revise Scottish Capital Investment Manual to take account of changes in sustainable development policy and strategy.	Scottish Capital Investment Manual is reviewed and revised as necessary.	Scottish Government, Health Facilities Scotland

S3-6	<p>Improve Regional Resilience Partnerships' risk and preparedness impacts assessment guidance. This will provide a more consistent approach to assessing the potential for emergencies, including severe weather events and widespread flooding and RRP's ability to respond to the consequences of these emergencies.</p>	<p>A process to prioritise emergencies that might occur across Scotland and measure RRP's capability and capacity to respond. A revised process was issued in December 2013 – Risk and Preparedness Assessment guidance. RRP's are currently completing the first versions of these and will use information from the UK National Risk Assessment (NRA), National Resilience Planning Assumptions (NRPAs) and Local Risk Assessment Guidance (LRAG) together with Scottish specific and regional expertise to carry out assessments.</p>	<p>Scottish Government, responder agencies</p>
S3-7	<p>To enhance the capability of Scotland's Fire and Rescue services through assessing their operational preparedness and response capabilities to severe weather events.</p>	<p>Current assessment of operational preparedness and response capability to severe weather events.</p>	<p>Scottish Fire and Rescue Service</p>
S3-8	<p>Continue to assess the potential impacts of environment factors on the delivery of police services through the Scottish Police Service Strategic Assessment.</p>	<p>The police service will continue to assess the impact of environmental factors on possible increases in demand to deal with for example, more severe and more frequent weather events or possible increases in organised outdoor events. This forms part of the routine and regular strategic assessment process.</p>	<p>Scottish Police Service</p>
S3-9	<p>Preparing Scotland suite of guidance to support legislative compliance, good practice and enhanced resilience across Scotland's responder agencies and wider resilience community.</p>	<p>Provision of guidance for responder agencies on complying with their duties under civil contingencies legislation.</p>	<p>Scottish Government</p>
S3-10	<p>Develop and extend training of accredited 'incident commanders' to provide greater resilience across the emergency and rescue services to deal with major or critical incidents.</p>	<p>Improved multi-agency operational capacity to ensure resilience of command to deal with any major or critical incident.</p>	<p>Scottish Police Service</p>

S3-11	Promote and support the production of 'Lessons Learned' from agency debriefs on weather related events and action the lessons learnt through changes to policy, processes and training.	Collective responsibility to identify lessons from single and multi-agency debriefs on climate-related events and action the lessons through changes to policy, processes and training.	Scottish Government, responder agencies
S3-12	Delivery of a wide programme of specialist and technical training.	Equipping Fire and Rescue Service to respond to all types of incidents, including those resulting from severe weather.	Scottish Fire and Rescue Service
S3-13	Support a Scottish flood forecasting service.	An improved forecasting service – up to five days' warning of potential flood risk – enables the emergency and rescue services to be better prepared to respond. It also helps address vulnerable communities' flood risk.	Scottish Environment Protection Agency, Met Office

What else needs to be done?

In some cases, the existing and planned action may be enough to achieve the objective. The following table sets out other possible additional courses of action. Some or all of these may become firm policies once development work is complete and/or financial resources allow.

Objective S1 - Understand the effects of climate change and their impacts on people, homes and communities			
No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
S1-3	Build on the Health Protection Scotland Scoping Report on the effect of extreme weather events on public health to identify priority areas for action.	Consider the findings of the report and implement key recommendations of the report. This is a wide-ranging report which provides a comprehensive overview of the potential impacts on health due to climate change.	Health Protection Scotland, Scottish Government
S1-4	Assessment of new, emerging or re-emerging disease epidemiology and research to increase the understanding of how these relate to public health and determine what possible future action is required.	<p>This work will increase understanding of issues in relation to epidemiology of diseases of public health concern, and will determine what, if any, future action is required.</p> <p>There are a number of potential impacts of changing climates, most obviously an increase in temperature leading to new or re-emerging diseases which require a climate unlike that currently found in Scotland. For example, an increase in temperatures could lead to an increase in particular ticks which carry certain diseases. Similarly, a wetter, warmer climate could see an increase in water-based diseases. We will need to work with Health Protection Scotland to consider the likelihood of the incidence of particular diseases occurring in different climatic conditions, and to what extent this would pose a health risk. It is likely that the initial scoping work can be carried out in the next 5 years, but an assessment of the need for any further work could not be made until after this first phase has been completed.</p>	Health Protection Scotland, Scottish Government

S1-5	<p>Undertake research to strengthen the evidence base for risk assessment and planning purposes as well as partner and stakeholder engagement. This should be widely disseminated across Emergency and Rescue Services, Scottish Government and Local Authorities.</p>	<p>Robust research base supporting informed medium and longer term operational decision making.</p>	<p>Scottish Government, Met Office, ClimateXChange</p>
S1-6	<p>Research to inform decision making about future resource allocation and 'spend to save' options – research should assess the possible future economic impact on the Emergency and Rescue Services of climate change adaptation against current expenditure patterns.</p>	<p>Robust research base supporting informed medium and longer term operational decision making.</p>	<p>Scottish Government, ClimateXChange</p>
S1-7	<p>Extreme Weather Event (EWE) All Hazard Health Protection Plan will be developed over the next five years.</p>	<p>Scotland already experiences variable extreme weather events which are likely to become more frequent with the changing climate, impacting on health services and communities. The 'All Hazard' approach recognizes the common components of a comprehensive health protection response and the necessity of preparedness of health services. Whilst the plan will have current utility, strengthening health protection activity and communication messages, it will also provide a framework for responding to future hazards and novel risks.</p>	<p>Scottish Government</p>

Objective S2 – Increase the awareness of the impacts of climate change to enable people to adapt to future extreme weather events

No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
S2-14	Improve public information and access to guidance on heat waves.	Develop guidance on action to take in heat waves, with specific tailoring for those most vulnerable to the effects and their carers. Information campaigns should be prepared in advance of prolonged heat waves and ready to disseminate when appropriate.	Health Protection Scotland, Scottish Government
S2-15	Emergency and Rescue Services to consider opportunities for raising public awareness around flooding risks and protective activity.	More informed and resilient communities.	Emergency and Rescue Services

Objective S3 – Support our health service and emergency responders to enable them to respond effectively to the increased pressures associated with a changing climate

No.	Proposal and description	How will this help deliver the Objective?	Who will deliver?
S3-14	Take forward appropriate ‘Good Places Better Health for Scotland’s Children’ recommendations. Good Places Better Health recommendations were published in December 2011.	The following recommendations could be examined further in terms of their contribution to climate change resilience: <ul style="list-style-type: none"> • Review energy efficient criteria of the Tolerable Standard and the Scottish Housing Quality Standard to enable energy efficiency improvements; • Streamline and simplify the grants system for energy efficiency improvements; • Improve Registered Social Landlord action on fuel poverty; • Improve the uptake of home insulation grants; • Use point of sale/exchange of lease/construction of extensions to require communication and/or upgrading of building’s energy efficiency; • Ensure home reports include details of how to access any grant funding for energy efficiency improvements. 	Scottish Government
S3-15	Need to consider chronic diseases where a changing climate could add extra stresses.	Warmer weather could worsen air quality (exacerbates effects of air pollution) and increased problems for asthma sufferers. Increased damp weather could worsen chronic lung conditions such as COPD.	Scottish Government

ADAPTATION SCOTLAND PROGRAMME

The Scottish Government funds the Adaptation Scotland programme to ensure wider engagement in meeting the objectives of this Programme. The Adaptation Scotland programme provides guidance and support to help organisations, businesses and communities in Scotland prepare for, and build resilience to, the impacts of climate change.

Adaptation Scotland offers free access to the best quality data on climate trends and their impacts in Scotland as well as access to tools, guidance and advice on adapting to the impacts of a changing climate⁵⁴.

Adaptation Scotland engages with national, regional and local stakeholders in Scotland who are crucial to building Scotland's resilience to the impacts of climate change. Adaptation Scotland's highly networked approach encourages new connections, collaborations, partnerships and innovations. Partnership projects bring together public, private and community sectors to identify climate change impacts and address shared risks and opportunities. This work develops shared understanding and the capacity of organisations and individuals to respond. Adaptation Scotland also provides expert advice to the Scottish Government, including input to the development of the Scottish Climate Change Adaptation Programme.

Promoting Science and Research

The work of Adaptation Scotland is underpinned by world leading climate information and adaptation science. The programme has strong links across the scientific research community and works in partnership to provide decision makers and practitioners with the latest information to support adaptation planning and action.

The Adaptation Scotland website hosts and links to a range of key information including:

Past climate trends - Adaptation Scotland has developed a simple online interactive tool for accessing information on trends in Scotland's climate since 1910, based on Met Office data. Scotland's Environment website⁵⁵ hosts the Climate Trends Handbook and a tool for exploring detailed climate data for Scotland.

⁵⁴ www.adaptationscotland.org.uk

⁵⁵ <http://www.environment.scotland.gov.uk/>

Future climate projections – Adaptation Scotland has developed an online interactive tool based on UKCP09⁵⁶ data for Scottish ‘regions’. The website also includes a compendium of charts and maps and links to sources of further information.

Supporting Public Bodies

The Scottish Government funds the Adaptation Scotland programme to support public bodies to adapt to the impacts of climate change. This includes supporting leadership development and capacity building through providing training, promoting partnership working and linking public sector leaders with the latest climate information and adaptation science.

Through partnership working with the Sustainable Scotland Network, COSLA and public bodies, Adaptation Scotland is working strategically to influence adaptation work across the public sector. This includes a priority focus on promoting the implementation of a risk-based approach to adaptation and supporting an annual review of local authority adaptation progress.

Adaptation Scotland plays a key role in supporting public bodies compliance with the public bodies climate change duties introduced by the Climate Change (Scotland) Act 2009, which requires them to exercise their functions in a way which will help deliver this Programme. Individual organisations are supported to identify climate change impacts, risks and opportunities through training and mentoring.

Guidance, practical tools and web based resources include:

Introduction to adaptation for the public sector – High level briefing showing how Scotland’s climate is changing and describing impacts on public sector assets, infrastructure and services.

Five steps to managing your climate risks – Operational guidance to help organisations develop arrangements for managing their climate risks and work towards compliance with the public bodies climate change duties.

Case studies – Web-based case studies show examples of adaptation planning and action from across Scotland.

⁵⁶ UK Climate Projections 2009 (UKCP09). These projections show the changes that can be expected across the UK, including Scotland, during the rest of this century.

Supporting Business

Adaptation Scotland engages with Scotland's 2020 Climate Group to raise awareness of adaptation among the business representatives. The Adaptation Scotland programme helps to develop business sector leadership on adaptation through providing key information about climate impacts for business and developing a variety of private, public and community sector partnership projects.

Business focused guidance and information is provided to enable businesses to identify and plan for climate impacts, risks and opportunities.

Online resources include:

Adapting to climate change: a guide for businesses in Scotland – High level briefing showing how Scotland's climate is changing, describing impacts and providing a basic guide to adapting.

Climate risk management plan template – A quick and efficient process that businesses can use to identify, record and manage business related climate risks.

Information notes for SMEs⁵⁷ – Briefing notes to help SMEs identify climate change impacts and take action to reduce risks.

Supporting Communities

Adaptation Scotland is working with communities and partner organisations to better understand the challenges that Scotland's communities will face as a result of climate change and, develop resources to raise awareness and help support on the ground action.

Adaptation Scotland has worked with communities to develop a series of online resources that can be used both by communities and intermediary organisations. Resources include:

Sharing knowledge: Are you ready? – Are Your Ready? is a short film and set of discussion questions that communities can use to begin conversations about weather event impacts and community responses.

Exploring impacts and opportunities: community workshops – A guide to running a series of workshops that communities can use to explore local climate change impacts and identify opportunities for taking action.

Sources of practical and financial support – Web pages with details of practical and financial support available to help communities plan and implement local adaptation projects.

Case studies – Web-based case studies show examples of adaptation planning and action from communities across Scotland.

⁵⁷ Small and Medium Enterprises

Supporting Collaboration

No one organisation will be able to adapt to climate change in isolation and Adaptation Scotland is supporting stakeholders to work collaboratively to adapt.

Information and resources to support collaborative working include:

Climate Ready Clyde project – Details of workshops and resources used to begin developing a shared adaptation planning process in Glasgow and the Clyde Valley.

Adaptation workshops for planners – Designed to build the capacity of planners to include adaptation at the heart of strategic and local development planning processes. Developed in partnership with TAYPlan Strategic Development Planning Authority, SEPA, Historic Scotland, Architecture and Design Scotland, Scottish Natural Heritage, and Perth and Kinross Council.

Case Study

Climate Ready Clyde

The Climate Ready Clyde project was set up by the Adaptation Scotland programme and has already increased understanding of how changes in climate are likely to affect different organisations, services and sectors across the region, and how the responses of individual sectors and organisations will have knock-on effects on the ability of others to respond.

Project partners have developed a shared vision setting out a clear and ambitious commitment to adapting to the impacts of climate change.

The project shows that organisations and businesses are willing and able to work across traditional institutional and sector boundaries to address risks and opportunities from climate change. Whilst Adaptation Scotland's facilitation role was crucial in supporting the project at the start, the legacy of the project is of new working relationships and a shared vision of a Climate Ready Clyde.

**Glasgow and Clyde Valley
Adaptation Scotland**

UK CCRA Ref	UK CCRA Impact	Theme	Objective
AG1b	Changes in wheat and spring barley yield (due to warmer springs)	Natural Environment	N1
AG1c	Changes in potato yield (due to combined climate effects and CO2)	Natural Environment	N1
AG1d	Changes in spring barley yield (due to warmer springs)	Natural Environment	N1
AG1e	Changes in winter barley yield (due to wetter winters)	Natural Environment	N1
AG2/FL4	Flood risk to high quality agricultural land	Natural Environment	N2
AG3	Risk of crop pests and diseases	Natural Environment	N1, N2 N3
AG4	Drier soils (due to warmer and drier summer conditions)	Natural Environment	N1 N2 N3
AG7a	Reduction in milk production due to heat stress	Not being addressed in this programme	
AG8a/b/AG15	Livestock heat stress factors	Not being addressed in this programme	
AG10	Changes in grassland productivity	Natural Environment	N1, N2
AG17/AG59	Increase in greenhouse gas emissions	Natural Environment	N1
AG19	Soil erosion and leaching	Natural Environment	N1 N2 N3
AG21	Waterlogging effects (annual)	Natural Environment	N1 N2 N3
AG25/AG51/AG52	Agricultural land classification and crop suitability	Natural Environment	N1
AG26/AG27	Biodiversity/wildlife changes	Natural Environment	N2 N3
AG30/AG57/AG58	Breeding habits/reproductive nature of species	Not being addressed in this programme	
AG44	Livestock pests and diseases	Natural Environment	N1, N2 N3
AG65	Loss of particular landscapes and associated rural communities, previously managed by livestock keepers	Natural Environment	N3
AG66	Human food supply from domestic agriculture	Natural Environment Buildings and Infrastructure Networks	N1, N3 B3
BD1	Risk to species and habitats due to drier soils	Natural Environment	N2, N3
BD2	Risks to species and habitats due to coastal evolution	Natural Environment	N2, N3
BD3	Risk of pests to biodiversity	Natural Environment	N2, N3
BD4	Risks of diseases to biodiversity	Natural Environment	N2, N3
BD5	Species unable to track changing climate space	Natural Environment	N2, N3
BD6	Environmental effects of climate mitigation measures	Natural Environment	N1
BD8	Changes in soil organic carbon	Natural Environment	N1
BD9	Changes in species migration patterns	Natural Environment	N2, N3
BD10	Biodiversity risks due to warmer rivers and lakes	Not being addressed in this programme	
BD11	Generalists species more able to adapt than specialists	Natural Environment	N2, N3
BD12	Wildfires due to warmer and drier conditions	Natural Environment	N3
BD13	Water quality and pollution risks	Natural Environment	N1

BD14	Ecosystems risks due to low flows and increased water demand	Natural Environment	N2, N3
BD15	Increased societal water demand	Buildings and Infrastructure Networks	B2
BD20	Major coastal flood/reconfiguration (includes coastal erosion)	Natural Environment	N1, N2
BD21	Agricultural intensification	Natural Environment	N1
BD23	Asynchrony between species breeding cycle and food supply	Not being addressed in this programme	
BD44	Saline intrusion	Not being addressed in this programme	
BD46	Loss of service through loss of keystone species	Natural Environment	N2, N3
BE4/FL15	Cultural heritage at flood/erosion risk	Buildings and Infrastructure Networks	B1, B2
BE5	Effectiveness of green space for cooling	Not being addressed in this programme	
BE9	Reduction in energy demand for heating	Buildings and Infrastructure Networks	B1, B2
BE10, BE11, BE12, BE15, BE18, FL6, FL24	Property at significant risk of flooding	Society Buildings and Infrastructure Networks	S1, S3 B2
BE13	Rainwater penetration	Buildings and Infrastructure Networks	B1, B3
BE31	Increase in damp, mould and insect pests in buildings	Society Buildings and Infrastructure Networks	S2 B1, B3
BE32	Waterlogging	Not being addressed in this programme	
BU1	Climate risks to investment funds	Not being addressed in this programme	
BU2	Monetary losses due to tourist assets at risk from flooding	Not being addressed in this programme	
BU3	Risk of restrictions in water abstraction for industry	Not being addressed in this programme	
BU4	Risks of business disruption due to flooding	Not being addressed in this programme	
BU5	Loss of productivity due to ICT disruption	Not being addressed in this programme	
BU6	Mortgage provision threatened due to increased flood risk	Buildings and Infrastructure Networks	B3
BU7	Insurance industry exposure to UK flood risk	Society	
BU8	An expansion of tourist destinations in Scotland	Not being addressed in this programme	
BU9	A decrease in output for businesses due to supply chain disruption	Not being addressed in this programme	
BU29	Loss of natural resource which attracts tourists leading to loss of revenue and requirements to shift assets	Not being addressed in this programme	
BUr1	Impacts on angling, gaming or course fishing	Not being addressed in this programme	
BUr2	Underestimation of decommissioning liabilities and end of life costs	Not being addressed in this programme	
EN1	Energy infrastructure at significant risk of flooding	Buildings and Infrastructure Networks	B2, B3
EN2	Energy demand for cooling	Not being addressed in this programme	
EN4	Risk of restrictions in water abstraction for energy generation	Not being addressed in this programme	
EN5	Demand by water suppliers	Not being addressed in this programme	
EN6	Electricity turbine efficiency	Not being addressed in this programme	
EN7	Gas pipe compressor rating	Not being addressed in this programme	

EN8	Power station cooling process	Not being addressed in this programme	
EN10	Energy transmission efficiency capacity losses due to heat - over ground	Not being addressed in this programme	
ENr1	Fuel poverty (people affected)	Society Buildings and Infrastructure Networks	S2 B3
FL1	Number of people at significant risk of flooding	Society	S2, S3
FL2	Vulnerable people at significant risk of flooding	Society	S2, S3
FL8a	Roads at significant risk of flooding	Buildings and Infrastructure Networks	B1, B2, B3
FL8b	Railways at significant risk of flooding	Buildings and Infrastructure Networks	B1, B2, B3
FL11a/ENr2	Power stations at significant risk of flooding	Buildings and Infrastructure Networks	B1, B2, B3
FL11b	Sub-stations at significant risk of flooding	Buildings and Infrastructure Networks	B1, B2, B3
FL13	Ability to obtain flood insurance for residential properties	Society Buildings and Infrastructure Networks	S2 B3
FL14a	Agricultural land lost due to coastal flooding	Not being addressed in this programme	
FL14b	Priority habitats lost due to coastal erosion	Not being addressed in this programme	
FL17	Impacts of geomorphological changes	Not being addressed in this programme	
FL7/FL24/FL27	Flooding of non-residential property	Buildings and Infrastructure Networks	B2,
FL41	Snowmelt flooding (reduced attenuation)	Not being addressed in this programme	
FO1a	Forest extent affected by red band needle blight	Natural Environment	N2
FO1b	Forest extent affected by green spruce aphid	Natural Environment	N2
FO2	Loss of forest productivity due to drought	Natural Environment	N3
FO3	Windthrow and storm damage	Natural Environment	N3
FO4b	Increase of potential yield of Sitka spruce in Scotland	Natural Environment	N3
FO5	Biodiversity loss (forestry)	Natural Environment	N1, N2
FO7/FO14	Snow and frost damage	Natural Environment	N1
FO20/FO26	Winter hardening	Not being addressed in this programme	
HE1	Summer mortality due to higher temperatures	Society	S1, S2
HE2	Summer morbidity due to higher temperatures	Society	S1, S2
HE3	Extreme weather event (flooding and storms) mortality	Society	S1,
HE5	Decline in winter mortality due to higher temperatures	Society	S1,
HE6	Decline in winter morbidity due to higher temperatures	Society	S1,
HE7	Extreme weather event (flooding and storms) injuries	Society	S1, S2, S3
HE10	Effects of floods/storms on mental health	Society	S2
HE11/HE17	Increase in prevalence of certain vector-borne diseases (ticks and lymes)	Not being addressed in this programme	
HE15	Food borne diseases	Not being addressed in this programme	
HE16/MA2b	Incidents of human illness due to hosts and pathogens	Society	S1, S2, S3

HE19	Increased algal or fungal/mould growth in buildings affecting respiratory conditions	Society Buildings and Infrastructure Networks	S2, S3 B3
MA1	Risk of harmful algal blooms due to changes in ocean stratification	Natural Environment	N2
MA2a	Decline in marine water quality due to sewer overflows	Not being addressed in this programme	
MA3	Increased ocean acidification	Natural Environment	N1
MA4a	Changes in fish catch latitude/centre of gravity (cod/haddock)	Natural Environment	N3
MA4b	Changes in fish catch latitude/centre of gravity (plaice/sole)	Natural Environment	N3
MA5b	Opening of Arctic shipping routes due to ice melt	Not being addressed in this programme	
MA6	Distribution of marine alien/invasive species	Natural Environment	N2
MA23	Plankton Blooms	Natural Environment	N2
MA30	Damage to cultured aquatic species	Natural Environment	N3
MA39	Physical effects of extreme events (flooding) on shallow marine habitats	Natural Environment	N1
MAR1	Species migration (marine)	Natural Environment	N2
TR1	Disruption to road traffic due to flooding	Buildings and Infrastructure Networks	B1, B2, B3
TR2	Landslide risks on the road network	Buildings and Infrastructure Networks	B1, B2, B3
TR6	Scouring of road and rail bridges	Buildings and Infrastructure Networks	B1, B2, B3
TRr1	Coastal erosion	Not being addressed in this programme	
WA1	Warmer and drier conditions	Natural Environment	N2
WA2	Lower summer river flows (Q95)	Natural Environment	N1, N2
WA4	Changes in household water demand	Not being addressed in this programme	
WA5	Public water supply-demand deficits	Natural Environment	N2
WA9	Raw water quality	Not being addressed in this programme	
WA10	Combined sewer overflow spill frequency	Buildings and Infrastructure Networks	B1, B3
WA13	Changed recharge and groundwater levels	Not being addressed in this programme	
GNr1	Emergency response to events (floods)	Society	S1, S3
GNr2	Emergency response to events (fires)	Natural Environment	N3
GNr3	Customer demands (opportunities)	Not being addressed in this programme	
GNr4	Changes in global trading patterns	Not being addressed in this programme	
GNr5	Impact of outdoor leisure, sport and tourism	Not being addressed in this programme	
GNr6	Key workers unable to get to work due to extreme events or infrastructure failure	Buildings and Infrastructure Networks	B2
GNr7	Immigration to EU countries (including UK) and northwards migration within EU space; UK citizens living abroad may return to the UK, leading to increased demand for water, food, energy, health services etc.	Not being addressed in this programme	
GNr8	Cost of international emergency aid	Not being addressed in this programme	

NATURAL ENVIRONMENT

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
N1 - Understand the effects resulting from climate change and their impacts on the natural environment	AG1b Changes in wheat and spring barley yield	N1-1 Raising awareness of implications of climate change for nature.	BD8 BD13 BD20
	AG1c Changes in potato yield	N1-11 Continue to fund the Strategic Research Portfolio in Rural and Environmental Science to improve the evidence base on the likely impacts of climate change on Scottish agriculture and ensure effective knowledge transfer of research outputs.	AG1b/AG1c/AG1d/AG1e AG3 AG4 AG10 AG17/AG59 AG19 AG21 AG25/AG51/AG52 AG44 BD6 BD8 BD21
	AG1d Changes in spring barley yield		
	AG1e Changes in winter barley yield		
	AG3 Risk of crop pests and diseases		
	AG4 Drier soils (due to warmer and drier summer conditions)	N1-12 Deliver the current programme of research work on the effects of climate change on Scottish food security as well as supporting the work of the UK Global Food Security Programme.	AG66
	AG10 Changes in grassland productivity	N1-14 Establishment of a co-ordinated Energy Sector Climate Change impacts research programme which would consider the impacts of changing energy generation on biodiversity and ecosystem services.	BD8 BD13
	AG17/AG59 Increase in greenhouse gas emissions	N1-9 Supporting citizen science and voluntary environmental monitoring.	N/A
AG19 Soil erosion and leaching AG21 Waterlogging effects (annual)	N1-2 Increase understanding of the implications of climate change for nature through data gathering, analysis and research.	BD8 BD13 BD20	

	AG25/AG51/AG52 Agricultural land classification and crop suitability	N1-3 Undertake spatial modelling, based around different scenarios, of potential risks to existing forests in order to evaluate the impacts that climate change could have on different forest types.	FO5
	AG44 Livestock pests and diseases	N1-4 Improve understanding on how we can develop more resilient forests, identify adaptation strategies for all types of woodlands, and demonstrate these in forest settings.	FO5 FO7
	AG66 Human food supply from domestic agriculture	N1-5 Enhance collaborative research into tree pests and diseases to develop understanding of the etiology, pathology, epidemiology and management of pests/diseases in a changing climate.	FO5 FO7
	BD6 Environmental effects of climate change mitigation measures	N1-10 Developing datasets to support flood risk, river and coastal management.	AG2/FL4 AG21 MA39
	BD8 Changes in soil organic carbon	N1-8 Understand the risks associated with coastal flooding through development and implementation of local flood risk plans.	AG2/FL4 AG21 MA39
	BD13 Water quality and pollution risks	N1-6 Marine Scotland will use marine research strategies and monitoring programmes to gather data on the impact climate change is having on the seas.	MA3
	BD20 Major coastal flood/reconfiguration (includes coastal erosion)	N1-7 Continue support for the Marine Climate Change Impacts Partnership (MCCIP).	MA3 MA39 WA2
	BD21 Agricultural intensification		

	<p>FO5 Biodiversity loss (forestry)</p> <p>FO7, FO14 Snow and frost damage</p> <p>MA3 Increased ocean acidification</p> <p>MA39 Physical effects of extreme events (flooding) on shallow marine habitats</p> <p>WA2 Lower summer river flows (Q95)</p>	<p>N1-13 Manage and monitor changes to Scotland's transport infrastructure environment to detect impacts and changes on biodiversity and vegetation growing cycles.</p>	<p>N/A - risks directly related to changing weather patterns i.e. warmer/drier summers; warmer wetter winters creating longer growing seasons.</p>
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OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
N2 - Support a healthy and diverse natural environment with the capacity to adapt	AG2/FL4 Flood risk to high quality agricultural land	N2-2 The Scottish Planning Policy includes green networks, green space, street trees and other vegetation, green roofs, wetlands and other water features, and coastal habitats in helping Scotland to mitigate and adapt to climate change.	BD1 BD3 BD4 BD5
	AG3 Risk of crop pests and diseases	N2-3 Demonstrate adaptive management in National Nature Reserves to help explain the implications of climate change for nature and demonstrate management that takes account of these implications.	BD1 BD2 BD3 BD4 BD5 BD9 BD11 BD14 BD46
	AG4 Drier soils		
	AG10 Changes in grassland productivity	N2-5 Pilot the use of the Scottish Natural Heritage Wildlife Management Framework to integrate climate change risks into wildlife management decisions (including deer).	BD1 BD3 BD4 BD5 BD46
	AG19 Soil erosion and leaching		
	AG21 Waterlogging effects (annual)	N2-4 Manage designated sites for land based biodiversity.	BD1 BD2 BD3 BD4 BD5 BD9 BD11 BD14 BD46
	AG26/AG27 Biodiversity/wildlife changes		
AG44 Livestock pests and diseases			
BD1 Risk to species and habitats due to drier soils	N2-6 Develop the ecosystem approach into a usable set of tools for use by decision makers.	BD1 BD2 BD3 BD4 BD5 BD9 BD11	
BD2 Risks to species and habitats due to coastal evolution			

	BD3 Risk of pests to biodiversity		BD14 BD46
	BD4 Risks of diseases to biodiversity	N2-7 Reduce the pressure on ecosystems from invasive non-native species (INNS).	BD3 BD4 BD9
	BD5 Species unable to track changing climate space	N2-8 Implement the Land Use Strategy (LUS) and associated action plan.	BD1 BD2 BD3 BD4 BD5 BD9 BD11 BD14 BD46
	BD9 Changes in species migration patterns		
	BD11 Generalists species more able to adapt than specialists	N2-9 Implement the Scottish Biodiversity Strategy.	BD1 BD2 BD3 BD4 BD5 BD9 BD11 BD14 BD46
	BD14 Ecosystems risks due to low flows and increased water demand		
	BD20 Major coastal flood/reconfiguration (includes coastal erosion)		
	BD46 Loss of service through loss of keystone species	N2-1 Review objectives and priorities for action in Scotland's Wild Deer: a National Approach (WDNA).	BD1 BD3 BD4 BD5
	FO1a Forest extent affected by red band needle blight	N2-10 Promote the UK Forestry Standard and Climate Change guidelines.	FO1a FO1b FO5
	FO1b Forest extent affected by green spruce		
		N2-11 Embed climate change adaptation considerations, and potential responses such as habitat networks and green networks, into wider land use planning decisions through the use of Forestry and Woodland Strategies, regional land use strategies, and Strategic and Local Development Plans and development master-plans.	FO1a FO1b FO5

<p>aphid</p> <p>FO5 Biodiversity loss (forestry)</p> <p>MA1 Risk of harmful algal blooms due to changes in ocean stratification</p> <p>MA6 Distribution of marine alien/invasive species</p> <p>MA23 Plankton Blooms</p> <p>MAr1 Species migration (marine)</p> <p>WA1 Warmer and drier conditions</p> <p>WA2 Lower summer river flows (Q95)</p> <p>WA5 Public water supply-demand deficits</p>	<p>N2-12 Improve the condition and connectivity of native woodlands, promote natural regeneration as a means of increasing resilience to change, and take other steps to increase adaptive capacity in woodlands.</p>	<p>FO1a FO1b FO5</p>
	<p>N2-23 Encourage the consideration of climate change impacts (and how they will be addressed) in Forest Plans, and support this with grants and regulations so as to ensure that forest plans support ecosystems and habitat resilience and allow resilience-building measures to be trialled by forest managers.</p>	<p>FO1a FO1b FO5</p>
	<p>N2-13 The National Marine Plan (NMP) will set out objectives and policies for sustainable development of Scotland's seas; promoting economic growth while ensuring growth occurs in balance with the protection of natural and historic heritage.</p>	<p>MA1 MA6 MA23 MAr1</p>
	<p>N2-14 Regional Marine Plans will be developed from 2014 and will shape regional/local objectives and policies for coastal and marine management and include policies relating to climate change adaptation (and mitigation).</p>	<p>MA1 MA6 MA23 MAr1</p>
	<p>N2-15 Manage designated sites for the marine environment.</p>	<p>MA1 MA6 MA23 MAr1</p>
	<p>N2-16 Develop mechanisms to minimise the introduction and establishment of invasive non-native species into Scottish waters.</p>	<p>MA6 MAr1</p>
	<p>N2-17 Implement River Basin Management Plans (RBMP).</p>	<p>WA1 WA2 WA5</p>
	<p>N2-18 Support the development of Local Flood Risk Management Plans.</p>	<p>WA1 WA2 WA5</p>
	<p>N2-19 Improve the condition of river Special Areas of Conservation as part of River Basin Management Plans.</p>	<p>WA1 WA2 WA5</p>
	<p>N2-20 Assess and manage coasts, promoting adaptive coastal management that works with natural processes.</p>	<p>BD2 BD20</p>

		<p>N2-21 Promote the Farming For A Better Climate Programme. .</p>	<p>AG2/FL4 AG3 AG4 AG10 AG19 AG21 AG26/AG27 AG44</p>
		<p>N2-22 Support the project "Future Proofing Scotland's Farming". Scotland's Farming Innovation Network and Planning for Profit.</p>	<p>AG2/FL4 AG3 AG4 AG10 AG19 AG21 AG26/AG27 AG44</p>

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
N3 - Sustain and enhance the benefits, goods and services that the natural environment provides	AG3 Risk of crop pests and diseases AG4 Drier soils AG19 Soil erosion and leaching	N3-1 Implement the EU reform of the Common Agricultural Policy.	AG4 AG19 AG21 AG26/AG27 AG65
	AG21 Waterlogging effects (annual) AG26/AG27 Biodiversity/wildlife changes AG44 Livestock pests and diseases AG65 Loss of particular landscapes and associated rural communities, previously managed by livestock keepers	N3-2 Support Scotland's Animal Health Regime to help prevent the introduction and spread of harmful organisms.	AG44 AG66
	AG66 Human food supply from domestic agriculture BD1 Risk to species and habitats due to drier soils BD2 Risks to species and habitats due to coastal evolution	N3-3 Support Scotland's Plant Health Service to help prevent the introduction and spread of harmful organisms.	AG3 AG66
	BD3 Risk of pests to biodiversity	N3-16 Sourcing For Growth Initiative. A knowledge hub to match food manufacturing companies with producers of quality Scottish produce has been set up to build on the nation's growing gourmet reputation.	AG66

<p>BD4 Risks of diseases to biodiversity</p> <p>BD5 Species unable to track changing climate space</p> <p>BD9 Changes in species migration patterns</p> <p>BD11 Generalists species more able to adapt than specialists</p> <p>BD12 Wildfires due to warmer and drier conditions</p> <p>BD14 Ecosystems risks due to low flows and increased water demand</p> <p>BD46 Loss of service through loss of keystone species</p> <p>FO2 Loss of forest productivity due to drought</p> <p>FO3 Windthrow and storm damage</p> <p>FO4b Increase of potential yield of Sitka spruce in Scotland</p> <p>Gnr2 Emergency response to events (fires)</p>	<p>N3-17 Greater recognition of the role of integrated land management in tackling climate change.</p>	<p>BD1</p> <p>BD2</p> <p>BD3</p> <p>BD4</p> <p>BD5</p> <p>BD9</p> <p>BD11</p> <p>BD14</p> <p>BD46</p>
	<p>N3-4 Promote the use of Ecological Site Classification, Forest GALES.</p>	<p>FO2</p> <p>FO4b</p>
	<p>N3-7 Publish resources for managers of productive forests to help them develop more resilient forests in a changing climate and in the face of tree health threats.</p>	<p>FO2</p> <p>FO4b</p>
	<p>N3-7 Promote tree health response contingency planning to enable rapid on-the-ground action to deal with new tree health threats and to enable targeted deployment of emergency measures.</p>	<p>FO2</p> <p>FO4b</p>

<p>MA4a Changes in fish catch latitude/centre of gravity (cod/haddock)</p> <p>MA4b Changes in fish catch latitude/centre of gravity (plaice/sole)</p> <p>MA30 Damage to cultured aquatic species</p>	<p>N3-10 Enhance operational capacity to enable earlier detection and subsequent management of tree pests and diseases.</p>	<p>FO2 FO4b</p>
	<p>N3-5 Implement the Scottish Windthrow Contingency Plan to help minimise the financial impact of wind damage to commercial forests.</p>	<p>FO3</p>
	<p>N3-6 Support the Scottish Wildfire Forum to help ensure that land managers and the emergency services work together to prevent and manage wildfires.</p>	<p>BD12</p>
	<p>N3-9 Develop Operational Guidance for managing incidents of wildfire for fire and rescue service managers and personnel.</p>	<p>BD12 GNr2</p>
	<p>N3-11 Common Fisheries Policy (CFP). Influence the EU reform of the CFP to ensure that it recognises the impacts of climate change and is flexible to environmental change.</p>	<p>MA4a MA4b</p>
	<p>N3-12 Improve targeting of species by using selective fishing gear and reducing discards through conservation credits and TR2 schemes.</p>	<p>MA4a MA4b</p>
	<p>N3-13 Manage the impacts of climate change to help fishing and aquaculture industries achieve Maximum Sustainable Yield (MSY) by 2015, where possible, and by 2020 for all stocks at the latest.</p>	<p>MA4a MA4b MA30</p>
	<p>N3-14 Introduce new Technical Standards for containment by Scottish fish farms.</p>	<p>MA30</p>
	<p>N3-15 Fishing and aquaculture industries to develop and introduce new technologies for environmentally sustainable commercial fishing and aquaculture.</p>	<p>MA4a MA4b MA30</p>

BUILDINGS AND INFRASTRUCTURE NETWORKS

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
B1 – Understand the effects of climate change and their impacts on buildings and infrastructure networks	BE4/FL15 Cultural heritage at flood/erosion risk	B1-1 Research to identify necessary resilience measures for new buildings.	BE31 BE13 BE9
	BE9 Reduction in energy demand for heating	B1-2 Research to identify necessary resilience measures for existing buildings/heritage assets	BE31 BE13 BE9 BE4/FL15
	BE13 Rainwater penetration		
	BE31 Increase in damp, mould and insect pests in buildings	B1-4 Implement Secure and Resilient - A CNI Strategy for Scotland.	ENr2/FL11a FL11b
	FL11a/ENr2 Power Stations at significant risk of flooding		
	FL8a Roads at significant risk of flooding		
FL8b Railways at significant risk of flooding	B1-16 Develop an Energy Sector Climate Change impacts research programme.	ENr2/FL11a FL11b	
FL11b Sub-station at significant risk of flooding			
TR1 Disruption to road	B1-5 Trunk Road Customer Care Survey, Passenger focus survey and National Household Survey.	N/A	

	traffic due to flooding	B1-6 National Transport Strategy (2006)	TR1 TR2 TR6 FL8a FL8b
	TR2 Landslide risks on the road network	B1-11 Scottish Road Network Climate Change Study (2005).	TR1 TR6 FL8a
	TR6 Scouring of road and rail bridges	B1-8 Research under the Landslide Implementation Plan (2008).	TR2
	WA10 Combined sewer overflow spill frequency	B1-9 Support the report on "Wetter weather, public transport and traffic/congestion patterns in urban areas".	TR1 FL8a FL8b
		B1-10 Establish a central coordinating point for information and data collection relating to climate effects on the transport network and for developing knowledge sharing activities for this sector.	TR1 TR2 TR6 FL8a FL8b
		B1-7 A report on risks from fog projections.	N/A
		B1-12 Engagement with World Road Association and UK and European Road/Transport Authorities.	TR1 TR2 TR6 FL8a
		B1-17 Assessment of potential sea level rise risk at specific Scottish ports.	N/A

		B1-18 Tomorrow Railways and Climate Change Adaptation (TRACCA).	TR6 FL8b
		B1-19 To consider a long-term approach to the management of surface water to ensure that sewer systems are resilient to climate change.	WA10
		B1-13 Flood Risk Management Plans.	WA10
		B1-14 River Basin Management Plans (RBMP)	WA10
		B1-15 Study of impact of flows on sewerage network.	WA10
		B1-3 Research to assess the benefits or property level flood protection products.	BE4/FL15

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
B2 – Provide the knowledge, skills and tools to manage climate change impacts on buildings and infrastructure	BD15 Increased societal water demand	B2-1 Policy to introduce under the building regulations a new requirement to extend non-domestic sustainability labelling to school buildings.	BE9 BE10, BE11, BE12, BE15, BE18, FL6, FL24 FL7/24/27
	BE4/FL15 Cultural heritage at flood/erosion risk	B2-4 Implement Historic Scotland’s Climate Change Action Plan (2012-2017).	BE4/FL15
	BE9 Reduction in energy demand for heating	B2-3 Water Use Efficiency.	BE9
	BE10, BE11, BE12, BE15, BE18, FL6, FL24 Property at significant risk of flooding	B2-2 Sustainable Urban Drainage Systems (SUDS) Working Party.	BE10, BE11, BE12, BE15, BE18, FL6, FL24
	EN1 Energy infrastructure at significant risk of flooding	B2-5 Joint agency climate action programme.	BE4/FL15 BE10, BE11, BE12, BE15, BE18, FL6, FL24
	FL11a /ENr2 Power stations at significant risk of flooding	B2-19 The drafting of regulations to implement Section 63 of the Climate Change (Scotland) Act 2009.	BE9
	FL8a Roads at significant risk of flooding	B2-20 To extend the requirement for sustainability labelling beyond schools to other non-domestic buildings.	BE9 BE10, BE11, BE12, BE15, BE18, FL6, FL24, FL7/24/27
	EN1 Energy infrastructure at significant risk of flooding	FL11b Sub-stations at significant risk of flooding	
FL8b Railways at significant risk of flooding	GNr6 Key workers unable to get to work due to extreme events of infrastructure failure		

	TR1 Disruption to road traffic due to flooding	B2-6 Liaise with industry on thermal generation (generation of electricity from sources that create heat, such as coal, gas and nuclear).	EN1
	TR2 Landslide risks on the road network		
	TR6 Scouring of road and rail bridges	B2-21 Establish a Scottish Government Energy Sector Flood Risk work stream.	EN1 ENr2/FL11a FL11b
		B2-8 Transport Scotland Asset Management Strategy.	GNr6 TR1 TR2 TR6 FL8a FL8b
		B2-9 High Winds Strategy (2009).Strategy for managing the impacts of high winds on the trunk road network.	GNr6
		B2-10 Third and Fourth Generation road maintenance contracts.	GNr6 TR1 TR2 TR6 FL8a
		B2-11 Implement the Scottish Integrated Maritime Transport Strategy.	FL8a FL8b GNr6 TR1
		B2-12 Road Scotland Act (1984): Asset Management Plans and Network Rail Asset Management Policy.	TR6
	B2-13 Road Scotland Act (1984): Implement Resilience Plans.	GNr6 TR1 TR2 TR6 FL8a	

		B2-14 Local Forest Management Strategies to Tackle Slope Instability.	TR2
		B2-15 High level output specification for railways; related to the public performance measures to consider “severe disruption”.	TR6 FL8b
		B2-22 Network Rail Strategic Business Plan.	TR6 FL8b
		B2-16 Gather data to inform Scottish Water’s investment programme from 2015 onwards which will address adaptation needs of water infrastructure.	BD15
		B2-17 Integrated approach to catchment modelling.	BD15
		B2-18 Manage leakage to water distribution network.	BD15

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
B3 – Increase the resilience of buildings and infrastructure networks to sustain and enhance the benefits and services provided	AG66 Human food supply from domestic agriculture	B3-1 Building Regulations Guidance.	BE13 BE31
	BE13 Rainwater penetration	B3-2 Planning Advice Notes (PAN).	BE13 BE31
	BE31 Increase in damp, mould and insect pests in buildings	B3-3 Scottish Planning Policy (SPP) (Climate Change).	BE13 BE31
	BU6 Mortgage provision threatened due to increased flood risk	B3-4 Raise awareness and provide access to knowledge via Sust: Sustainability in Architecture programme.	BE13 BE31
	EN1 Energy infrastructure at significant risk of flooding	B3-5 Commission and promote demonstration projects in association with funders/developers about the benefits of incorporating sustainable design in their projects.	BE13 BE31
	ENr1 Fuel poverty (people affected)	B3-6 Home Energy Efficiency Programme for Scotland.	ENr1
	FL11a /ENr2 Power stations at significant risk of flooding	B3-7 The Energy Efficiency Standard for Social Housing.	ENr1
	FL8a Roads at significant risk of flooding	B3-8 Improve Housing Quality by ensuring all houses meet the tolerable standard, and that all social housing meets the Scottish Housing Quality Standard (SHQS) by 2015.	ENr1 BE31 HE19
	FL8b Railways at significant risk of flooding FL11b Sub-stations at significant risk of flooding	B3-9 Develop draft regulations for consultation by 2015 which would set minimum standards for energy efficiency in private sector housing, likely to be under section 64 of the Climate Change (Scotland) Act 2009.	ENr1

	FL13 Ability to obtain flood insurance for residential properties	B3-10 Promote Keeping Scotland Running - A Guide to Critical Infrastructure Resilience.	EN1 ENr2/FL11a FL11b
	HE19 Increased algal or fungal/mould growth in buildings affecting respiratory conditions		
	TR1 Disruption to road traffic due to flooding	B3-11 Civil Contingencies Act (2004): Transport resilience community engagement.	TR1 TR2 TR6 FL8a FL8b
	TR2 Landslide risks on the road network	B3-15 High Level Output Specification and Scottish Ministers' Guidance to the Office of Rail Regulation.	TR6, FL8b
	TR6 Scouring of road and rail bridges	B3-13 Improving driver skills in extreme weather (road and rail).	FL8a FL8b
	WA10 Combined sewer overflow spill frequency	B3-16 Introduce new guidance on good public transport interchange design to cope with more extreme weather.	N/A
		B3-14 Market Driven Supply Chain.	AG66
		B3-13 River Basin Management Plans (RBMP).	WA10

SOCIETY

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
S1 - Understand the effects of climate change and their impacts on people, homes and communities	BE10, BE11, BE12, BE15, BE18, FL6, FL24 Property at risk of flooding	S1-2 Research to identify and develop an understanding of communities, in particular, vulnerable groups to the flood risk impacts brought by climate change.	HE7 BE10, BE11, BE12, BE15, BE18, FL6, FL24
	GNr1 Emergency response to events (floods)	S1-3 Build on the Health Protection Scotland Scoping Report on the effect of extreme weather events on public health to identify priority areas for action.	HE7
	HE1 Summer mortality due to higher temperatures	S1-4 Assessment of new, emerging or re-emerging disease epidemiology and research.	HE16/MA2b
	HE2 Summer morbidity due to higher temperatures	S1-1 The Food Standards Agency (FSA) to continue to develop a greater understanding of the main food borne disease related pathogens.	HE16/MA2b
	HE3 Extreme weather event (flooding and storms) mortality	S1-7 Extreme Weather Event (EWE) All Hazard Health Protection Plan.	GNr1 HE1 HE2 HE3 HE5 HE6 HE7
	HE5 Decline in winter mortality due to higher temperatures	S1-5 Undertake research to strengthen the resilience evidence base for risk assessment and planning purposes as well as partner and stakeholder engagement.	GNr1
	HE6 Decline in winter morbidity due to higher temperatures		
	HE7 Extreme weather events (flooding and storms) injuries HE16/MA2b Incidents of human illness due to hosts and pathogens	S1-6 Research to inform decision making about future resource allocation and 'spend to save' options – research should assess possible future economic impact on the Emergency and Rescue Services of climate change adaptation against current expenditure patterns.	GNr1

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
S2 – Increase the awareness of the impacts of climate change to enable people to adapt to future extreme weather events	BE10, BE11, BE12, BE15, BE18, FL6, FL24 Property at significant risk of flooding	B3-1 Building Regulations Guidance.	ENr1 BE31 HE19
	BE31 Increase in damp, mould and insect pests in buildings	S2-1 Eradicate fuel poverty by 2016 as far as practicable.	ENr1
	ENr1 Fuel poverty (people affected)	S2-2 Scottish Government to continue to raise awareness and provide information to society on how best to adapt to a changing climate.	BE10, BE11, BE12, BE15, BE18, FL6, FL24 HE7 FL1 FL2
	FL1 Number of people at significant risk of flooding	S2-3 The Food Standards Agency (FSA) to improve the understanding of food safety related behaviour by consumers and targeted education to assist in greater consumer knowledge and understanding of risks in the domestic sector.	HE16/MA2b
	FL2 Vulnerable people at significant risk of flooding	S2-14 Improve public information and access to guidance on heat waves.	HE1 HE2
	FL13 Ability to obtain flood insurance for residential properties	S2-5 Develop and promote resources which support capacity building in communities, to help build resilience to emergencies, including responding to severe weather events.	FL1 FL2 BE10, BE11, BE12, BE15, BE18, FL6, FL24 HE7
	HE1 Summer mortality due to higher temperatures	S2-4 Develop psychosocial disaster recovery guidance to support a better response to people who have experienced trauma.	HE10
	HE2 Summer morbidity due to higher temperatures HE7 Extreme weather events (flooding & storms) injuries		

	HE10 Effects of flood/storms on mental health	S2-7 Undertake all risk resilience assessments across each of the National Infrastructure (NI) sectors, including the impacts of climate change.	BE10, BE11, BE12, BE15, BE18, FL6, FL24 HE7
	HE19 Increased algal or fungal/mould growth in buildings affecting respiratory conditions	S2-6 Continue to develop the Ready Scotland website as a source of advice and information for the public about preparing for and managing the potential consequences of emergencies, including severe weather events.	FL1 FL2 BE10, BE11, BE12, BE15, BE18, FL6, FL24 HE7
	HE16/MA2b Incidents of human illness due to hosts and pathogens	S2-15 Emergency and Rescue Services to consider opportunities for raising public awareness around flooding risks and protective activity.	FL1 FL2 BE10, BE11, BE12, BE15, BE18, FL6, FL24 HE7
		S2-8 Promote and support SEPA flood risk awareness raising activities.	FL1 FL2 BE10, BE11, BE12, BE15, BE18, FL6, FL24 FL13
		S2-9 Deliver Flood Warning Dissemination Programme to enable Floodline messages to be delivered direct to all registered users.	FL1 FL2 BE10, BE11, BE12, BE15, BE18, FL6, FL24
		S2-10 Increase awareness of flood risk and flood resilience in schools by working through the Curriculum for Excellence.	FL1 FL2

		S2-11 Ready For Emergencies resilience resource for schools.	FL1 FL2
		S2-12 Improve education on flood risk management to increase awareness and understanding of the importance of community resilience.	FL1 FL2
		S2-13 Support the Scottish Flood Forum.	BE10, BE11, BE12, BE15, BE18, FL6, FL24 FL1 FL2

OBJECTIVE	CCRA RISKS ADDRESSED BY OBJECTIVE	SUMMARY OF POLICIES AND PROPOSALS	CCRA RISKS TACKLED BY ACTION
S3 – Support our health service and emergency responders to enable them to respond effectively to the increased pressures associated with a changing climate	BE10, BE11, BE12, BE15, BE18, FL6, FL24 Property at significant risk of flooding	S3-2 Scotland Property and Asset Management Plans.	BE10, BE11, BE12, BE15, BE18, FL6, FL24
	FL1 Number of people at significant risk of flooding	S3-4 NHS Procurement and Estates to consider accommodation design for housing IT equipment.	BE10, BE11, BE12, BE15, BE18, FL6, FL24
	FL2 Vulnerable people at significant risk of flooding	S3-1 NHS Scotland Boards to develop individual Climate Change Adaptation Plans in accordance with the NHS Scotland Sustainable Development Strategy.	BE10, BE11, BE12, BE15, BE18, FL6, FL24 GNr1
	GNr1 Emergency response to events (floods)	S3-5 Revise Scottish Capital Investment Manual to take account of changes in sustainable development policy and strategy.	BE10, BE11, BE12, BE15, BE18, FL6, FL24 GNr1
	HE7 Extreme weather events (flooding and storms) injuries	S3-15 Need to consider chronic diseases where a changing climate could add extra stresses e.g. warmer weather could worsen air quality (exacerbates effects of air pollution) and increased problems for asthma sufferers.	HE16/MA2b
	HE16/MA2b Incidents of human illness due to hosts and pathogens	S3-3 VTEC/E.Coli 0157 Action Plan.	HE16/MA2b
	HE19 Increased algal or fungal/mould growth in buildings affecting respiratory conditions	S3-14 Take forward appropriate ‘Good Places Better Health for Scotland’s Children’ recommendations.	HE19
		S3-13 Support a Scottish flood forecasting service.	HE7 BE10, BE11, BE12, BE15, BE18, FL6, FL24 FL1 FL2

		S3-11 Promote and support the production of 'Lessons Learned' from agency debriefs on weather related events and action the lessons through changes to policy, processes and training.	GNr1
		S3-6 Improve Strategic Coordinating Groups (SCGs) risk and impacts assessment guidance.	GNr1
		S3-9 Preparing Scotland suite of guidance.	GNr1
		S3-7 To enhance the capability of Scotland's Fire and Rescue services.	GNr1
		S3-10 Develop and extend training of accredited 'incident commanders'.	GNr1
		S3-12 Delivery of a wide programme of specialist and technical training.	GNr1
		S3-8 Continue to assess the potential impacts of environment factors on the delivery of police services through the Scottish Police Service Strategic Assessment.	GNr1

IMPACTS NOT BEING ADDRESSED IN THIS PROGRAMME

RISK	REASON FOR EXCLUSION
AG7a Reduction in milk production due to heat stress	Low risk for Scotland – defer to future Programmes.
AG8a/b/AG15 Livestock heat stress factors	Low risk for Scotland – defer to future Programmes.
AG30/AG57/AG58 Breeding habits/reproductive nature of species	Low risk for Scotland – defer to future Programmes.
BD10 Biodiversity risks due to warmer rivers and lakes	This is a prediction rather than a risk.
BD23 Asynchrony between species breeding cycle and food supply	Too uncertain - await second UKCCRA to establish if evidence base has improved.
BD44 Saline Intrusion	Too uncertain - await second UKCCRA to establish if evidence base has improved.
BE5 Effectiveness of green space for cooling	Low risk (2050s), low confidence - too uncertain - await second UKCCRA to establish if evidence base has improved.
BE32 Waterlogging	Too uncertain - await second UKCCRA to establish if evidence base has improved.
BU1 Climate risks to investment funds	Too uncertain - await second UKCCRA to establish if evidence base has improved.
BU2 Monetary losses due to tourist assets at risk from flooding	Too uncertain - await second UKCCRA to establish if evidence base has improved.
BU3 Risk of restrictions in water abstraction for industry	Low risk (2020s), low confidence - too uncertain - await second UKCCRA to establish if evidence base has improved.
BU4 Risk of business disruption due to flooding	Low risk (2020s), - await second UKCCRA to establish if evidence base has improved.
BU5 Loss of productivity due to ICT disruption	Too uncertain - await second UKCCRA to establish if evidence base has improved.
BU8 An expansion of tourist destinations in Scotland	This is a prediction rather than a risk.
BU9 A decrease in output for businesses due to supply chain disruption	Too uncertain - await second UKCCRA to establish if evidence base has improved.
BU29 Loss of natural resource which attracts tourists leading to loss of revenue and requirements to shift assets	Low risk (2020s), low confidence - too uncertain - await second UKCCRA to establish if evidence base has improved.
BUr1 Impacts on angling, gaming or course fishing	Low risk until 2080s – defer to future Programmes.
BUr2 Underestimation of decommissioning liabilities and end of life costs	Too uncertain - await second UKCCRA to establish if evidence base has improved.
EN2 Energy demand for cooling	Low risk until 2050s– defer to future Programmes.
EN4 Risk of restrictions in water abstraction for energy generation	Low risk until 2080s.

EN5 Demand by water suppliers	Low risk for Scotland – defer to future Programmes.
EN6 Electricity turbine efficiency	Too uncertain - await second UKCCRA to establish if evidence base has improved.
EN7 Gas pipe compressor rating	Too uncertain - await second UKCCRA to establish if evidence base has improved.
EN8 Power station cooling process	Too uncertain - await second UKCCRA to establish if evidence base has improved.
EN10 Energy transmission efficiency capacity losses due to heat - over ground	Low risk until 2080s – defer to future Programmes.
FL14a Agricultural land lost due to coastal flooding	Low risk – although may present local issues.
FL14b Priority habitats lost due to coastal erosion	Low risk - approximately 70% of Scotland's coastline is classified as hard.
FL17 Impacts of geomorphological changes	Too uncertain - await second UKCCRA to establish if evidence base has improved.
FL41 Snowmelt flooding	No permanent snow caps in Scotland therefore no impact on water levels.
FO20/FO26 Winter hardening	Low risk, low confidence - await second UKCCRA to establish if evidence base has improved.
HE11/HE17 Increase in prevalence of certain vector-borne diseases (ticks and lymes)	Overall low risk, may present local issues due to changes in ecosystems.
HE15 Food borne diseases	Too uncertain - await second UKCCRA to establish if evidence base has improved.
MA2a Decline in marine water quality due to sewer overflows	This is a prediction rather than a risk.
MA5b Opening of the arctic shipping routes due to ice melt	To be considered for future Programmes.
TRr1 Coastal erosion	Low risk for Scotland, although may present local issues.
WA4 Changes in household water demand	Not expected to be a major risk to Scotland – defer to future Programmes.
WA9 Raw water quality	Science base limited, await second UKCCRA to establish if evidence base has improved.
WA13 Changed recharge and groundwater levels	Not a current risk for Scotland – defer to future Programmes.
GNr3 Customer demands (opportunities)	Too uncertain - await second UKCCRA to establish if evidence base has improved.
GNr4 Changes in global trading patterns	Too uncertain - await second UKCCRA to establish if evidence base has improved.
GNr5 Impact of outdoor leisure, sport and tourism	Not a current risk for Scotland – defer to future Programmes.
GNr7 Immigration to EU countries (including UK) and northwards migration within EU space: UK citizens living abroad may return to the UK, leading to increased demand for water, food, energy, health services etc.	Too uncertain - await second UKCCRA to establish if evidence base has improved.
GNr8 Cost of international emergency aid	Too uncertain - await second UKCCRA to establish if evidence base has improved.



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