



# **Final assessment: The first Scottish Climate Change Adaptation Programme**

Committee on Climate Change  
March 2019







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# Acknowledgements

The Committee would like to thank:

**The team that prepared this report:** This was led by Cara Labuschagne and included Kathryn Brown, Jo Barrett, David Style, Andrew Russell, Brendan Freeman, Gemma Holmes and Chris Stark.

**Other members of the Secretariat who contributed to this report:** Yogini Patel, Alexandra Scudo, Steven Harry, Peter Budden, Thomas Andrew and Indra Thillainathan.

**ClimateXChange for its indicators work:**

Ruth Monfries (Royal Botanic Garden Edinburgh), Anna Moss (University of Dundee), Anne Marte Bergseng (ClimateXChange).

**Individuals who provided advice on the content and analysis in the report:**

Jim Densham, Professor Rohinton Emmanuel, Katharine Knox, Dr Colin Ramsay, Alistair McVittie, Professor Chris Spray, Philip Wright, members of the Institution of Civil Engineers Scotland (Sara Thiam, Graham Edmond, Adrian Johnson, Walter Scott, Dr Kenny MacDougall, Anusha Shah, Peter Robinson, Professor Gordon Masterton, Jamie Christie).

**Organisations that have contributed to our research and analysis:**

Adaptation Scotland (Sniffer), Forestry Commission Scotland, Forest Enterprise Scotland, Health Protection Scotland, Historic Environment Scotland, Network Rail, NHS Scotland, Scottish Government, Scottish Natural Heritage, Scottish Water, SEPA, Sustainable Scotland Network, Transport Scotland.

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Document laying number: SG/2019/16

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# The Adaptation Committee



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Baroness Brown of Cambridge DBE FREng FRS (Julia King) is an engineer, with a career spanning senior engineering and leadership roles in industry and academia. She currently serves as Chair of the CCC's Adaptation Committee; non-executive director of the Offshore Renewable Energy Catapult; and Chair of the Carbon Trust. She was non-executive director of the Green Investment Bank, she led the King Review on decarbonising transport (2008). She is currently supporting the UK offshore wind sector as Sector Champion for the development of the Sector Deal as part of the Government's Industrial Strategy. She is a Fellow of the Royal Academy of Engineering and of the Royal Society, and was awarded DBE for services to higher education and technology. She is a crossbench Peer and a member of the House of Lords European Union Select Committee.



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Michael Davies is Professor of Building Physics and Environment at the UCL Institute for Environmental Design and Engineering (IEDE). His research interests at UCL relate to the complex relationship between the built environment and human well-being. He is also the Director of the Complex Built Environment Systems Group at UCL, and a member of the Scientific Advisory Committee of 'Healthy Polis', which is the International Consortium for Urban Environmental Health and Sustainability.



## **Professor Jim Hall**

Jim Hall FREng is Professor of Climate and Environmental Risks at the University of Oxford. He is also the Editor of the journal, *Water Resources Research*, an advisor to the World Bank on water security, a member of the Public Voice Committee of the Institution of Civil Engineers, and a member of the National Infrastructure Commission's Expert Advisory Group. Professor Hall was previously co-chair of the OECD/Global Water Partnership Task Force on Water Security and Sustainable Economic Growth, and a member of the Engineering Policy Committee of the Royal Academy of Engineering.



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Georgina Mace is Professor of Biodiversity and Ecosystems in the UCL Centre for Biodiversity and Environment Research (CBER). Her research interests at UCL are in measuring the trends and consequences of biodiversity loss and ecosystem change. She was previously a member of the UK Government's Natural Capital Committee, and a member of the Natural Environment Research Council. Professor Mace is the winner of the 2007 International Cosmos Prize, and the 2016 Heineken Prize for Environmental Science.



### **Ece Ozdemiroglu**

Ece Ozdemiroglu is an environmental economist and the founding director of etec (Economics For the Environment Consultancy). She specialises in interpreting economic value evidence for decision-making. Her other roles include: Economics Lead of the Valuing Nature Programme, the Convener of the British Standards Institute's Committee on Assessing and Valuing Natural Capital, a Member of the Natural Capital Initiative steering group, and the Associate Editor of the Journal for Environmental Economics and Policy.



### **Rosalyn Schofield**

Rosalyn Schofield LLB is a solicitor and a Director of Company Secretariat at Associated British Foods plc, where she has global responsibility for the environmental sustainability and impact of the business. Rosalyn is the Chair of the CCC's Audit Committee, and a Trustee of Regent's University London where she chairs the Audit and Risk Committee. She has previously worked as a Legal Director at JD Wetherspoon plc, and as a commercial property lawyer in private practice.



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# Executive Summary



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**The climate in Scotland is changing, and the latest UK climate projections indicate further changes this century. Increases in seasonal temperatures, sea level and annual rainfall are all being observed in Scotland. Recent extreme weather events, such as storm Ali in September 2018, are expected to become more frequent under a changing climate.**

This is the second independent assessment of progress of the Scottish Climate Change Adaptation Programme (SCCAP) by the Adaptation Committee of the Committee on Climate Change (CCC). This assessment focuses on what has changed since the Committee's first assessment in 2016, in implementing policies and actions in the SCCAP and managing Scotland's vulnerability to climate risks.

**The most notable progress in managing current and future climate risk since the first assessment relates to peatland restoration, actions to increase marine resilience and an improved understanding of the number of people in Scotland living in areas at flood risk.** Many SCCAP policies and actions have progressed since the Adaptation Committee's first assessment. There are monitoring frameworks in place covering a number of adaptation priorities, including the National Performance Framework, Scotland's Biodiversity Strategy, the National Marine Plan and the National Planning Framework.

**The areas of greatest continued concern include increases in pests and diseases in Scottish forests, declines in seabird populations and soil health.** A number of key targets and actions for soil conservation and sustainable land management are not on track and there are insufficient data to assess the vulnerability of soils to climate change. There is a lack of understanding, combined with a significant lack of reporting and data on the resilience of digital infrastructure and infrastructure interdependencies. There are fewer national targets and a lack of monitoring for the 'Society'-related actions in the SCCAP compared to the other themes and a lack of activities related to business impacts and opportunities from climate change.

**There also remain key data and evidence gaps that make it difficult to assess progress for a number of priorities.** Although mapping flood risk has improved, the extent of housing and other infrastructure development in flood risk areas and the uptake of sustainable drainage systems is still unknown. There is a lack of data and metrics against which to assess health impacts from climate change and vulnerability of people and infrastructure to extreme weather events other than flooding, as well as gaps in understanding what actions are taking place.

**The draft second SCCAP currently out for consultation proposes an integrated approach to monitoring and evaluation and sets out principles and governance arrangements for such a framework.** This is based on a research project by ClimateXChange and was initiated following the Adaptation Committee's first independent assessment of the SCCAP. The research project included an assessment of significant gaps in the current indicators.

## **Key messages: Natural environment**

**There is continued evidence of actions being taken that will help reduce vulnerability to climate change, including restoring larger areas of degraded peatlands than planned, achieving EU water quality objectives and the designation of new Marine Protected Areas.** Semi-natural habitats need to be in good condition in order to give species the best chance of adapting naturally as the climate changes. Measures that aim to protect and enhance the resilience of Scotland's natural environment are well embedded in key policies and strategies, with monitoring frameworks in place to assess progress. Extensive research has been conducted to quantify coastal change.



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**Some indicators of vulnerability are moving in a positive direction, for example Scotland's coastal waters are in good ecological condition and the condition of lochs is relatively stable with 64% of lochs in Scotland meeting Good Overall Status in 2016.** The proportion of woodland features in favourable condition remains stable after an initial improvement in long-term condition.

**Efforts in some policy areas have slowed since the first assessment and a number of indicator trends are negative.** Progress with restoration of native woodland is not sufficient to meet current Scottish Government targets. There has been a scaling back of ambition for improvements in freshwater habitat condition since the publication of the River Basin Management Plans (RBMPs) due to resource constraints. Meanwhile the number of freshwater habitat features with invasive non-native species identified as a pressure is increasing. The presence of pests and diseases in Scotland's forests is increasing, and Dothistroma Needle Blight (DNB) in particular now appears to be endemic. Populations of seabirds and some specialist breeding farmland birds are in decline, though populations of other terrestrial breeding birds are increasing. The ecological status of estuaries in Scotland is poor and is not showing signs of improvement - 15% of estuaries did not meet Good Overall Status in 2016.

**Conclusions cannot be made about vulnerability in some areas where there is a lack of data or gaps in understanding of the risks.** For example, there is a lack of research or appropriate metrics to assess the vulnerability of Scottish soils to climate impacts and a recent review concluded that the full extent of erosion or compaction is not currently known. Updated information on the species mix and rate of planting of vulnerable forest species is also not available.

## **Key messages: Buildings and infrastructure networks**

**There is continued action to support resilience of buildings and infrastructure networks to flooding, such as the consideration of climate change in design and location of new infrastructure. More work is needed to assess and plan for coastal risks.** The Scottish Environment Protection Agency (SEPA) published the second National Flood Risk Assessment (2018 NFRA) in December 2018, which uses an updated methodology to give a better understanding of current levels of risk from river, coastal and surface water flooding. The assessment identifies 284,000 homes, businesses and services which are currently vulnerable to river, coastal and surface water flooding in a 0.5% (1 in 200) annual probability event. Scotland's National Coastal Change Assessment - Dynamic Coast - was launched in 2017 and Phase 2 (2018 - 2022) will investigate the anticipated impact of climate change on future coastal erosion and coastal flooding. Currently less than 10% of Scotland's shoreline is covered by a Shoreline Management Plan (SMP) and with 19% of Scottish coastline identified as erodible, this means not all areas of erodible coast are covered by a SMP, let alone the additional areas that are also at risk from coastal flooding. Better linkage of research is required so that priorities for SMP development are based on the research findings.

**Investment in resilient energy, transport and water services continues to be encouraged and indicators of vulnerability show good progress in a number of areas including energy and water supply resilience.** Flooding is at present a very minor factor in energy supply interruption, accounting for just 0.03% of all Customer Interruptions in 2016. The resilience of transport networks is included in the National Transport Strategy and public sector reporting on climate adaptation measures by Transport Scotland and local transport partnerships ensures transparency. Scottish Water's 25 year Water Resources Management Plan includes actions that

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could be taken to improve the resilience of public water supplies. The number of unplanned interruptions to water supply, non-domestic water consumption and leakage from the public water supply continues to decrease and leakage targets are being met.

**Up to date building standards are in place for flood resilience, moisture penetration from heavy rain, heating and ventilation, but there is no strategy for retrofitting existing buildings with adaptation measures and only limited guidance is available on overheating in buildings.** Levels of domestic building disrepair have declined over the last ten years though there has been no significant change in the number of homes showing dampness since 2002 – around 4% in 2016. Measures to protect Scotland’s significant historic estate and risks to cultural heritage have been included in the new National Flood Risk Assessment but it is not yet possible to determine whether they are effective steps. There is limited reference to overheating in technical building standards.

**Gaps remain in the policy framework for flooding and for digital infrastructure; there are opportunities for the next SCCAP to strengthen effort.** There is no national assessment of whether actions identified in Flood Risk Management Strategies are sufficient to prevent flood risk increasing, or to identify the flood risk management interventions and investments needed. There is no national target to reduce the number of properties at risk of flooding. Local Flood Risk Management Plans do not monitor and report the number and location of new homes and other properties built in areas of flood risk. There are also no specific actions in the SCCAP for resilience of digital infrastructure and whilst investment in resilience through Ofgem is positive, the key SCCAP actions for energy sector resilience have not been taken up. Information on the extent to which data and telecoms facilities and services are exposed to extreme weather impacts is still hard to gather. There is also no evidence of specific measures taken to minimise risks of cascading failures between infrastructure sectors (transport, energy, digital and water) to improve systems resilience in Scotland, which is of particular importance in the context of rural communities where weather impacts can cause greater disruption.

**A lack of metrics and targets against which to assess vulnerability continues to be an issue, particularly in relation to the design and location of new infrastructure and the use of sustainable drainage.** There is still no evidence collected on whether new infrastructure is designed and located according to the sustainability and adaptation principles set out in the National Performance Framework. Although Key Performance Indicators (KPIs) for climate adaptation are under development by Network Rail and Transport Scotland, there are no data available on development in floodplains in recent years. The number and capacity of sustainable drainage systems (SuDS) installed in new developments and other developments retrofitted with SuDS is also not currently recorded.

## Key messages: Society

**Legislative duties and standards for organisational resilience are generally well defined for NHS Boards in Scotland and there is a good level of transparency regarding actions taken by health boards to adapt to climate change.** Regional frameworks are in place to monitor the resilience of emergency services in Scotland. The UK National Risk Register was updated in September 2017, with climate change risks becoming more prevalent and extensive guidance exists for emergency responders in Scotland. New guidance is available in the Climate Ready Business Guide for businesses to increase their resilience against climate change impacts. A range of research projects are also underway to better understand climate risks for business and inform future policy.

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**The SCCAP contains a large number of policies and actions aimed at increasing awareness of climate risks but more could be done to make them more specific and to track progress.**

'Adaptation Scotland' is a programme funded by the Scottish Government and delivered by the sustainability charity 'Sniffer'. Support provided by the Adaptation Scotland programme includes capacity building training programmes, support for partnership projects, providing expertise to inform policy relevant research online tools, resources and an enquiry service. Awareness of climate risk appears to be increasing - the proportion of adults in Scotland who view climate change as an immediate and urgent problem has increased by one third between 2013 and 2017, from 46% to 61%.

**There are fewer national targets and a lack of monitoring for the 'Society'-related actions in the SCCAP compared to the other themes.**

There are limited provisions in the standards for organisational resilience that extend to social care services, and there are no specific standards for climate resilience that social care providers have to conform to. While a suite of guidance on preparing for and responding to emergencies such as extreme weather exists, there are no national recovery goals or targets. Strategies and guidance for food-borne disease management have been developed. There is still no strategy or plan to reduce the health effects of UV radiation or vector-borne diseases, which could become more prevalent as the climate changes.

**There are some positive trends in reducing vulnerability including fuel poverty (linked to risks to health from cold) in Scotland, which is at its lowest rate since 2005/06.**

There is continued evidence of improvements in water efficiency by specific industry sectors, such as food and drink manufacturing and whisky production. Non-domestic water consumption has decreased in recent years. Data are not currently available to assess trends in water abstraction by industry.

**Many indicators of societal vulnerability to climate change are moving in the wrong direction and data limitations prevent assessment of specific actions, such as emergency response and actions to reduce the risk of overheating in buildings.**

Average temperatures across Scotland are increasing and the proportion of the population aged 75 and over has increased by 16% between 2007 and 2017. Older people are more vulnerable to climate-related health risks such as an increased risk of illness and death in both hot and cold weather. There is a lack of evidence on the impacts of extreme weather events on long-term health, the effectiveness of recovery plans, and the length of time it takes people and communities to recover. There is still a lack of data to assess the risk of overheating in buildings in Scotland and the extent to which the exposure and vulnerability of the population to pathogens is changing cannot currently be measured.

**The impact of climate hazards on business is not currently known.** There are no specific policies in the SCCAP focussed on business opportunities from climate change and no data to determine the extent to which such opportunities are being realised. Some Scotland-specific research on business opportunities from adaptation is underway to inform the next programme.

## Measuring progress since the CCC's first assessment in 2016

**As a comprehensive assessment of the adaptation policy landscape in Scotland was completed for the first assessment, this report focuses on what has changed since 2016.**

**The two reports should therefore be considered in conjunction to present a full picture of the achievements of the SCCAP over its five year lifespan.** The findings from this assessment are presented in the context of an overall 'rating' for each priority area below. The purpose of this rating is to highlight the areas where we are most concerned about the direction or speed of



travel in policies, actions and vulnerability indicators. This is intended to enable the Scottish Government to identify easily which areas require additional effort in the next iteration of the SCCAP.

The rating for each priority area is set out in Table 1. The analysis which sits behind these conclusions has been completed using the same assessment method that was used for the first assessment, which is explained in Chapter 1.

<b>Table 1. Summary assessment of adaptation priorities in the SCCAP</b>		
<b>Adaptation priority</b>	<b>CCC rating</b>	<b>Rationale for rating</b>
<b>Natural Environment (Chapter 2)</b>		
Terrestrial species and habitats	Mixed progress	Targets for habitat condition and species abundance have been published and monitoring is in place. Notable successes have occurred in meeting peatland restoration targets, with 10,300 ha restored (against a target of 5,100 ha by 2020). Indicators of species abundance and distribution are moving in the wrong direction, suggesting that despite the action underway, the vulnerability of terrestrial species and habitats is increasing.
Forestry	Mixed progress	Whilst SCCAP policies and actions are progressing, the CCC has continuing concerns about the increasing prevalence of pests and diseases, including Dothistroma Needle Blight which is now considered endemic. Goals for woodland restoration are not being met. Further urgent efforts are needed in the second SCCAP to consider how to reduce vulnerability to pests and diseases through increasing the diversity of tree planting, moving away from vulnerable pine species, and publishing updated statistics. The establishment of the Centre of Expertise in Plant Health is a positive step and the next SCCAP should include specific actions to address the concerns raised.
Soils and agriculture	High concern	A number of key targets and actions for soil conservation and sustainable land management are not on track and there are insufficient data and metrics to assess the vulnerability of soils to climate impacts. The Committee feels that sufficient progress has not been made over the first SCCAP period in better understanding and addressing soil health, given its critical role as a fundamental natural asset.

**Table 1.** Summary assessment of adaptation priorities in the SCCAP

Adaptation priority	CCC rating	Rationale for rating
Freshwater rivers and lochs	High concern	Targets and objectives are defined and progress of the actions set out in the SCCAP is on track, however there has been a scaling back of ambition for improvements in freshwater condition. Water quality in almost half of Scottish rivers is poor and not improving, and pressures on freshwater habitats from invasive non-native species are increasing, which suggests that current targets and actions may not be sufficient to address the rising risk. Loch condition remains relatively stable with 64% of lochs in Scotland meeting Good Overall Status in 2016.
Marine and coastal ecosystems	Mixed progress	SCCAP coverage of policies and progress of actions is mixed. Importantly, targets have been met to designate 10% of coastal waters as protected areas, and coastal waters are recorded as being in good condition. There has been a focus on research to develop a better understanding of coastal change. Some indicators show positive trends, but the ecological status of estuaries is not showing signs of improvement (15% of estuaries did not meet Good Overall Status in 2016) and declines in seabird populations are a serious cause for concern – seabird numbers have declined by 38% between 1986 and 2016 and climate change is considered to be one of the main reasons for the decline.
<b>Buildings &amp; Infrastructure Networks (Chapter 3)</b>		
Flooding and coastal erosion risk management	Mixed progress	Some positive action has taken place through publication of the updated National Flood Risk Assessment and Flood Risk Management Strategies and Plans. The policy framework could be strengthened in some areas, for example through greater roll-out of Shoreline Management Plans. For the second SCCAP, information needs to be collected on the number and location of properties in flood risk areas and be maintained to record risks and impacts over time.
Surface water and sewer flooding	Mixed progress	There has been positive progress in implementing SCCAP actions and an updated assessment of surface water flood risk has been completed. Monitoring arrangements in the current SCCAP do not appear to be adequate for responsible agencies to implement, for example because there is no timescale for local authorities to map existing sustainable drainage systems (SuDS), and data are not collected on uptake of SuDS in new developments. Further work is needed to collect this information in the second SCCAP.

**Table 1.** Summary assessment of adaptation priorities in the SCCAP

Adaptation priority	CCC rating	Rationale for rating
Development in flood risk areas	Mixed progress	While there are requirements to consider flood risk in planning new developments, the policy framework should be strengthened by requiring reporting on the number of new properties proposed and built in areas at flood risk, and trend information is needed on the extent of development in floodplains.
Resilience of buildings to extreme wind and rain	Mixed progress	There has been good progress in implementing SCCAP actions and the vulnerability of the housing stock to extreme wind and rain is declining. Levels of domestic building disrepair have gone down over the last ten years, though there has been no significant change in the number of homes showing dampness since 2002 – around 4% in 2016. There are limited provisions in building standards for retrofitting existing buildings with adaptation measures for the impacts of extreme wind and rain.
Water demand in the built environment	Mixed progress	Per capita consumption of water in Scotland remains high compared to many other European countries, at just over 150 litres per person per day. Plans are in place to reduce demand through lower consumption and leakage, and actions are underway to test water efficiency measures. The Committee would like to see demand fall further in the next SCCAP period.
Design and location of new infrastructure	Mixed progress	There is good coverage of climate change in policies such as the National Planning Framework, and SCCAP actions are progressing. There is a lack of information to assess vulnerability of new infrastructure to future climate risk.
<b>Resilience of infrastructure services:</b>		
A) Energy networks - generation, transmission and distribution	Mixed progress	Whilst a regulatory framework is in place, two key SCCAP actions have not been taken up (Energy Sector Climate Change impacts research programme and Scottish Government Energy Sector Flood Risk workstream) and there is a lack of data to assess trends in electricity supply disruption caused by severe weather events other than flooding.
B) Public water supplies	Positive progress	SCCAP policies and actions are progressing well and have a long-term focus. Interruptions to water supply are decreasing. Trends in weather-related disruptions cannot be assessed due to a lack of data, and this could be a focus for the next SCCAP.



**Table 1.** Summary assessment of adaptation priorities in the SCCAP

Adaptation priority	CCC rating	Rationale for rating
C) Ports, airports and ferry services	Mixed progress	There is limited provision in the SCCAP for adaptation actions related to ports, airports and ferry terminals, and there is a lack of data to assess whether steps are being taken to manage climate risk. Given the importance of these services for more remote communities in Scotland, more evidence on the scale of risk and action underway is needed as a priority for the next SCCAP.
D) Roads and the rail network	Positive progress	There are a large number of policies and actions in the SCCAP related to resilience of roads and rail and a number of actions are progressing as planned. Key Performance Indicators for climate adaptation are under development by Network Rail and Transport Scotland. Trends in road condition have remained static and around two thirds of road users are satisfied with the information provided on extreme weather and road condition.
E) Digital infrastructure	High concern	There are no specific actions in the SCCAP for digital infrastructure and strategies do not consider disruption from extreme weather. There is no information available to assess the vulnerability of data and telecommunication facilities.
Infrastructure interdependencies	Mixed progress	There has been positive progress in implementing some SCCAP actions, including the establishment of the Critical Infrastructure Resilience Partnership 2017 which provides a strategic policy forum for resilience issues. There is no evidence of specific measures taken across infrastructure sectors to improve systems resilience in Scotland. Some research is underway, which is anticipated to provide useful insights for the next SCCAP.
<b>Society (Chapter 4)</b>		
Resilience of the population to changes in temperature	Mixed progress	SCCAP actions are progressing, however there is limited provision for managing risks from hot and cold weather in the current SCCAP. Indicators of vulnerability show mixed results in the context of an ageing population, which is more vulnerable to both hot and cold weather. Fuel poverty is declining, which should be leading to reduced exposure to cold. Average temperatures are increasing and while this should reduce cold-related vulnerabilities, there is a lack of data to assess the corresponding risk of overheating in buildings under warmer conditions. There is limited reference to overheating in technical building standards.

**Table 1.** Summary assessment of adaptation priorities in the SCCAP

<b>Adaptation priority</b>	<b>CCC rating</b>	<b>Rationale for rating</b>
Resilience of people to pathogens, air pollution, UV radiation	Mixed progress	Strategies are in place for managing the risks of foodborne illness but there are no firm policy actions in the SCCAP related to the potential increase in risks from air pollution or UV radiation due to climate change. There remains a lack of data against which to assess vulnerability.
Public understanding of climate related risks	Positive progress	SCCAP actions are progressing and awareness of climate risk is increasing. The proportion of adults in Scotland who view climate change as an immediate and urgent problem has increased by one third between 2013 and 2017, from 46% to 61%.
Health and social care services	Mixed progress	Progress is being made in implementing adaptation actions for the healthcare sector but the SCCAP does not address risks to delivery of social care services. There are no indicators to assess the vulnerability of health and social care services to climate change. A research programme is underway which is anticipated to address some of the data gaps.
Emergency planning and response	Mixed progress	Whilst SCCAP coverage and implementation of actions is positive, particularly in relation to managing flood risk, there remains a lack of information to assess vulnerability of emergency planning and response services.
Recovery from extreme weather events	High concern	Some positive actions have taken place to improve recovery capabilities, however there is a lack of national targets for recovery from extreme weather events and a lack of evidence on the impacts of extreme weather events on people, and the effectiveness of recovery plans.
Business impacts from extreme weather	Mixed progress	The risks to businesses from climate change are increasing and the current SCCAP is light on adaptation actions for business. Research has been initiated since the first assessment to address gaps in data availability in order to inform the next SCCAP.
Business opportunities from climate change	Positive progress	While there are no specific policies in the SCCAP which focus on business opportunities, specific research is underway to inform the next programme.

**Table 1.** Summary assessment of adaptation priorities in the SCCAP

Adaptation priority	CCC rating	Rationale for rating
Supply chain disruptions	Mixed progress	While there is no overarching plan to address risks to Scottish businesses' supply chains from climate change, some sector specific strategies exist and actions are taking place. There is a lack of information however to assess the vulnerability of Scottish supply chains to climate impacts.
Water demand by industry	Positive progress	SCCAP actions for water efficiency are progressing and non-domestic water consumption has declined in recent years. Data are not available to assess trends in water abstraction by industry.

**Notes:** The criteria for the ratings are:

**Positive progress (green):** Based on the evidence available, the overall level of progress in managing risks and taking account of opportunities through the first SCCAP period is positive and there may be examples of best practice in adaptation. Where gaps have been identified, projects are in place to address them.

**Mixed progress (amber):** Based on the evidence available, while there have been some examples of positive action or risk reduction, there are some specific areas that need further attention and this gives some cause for concern.

**High concern (red):** Based on the evidence available, there is a major cause for concern, either through a lack of delivery of policies and actions, because vulnerability is increasing markedly, or because there is a lack of data to assess vulnerability in important areas.

## Building on the findings of the first assessment

**In completing the first assessment of the SCCAP in 2016, the Adaptation Committee identified the following high level recommendations for the Scottish Government, in preparing the second iteration of the SCCAP:**

- **Address all of the urgent risks and opportunities for Scotland identified in the UK Climate Change Risk Assessment.**
- **Identify a senior owner for each objective to be held accountable for its delivery.**
- **List the specific actions that will be taken to achieve each objective together with appropriate milestones and timescales.**
- **Introduce an effective monitoring regime, to allow the impact of actions and delivery of each objective to be properly assessed.**
- **Present the actions being taken within each sector together and co-ordinate their delivery.**

A number of recommendations pertaining to more specific areas of the SCCAP were also made in the first assessment. These recommendations have been revisited in the second assessment to assess what progress has been made, and responses to these are considered throughout the report. Overall, actions have been taken to address the recommendations from the first assessment. We have indicated throughout the report where we think further action is required.



As a result of this second assessment of progress, the Adaptation Committee presents the additional recommendations in Table 2 for the Scottish Government to consider in developing the second SCCAP – these are supplementary to the recommendations from the first assessment.

**A full list of all recommendations is included in Annex A (first assessment, with responses) and Annex B (second assessment).**

<b>Table 2.</b> Additional recommendations from the CCC's second assessment (in order of concern)			
<b>Adaptation Priority</b>	<b>Recommendation</b>	<b>Owner</b>	<b>Timescale</b>
All	<p><b>RECOMMENDATION 1:</b> Work with partners to improve the measurement of vulnerability to climate change in Scotland, and the actions being taken, in:</p> <p>a) Areas where appropriate metrics have been identified but vulnerability and actions are not being measured or analysed:</p> <ul style="list-style-type: none"> <li>• Impact of new development on long-term flood risks and risk management costs, including the use of Sustainable Drainage Systems to help manage surface water flood risks.</li> </ul> <p>b) Areas where appropriate metrics have not yet been identified or measured:</p> <ul style="list-style-type: none"> <li>• Overheating risks in buildings, including monitoring of internal temperatures in hospitals and care homes.</li> <li>• Rates of soil erosion including the uptake of soil conservation measures by farmers.</li> <li>• Securing the performance of infrastructure networks in severe weather.</li> <li>• Adequacy of actions being taken by Scottish businesses to prepare for extreme weather and adapt to climate change.</li> </ul>	Scottish Government	End 2020
Resilience of digital infrastructure (Chapter 3)	<p><b>RECOMMENDATION 2:</b> Include specific actions in the next SCCAP with regards to the resilience of digital infrastructure. Information on the exposure of data and telecommunication facilities and services to extreme weather impacts is limited and there are no actions in the current SCCAP related to this.</p>	Scottish Government	Next SCCAP in 2019

**Table 2.** Additional recommendations from the CCC's second assessment (in order of concern)

Adaptation Priority	Recommendation	Owner	Timescale
Resilience of the population to changes in temperature (Chapter 3)	<b>RECOMMENDATION 3:</b> The next SCCAP should commit to more ambitious actions to address current and long-term risks from both heat and cold.	Scottish Government and Health Protection Scotland	Next SCCAP in 2019
Forestry (Chapter 2)	<b>RECOMMENDATION 4:</b> Increase efforts to manage and reduce the spread of disease in order to increase resilience to climate change, including Dothistroma Needle Blight (DNB) and other pests and pathogens.	Forestry Commission Scotland	Next SCCAP in 2019
Surface water and sewer flooding (Chapter 3)	<b>RECOMMENDATION 5:</b> In preparing the next SCCAP, review monitoring and reporting arrangements for the uptake of Sustainable Drainage Systems. There may be an opportunity to collect information through public sector organisations.	Scottish Government and Scottish Environment Protection Agency	Next SCCAP in 2019
Flooding and coastal erosion risk management (Chapter 3)	<b>RECOMMENDATION 6:</b> Work with Local Authorities to identify the areas of coastline that are inhabited, at risk of erosion and/or at risk of flooding and ensure these are all covered by a Shoreline Management Plan.	Scottish Government	End 2020
Resilience of energy networks (Chapter 3)	<b>RECOMMENDATION 7:</b> Given that two programmes related to energy sector resilience in the current SCCAP were not taken up - Energy Sector Climate Change Impacts research programme and Scottish Government Energy Sector Flood Risk work stream – include actions in the next iteration of the SCCAP to ensure adaptation actions for energy sector resilience continue.	Scottish Government	Next SCCAP in 2019
Health and social care services (Chapter 4)	<b>RECOMMENDATION 8:</b> Include specific actions to understand and improve resilience of health and social care services in the next iteration of the SCCAP. Research such as that currently underway by ClimateXChange to provide data on the direct and indirect impacts of climate change on social care delivery and to understand risks and dependencies is crucial. The next SCCAP should commit to action to take the findings of this research forward.	Scottish Government	Next SCCAP in 2019

**Table 2.** Additional recommendations from the CCC's second assessment (in order of concern)

Adaptation Priority	Recommendation	Owner	Timescale
Health and social care services (Chapter 4)	<b>RECOMMENDATION 9:</b> Consider specific actions that can be incorporated into the next SCCAP to link adaptation to National Health and Wellbeing Outcomes. In particular, Outcome 4: 'Health and social care services are centred on helping to maintain or improve the quality of life of people who use those services'.	The Scottish Government	Next SCCAP in 2019

**Notes:** Recommendations are additional to those made in the first assessment. Refer to Annex A and B for the full set of recommendations from both SCCAP assessments.

## Next steps

The next SCCAP is currently under development and this report is a key input to that process. In June 2018, the Scottish Government sought the advice of the Adaptation Committee on adopting an outcomes based approach to climate change adaptation in Scotland for the next SCCAP.<sup>1</sup> The advice of the Adaptation Committee has been applied in developing the proposed framework and a period of stakeholder engagement and consultation on the next programme is underway. This report will add to the findings from the consultation and engagement activities to inform the next programme, which is due to be published later in 2019. The Adaptation Committee will be pleased to offer our support and advice during the delivery of the next SCCAP programme.

<sup>1</sup> The Scottish Government (2018) *Letter from the CCC to the Scottish Government*, <https://www.theccc.org.uk/publication/asc-writes-to-scottish-government-about-outcomes-based-approach-for-the-sccap/>



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# Chapter 1: The Scottish Climate Change Adaptation Programme





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## 1.1 A changing climate in Scotland

**There is continued evidence of a changing climate in Scotland and the latest climate projections indicate further significant and serious changes this century, if ambitious efforts are not made to reduce global greenhouse gas emissions. Increases in seasonal temperatures, sea level and annual rainfall are all being observed in Scotland. Recent extreme weather events, such as storm Ali in September 2018, are expected to become more frequent under a changing climate.<sup>2</sup>**

Average temperatures in Scotland have increased in line with global trends. The average annual temperature in the 2000's was 0.90°C warmer than the 1961-1990 average and warmer than any other decade since records began in 1910.<sup>3</sup> Annual rainfall over Scotland has increased since the 1970s, to a level 13% above the average for the early decades of the 20<sup>th</sup> century. All seasons have contributed to the increase in rainfall. Long-term monitoring of sea level at stations around the UK including Aberdeen shows the mean sea level for 2006 - 2008 was more than 10cm higher than during the 1920s.<sup>4</sup>

## 1.2 The Scottish policy landscape

**Scotland has a long-established statutory framework for mitigating and adapting to climate change, which is subject to ongoing scrutiny and review.** The framework for both mitigating and adapting to climate change was introduced by the Climate Change (Scotland) Act in 2009 (the Act). The Act established legally-binding carbon budgets, which dictate the extent of emitting activity allowed and climate change mitigation effort required to meet agreed targets. Scotland is currently performing well against its carbon budgets and is on track to meet interim 2020 emissions reduction targets.<sup>5</sup> The Act also put in place requirements to prepare Scotland for climate change and adapt to its impacts, which are set out in the Scottish Climate Change Adaptation Programme (SCCAP). The SCCAP includes objectives, proposals and policies to be delivered to address the risks and opportunities facing Scotland from climate change, identified by the UK Climate Change Risk Assessment (CCRA).<sup>6</sup> Consistent with the UK National Adaptation Programme (NAP), climate change adaptation policy in Scotland runs on a five year review cycle.

**The first SCCAP was published in May 2014, with the next programme to be published in 2019.** Ministers are required to provide Parliament with annual updates on progress.<sup>7</sup> The Act also makes provision for an independent assessment of progress towards implementing the programme every two years. The Adaptation Committee's first assessment of the SCCAP was

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<sup>2</sup> Met Office (2019) *UKCP18 Headline Findings*,

<https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/ukcp18/ukcp18-headline-findings.pdf>

<sup>3</sup> The Scottish Government (2017), *High Level Summary of Statistics Trend Last update: Thursday 19 January, 2017, Annual Mean Temperature*. Source: Met Office.

<sup>4</sup> Kendon M, McCarthy M, Jevrejeva S, Matthews A, Legg T. (2017), *State of the UK climate 2017*. Int J Climatol. 2018; 38 (Suppl. 2):1–35, <https://doi.org/10.1002/joc.5798>

<sup>5</sup> CCC (2018) *Reducing Emissions in Scotland - 2018 Progress Report to Parliament*,

<https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2018-progress-report-to-parliament/>

<sup>6</sup> The UK Climate Change Risk Assessment (CCRA) is published under section 56 of the UK Climate Change Act 2008.

<sup>7</sup> Scottish Government annual progress reports are available at <https://www.gov.scot/policies/climate-change/climate-change-adaptation/>

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published in September 2016.<sup>8</sup> After the first independent assessment, the Environment, Climate Change and Land Reform (ECCLR) Committee conducted an inquiry, which included an evidence session with Committee members. The Scottish Government's response to the enquiry questions were set out in a letter to the ECCLR Committee in early 2017.<sup>9</sup>

In 2018, Scottish Ministers asked the CCC to undertake this second assessment of the SCCAP.

### 1.3 The first SCCAP

#### **The SCCAP sets out around 150 policies and proposals to address the risks and opportunities Scotland faces from climate change.**

The first SCCAP sets out objectives in relation to adaptation to climate change, proposals and policies for meeting those objectives, and the period within which those proposals and policies will be introduced. The Act requires that the actions in the SCCAP address the risks identified in the UK Climate Change Risk Assessment. The Act also requires the programme to set out the arrangements for involving employers, trade unions and other stakeholders in meeting Ministers' objectives; and the mechanisms for ensuring public engagement in meeting those objectives.

When preparing the SCCAP, the Scottish Government prioritised those risks and opportunities from the first CCRA (CCRA1, published in 2012) that were considered to require early adaptation action in Scotland. The SCCAP focuses on devolved areas of policy, with the UK National Adaptation Programme (NAP) dealing with reserved matters.<sup>10</sup> Where relevant, the SCCAP makes reference to policies within the NAP that are important for adaptation in Scotland.

The SCCAP is divided into two parts:

- **Part 1** - lays out the Scottish Government's approach to engaging with others, as required under the Act. The SCCAP is a Government-led programme where most of the policies and proposals are owned by the Scottish Government and its delivery bodies and agencies. Each of the policies and proposals are delivered by organisations working in collaboration such as universities, utility companies, regulators, voluntary groups and environmental charities.
- **Part 2** - sets out policies and proposals under three themes: 'natural environment', 'buildings and infrastructure networks', and 'society'. The policies and proposals are sub-divided into three objectives for each theme. The SCCAP's overarching aim, outcomes for each theme and the nine objectives are detailed in Figure 1.1.

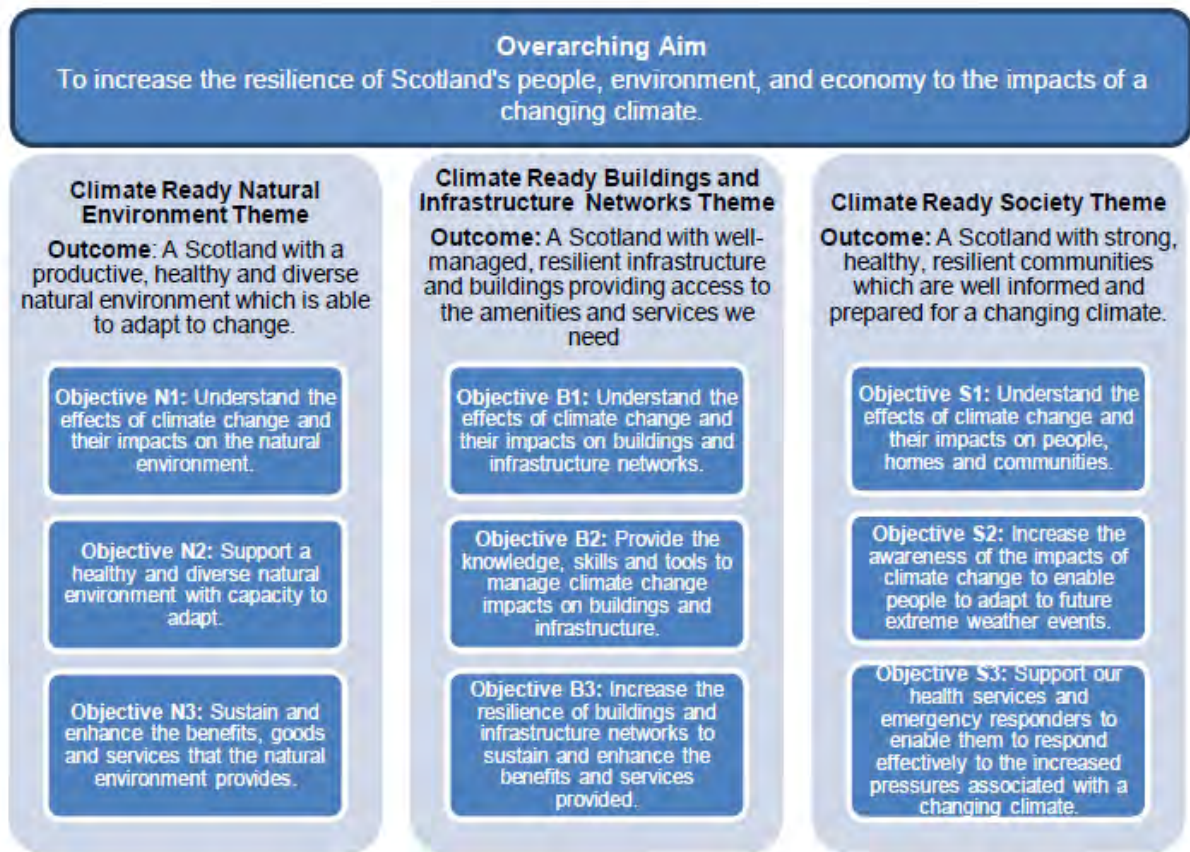
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<sup>8</sup> CCC (2016) *Scottish Climate Change Adaptation Programme: An independent assessment*, <https://www.theccc.org.uk/publication/scottish-climate-change-adaptation-programme-an-independent-assessment-for-the-scottish-parliament/>

<sup>9</sup> Scottish Government (2017) *Letter to ECCLR Committee*, [http://www.parliament.scot/S5\\_Environment/General%20Documents/20170113\\_Cabinet\\_Secretary\\_to\\_Convener\\_on\\_Climate\\_Change\\_Adaptation.pdf](http://www.parliament.scot/S5_Environment/General%20Documents/20170113_Cabinet_Secretary_to_Convener_on_Climate_Change_Adaptation.pdf)

<sup>10</sup> Reserved matters are those that the UK Government has control over, such as defence. The Scotland Act 1998: Schedule 5: <http://www.legislation.gov.uk/ukpga/1998/46/schedule/5>

**Figure 1.1.** Aim, themes and objectives within the Scottish Climate Change Adaptation Programme

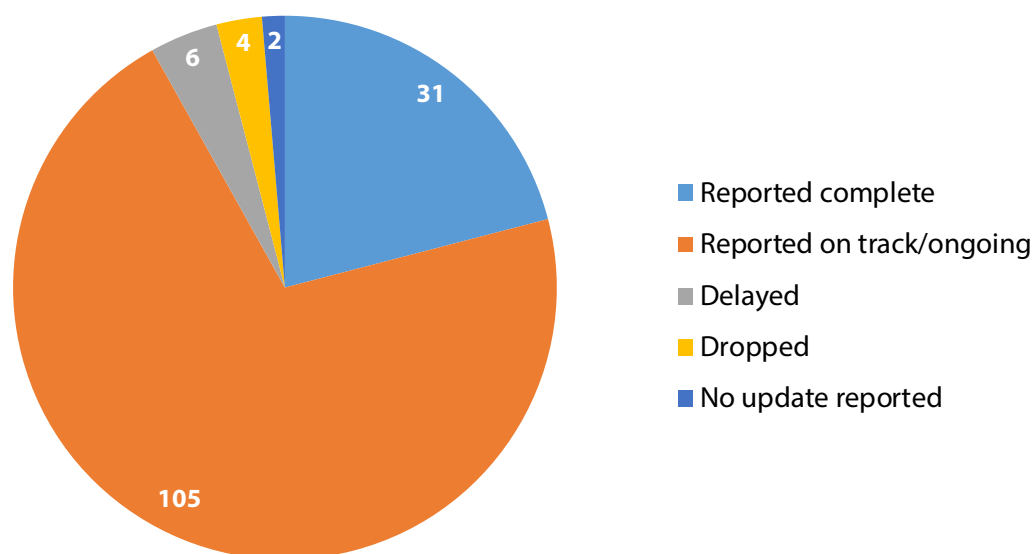


**Source:** The Scottish Government (2014) *Climate Ready Scotland: Scottish Climate Change Adaptation Programme*.

**The majority of policies and proposals set out in the SCCAP are reported as being on track or complete.** Since the publication of the SCCAP in 2014, the Scottish Government has prepared four annual progress reports. The results of the most recent progress report in 2018 are summarised in Figure 1.2.



**Figure 1.2.** Status of policies and proposals in the Scottish Climate Change Adaptation Programme



**Source:** The Scottish Government (2018) *Climate Ready Scotland: Scottish Climate Change Adaptation Programme, Fourth Annual Progress Report*.

**Notes:** Figure shows the number of policies and proposals in each category. The status of each policy or proposal is based on self-reporting by those responsible for their delivery.

## 1.4 The Climate Change Risk Assessment for Scotland

**The first UK Climate Change Risk Assessment was published in 2012 (CCRA1), and identified 144 risks and opportunities directly relevant to Scotland.** Projections of the future climate were based on the UK Climate Projections published in 2009 (UKCP09).<sup>11</sup> In 2017, the second UK Climate Change Risk Assessment (CCRA2) was published, including a Scotland-specific Evidence Report.<sup>12</sup> Both CCRA reports summarised the geographic variations in Scotland's climate, as well as differing impacts between urban, rural and remote Scottish regions.

As the SCCAP was designed in the context of CCRA1, consistent with the CCC's first assessment in 2016 this assessment considers whether the risks and opportunities identified in CCRA1 are being addressed. Where recommendations have been made for the next programme, these are cognisant of any changes in the evidence between CCRA1 and CCRA2, since the next adaptation programme will be defined in response to the risks and opportunities as stated in CCRA2. The CCC is currently developing the Evidence Report for the third CCRA, due in 2022.

<sup>11</sup> Murphy, J.M., et al. (2009) *UK Climate Projections Science Report: Climate change projections*. Met Office Hadley Centre, Exeter, <https://webarchive.nationalarchives.gov.uk/20181204111026/http://ukclimateprojections-ukcp09.metoffice.gov.uk/22530>

<sup>12</sup> CCC (2017) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Committee on Climate Change, London, <https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/national-summaries/scotland/>

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## Some of the key risks and opportunities for Scotland as a result of projected climate change are:

### Risks:

- Changes in soil conditions, biodiversity and landscape as a result of warmer, drier summers. With the majority of the UK's soil organic carbon in Scotland, changes in carbon stored in soils will have a more significant impact on priority habitats and provisioning of ecosystem services in Scotland than the rest of the UK.
- Reductions in river flows and water availability during the summer, affecting water supplies and the natural environment.
- Changes in, or loss of, species with specific threats to native species and migration patterns.
- Changes in coastal evolution affecting people, property, infrastructure, landforms, habitats and species.
- Changes to ocean water temperature and quality, affecting shellfish and the location of commercial fish stocks. Almost all existing UK marine based finfish aquaculture activity exists in Scotland.
- Increased risk of pests and diseases affecting agriculture and forestry, and the opportunity for new plants to bring associated new pests and pathogens.
- Increases in flooding both on the coast and inland, affecting people, property, infrastructure, landforms, habitats and species.
- Increases in insurance losses, ICT disruption and transport network disruption resulting from an increase in the occurrence of extreme weather events.
- An increase in the number of people at risk of death, injury or mental health problems as a result of flooding.
- Increased risks faced by the larger number of rural and isolated communities in Scotland reliant on (for example) limited transport or communication links or climate-sensitive businesses (e.g. fishing).

### Opportunities:

- Changes in crop, grass and forest productivity and land class leading to potential increases in yields. Central, Eastern and Southern Scotland may benefit the most from these changes. Wheat yields in particular were anticipated to increase significantly from longer growing seasons if water was not limiting.
- Increased tourist numbers and longer tourist seasons, providing an opportunity for new businesses and for established businesses to become more profitable.
- A reduction in the number of cold-related deaths and hospital admissions.<sup>13</sup>

Analysis in this report is stated in the context of these climate risks and opportunities, which are explained in more detail in subsequent chapters.

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<sup>13</sup> CCC (2016) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Committee on Climate Change, London, <https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/national-summaries/scotland/>

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## 1.5 Evaluating progress

**As this is the CCC's second assessment of progress of the SCCAP, this report focuses on what has changed since our first assessment.** The Act requires the CCC to report to Scottish Ministers<sup>14</sup> with its assessment of progress with the implementation of the objectives, policies and proposals in the SCCAP. In our first assessment the Adaptation Committee noted a lack of defined outcomes and timeframes in the SCCAP, making it difficult to measure progress of the objectives directly. As a result, the CCC developed a set of specific and measurable 'adaptation priorities' against which to assess progress.

**The analysis in this report uses the same framework of adaptation priorities as our first assessment to enable a consistent assessment of progress.** This approach enables us to assess progress of policy objectives in the context of changes in vulnerability to climate change impacts. The adaptation priorities focus on areas where the urgency of adaptation action is greatest and the scale of the challenge means effort will need to be sustained for many decades.

**The adaptation priorities used to assess progress with the SCCAP are broadly consistent with the adaptation priorities identified by the CCC for its assessment of the UK National Adaptation Programme (NAP).**<sup>15</sup> In some cases amendments have been made to reflect the priority climate change risks and unique circumstances in Scotland.

In the CCC's first assessment, the evaluation of progress focussed on three questions. This report maintains that framework but looks mainly at what has changed since our first assessment, giving an updated Red-Amber-Green (RAG) score and hence an updated assessment for each priority area:

- **Is there a plan?** In our first assessment, the CCC evaluated the extent to which policies and plans in each priority area address the relevant climate risks. This report highlights any changes in the policy landscape since our first report.
- **Are actions taking place?** The CCC has sought to identify what additional steps are being taken to manage climate change risks since our first assessment, through delivery of SCCAP policies and proposals as well as other relevant activity that may be helping to reduce the impact of climate change.
- **Is progress being made in managing vulnerability?** To arrive at an overall assessment, the CCC has considered the available evidence to conclude whether vulnerabilities to climate change risks are increasing or decreasing.

As well as considering the activity referenced within the SCCAP and the annual progress reports, additional information has been gathered through detailed stakeholder discussions, from Adaptation Reporting Power reports,<sup>16</sup> public bodies' duties reports and a wider literature

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<sup>14</sup> The Act requires the "relevant body" to report to Scottish Ministers and currently the Committee on Climate Change is listed as the relevant body in the associated secondary legislation.

<sup>15</sup> The CCC (2015) *Reducing emissions and preparing for climate change: 2015 Progress Report to Parliament*, <https://www.theccc.org.uk/publication/reducing-emissions-and-preparing-for-climate-change-2015-progress-report-to-parliament/>

<sup>16</sup> Under the Climate Change Act (2008) Defra asked a number of organisations to produce reports on their current and future projected effects of climate change on their organisation and their proposals for adapting to climate change. Reports are available at <https://www.gov.uk/government/collections/climate-change-adaptation-reporting-second-round-reports>

review. For the vulnerability assessment, a subset of the ClimateXChange indicators<sup>17</sup> have been updated for this assessment. These indicators measure, where possible, trends in exposure and vulnerability, and observed climate impacts, within each priority area. Other data sources include national indicators, published statistics and research papers.

Table 1.1 sets out the criteria for the RAG scores.

**Table 1.1. Criteria for the CCC’s Red-Amber-Green-Grey assessment of adaptation priorities**

	<b>Is there a plan?</b>	<b>Are actions taking place?</b>	<b>Is progress being made in managing vulnerability?</b>
<b>Green</b>	Where needed, plans or policies are in place to fully address the adaptation priority in the context of climate change.	All relevant SCCAP actions delivered or on-track, other relevant plans and policies are being implemented.	Vulnerability reducing, or not increasing. High uptake of low-regret actions. Long-term decisions are accounting for climate change projections.
<b>Amber</b>	Plans or policies in place that partially address the adaptation priority.	Not all relevant SCCAP actions are on-track, with partial delivery of other relevant plans and policies.	Some trends in vulnerability increasing. Scope to increase low-regret action. Decisions partially or inconsistently accounting for climate change projections.
<b>Red</b>	No specific policies or plans are in place.	Policies are not being implemented and relevant actions are behind schedule.	Most trends in vulnerability increasing. Minimal uptake of low-regret actions. Decisions do not take climate change into account.
<b>Grey</b>	N/A	No specific actions in the SCCAP, no apparent activity underway.	Insufficient evidence to make a judgement.

<sup>17</sup> The full suite of ClimateXChange indicators are available at <http://www.climateexchange.org.uk/adapting-to-climate-change/indicators-and-trends/>



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**Since the RAG scores summarise the progress for a number of policies/actions and vulnerability indicators for each adaptation priority, an overall 'rating' has also been specified for each priority area.** The purpose of this rating is to highlight the areas where the CCC is most concerned about the direction of travel in policies, actions and vulnerability indicators. This should enable the Scottish Government to easily identify which areas may require additional effort in the next iteration of the SCCAP, in order to appropriately prioritise efforts to manage future climate risk. The criteria for the overall ratings are:

- **Positive progress (green):** Based on the evidence available, the overall level of progress in managing risks and taking account of opportunities through the first SCCAP period is positive and there may be examples of best practice in adaptation. Where gaps have been identified, projects are in place to address them.
- **Mixed progress (amber):** Based on the evidence available, while there have been some examples of positive action or risk reduction, there are some specific areas that need further attention and this gives some cause for concern.
- **High concern (red):** Based on the evidence available, there is a major cause for concern, either through a lack of delivery of policies and actions, because vulnerability is increasing markedly, or because there is a lack of data to assess vulnerability in important areas.

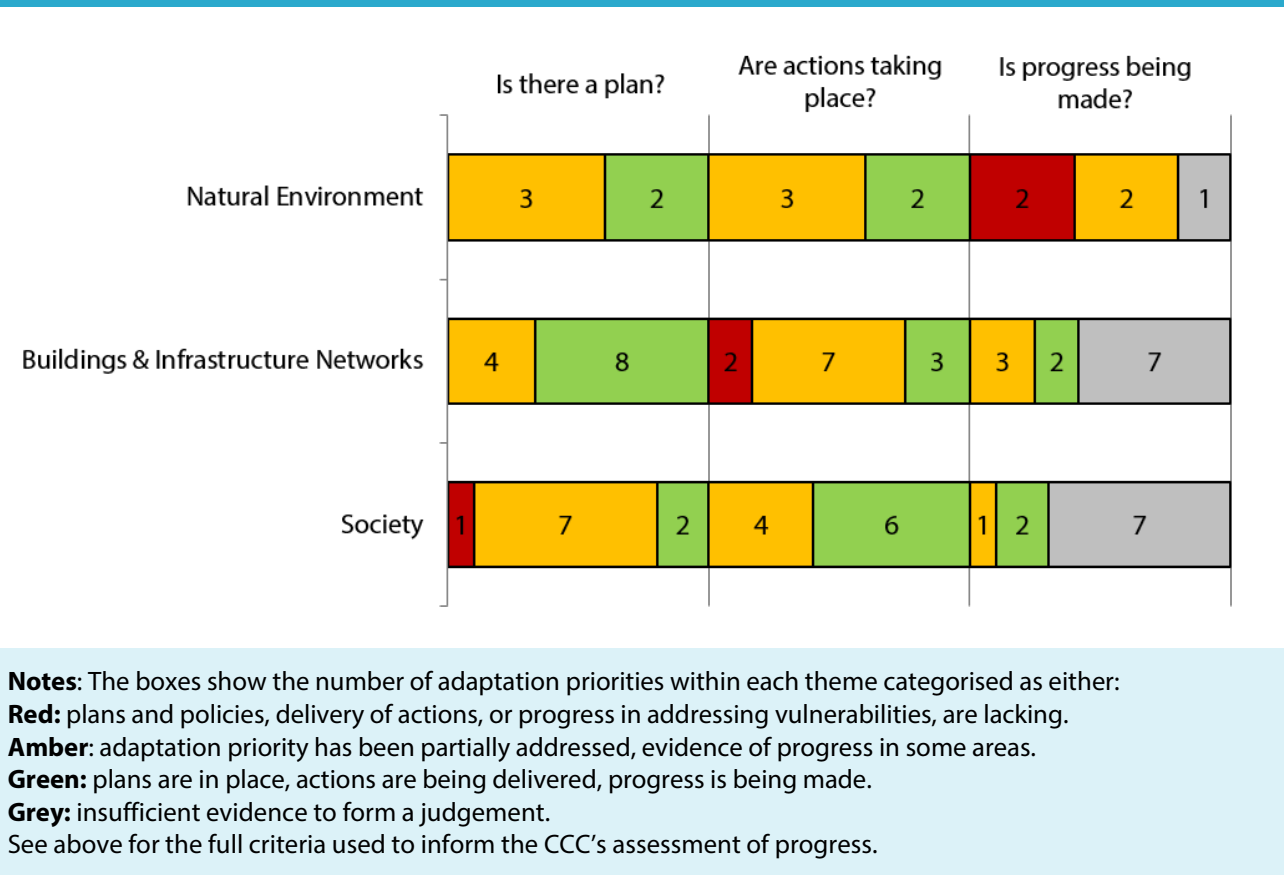
**The analysis in this report is structured according to the three themes in the SCCAP, with three chapters on Natural Environment, Buildings and Infrastructure Networks, and Society.**

Each chapter follows a consistent structure, providing:

- A summary of the key messages for the theme;
- An overview of the Scottish Government's vision and objectives as set out in the SCCAP;
- For each adaptation priority:
  - an overall rating;
  - a summary RAG assessment;
  - a description of the relevant climate change risks;
  - commentary on progress with implementing the relevant SCCAP policies and proposals;
  - an evaluation of progress in addressing the CCC's recommendations from the first assessment (where relevant);
  - an updated vulnerability assessment; and
  - additional recommendations for where new or revised policies should be considered, or where implementation of existing policy requires strengthening.

Figure 1.3 presents the overall assessment for the three SCCAP themes. In many areas, plans and policies are in place and actions are reported as either complete or on track (shown in green). Vulnerability is increasing in some specific areas (shown as red in the third column) and evidence of progress is mixed in others (shown in amber). Areas are highlighted in grey if there is insufficient evidence to form a judgement.

**Figure 1.3.** The Adaptation Committee's second assessment of the SCCAP



## 1.6 Looking towards the next SCCAP

**The next SCCAP is required to be published by the Scottish Government in 2019.**

With the formal publication of the second UK Climate Change Risk Assessment in 2017, a renewed SCCAP is due to be published by the Scottish Government in 2019. This should include updated policies and proposals together with revised aims, objectives and outcomes as appropriate.

In addition to specific policy-level recommendations, the CCC made high level observations on limitations of the SCCAP in our first assessment. In summary, those were:

- Some of the risks highlighted for Scotland in the first CCRA are not addressed within the current SCCAP.
- There is no clear ownership, oversight and delivery of the objectives stated within the SCCAP.
- Sector-specific activity is fragmented across several SCCAP objectives.
- The first SCCAP focuses on evidence-gathering and other supporting measures, rather than taking action to address risks.
- Progress against most of the SCCAP objectives, and the impact of policies and proposals, is not being measured.

As a result, **in addition to a number of detailed recommendations**, the CCC made the following high level recommendation:

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*"In preparing the next SCCAP the Scottish Government should:*

- *Address all of the urgent risks and opportunities for Scotland identified in the 2017 UK Climate Change Risk Assessment.*
- *Identify a senior owner for each objective that can be held accountable for delivery.*
- *List the specific actions that will be taken to achieve each objective together with appropriate milestones and timescales.*
- *Introduce an effective monitoring and evaluation regime, to allow the impact of actions and delivery of each objective to be fully assessed.*
- *Co-ordinate the actions being taken within each sector especially where they appear within different themes of the SCCAP".*

The recommendations in this report build on those from our first assessment and are set out in the Executive Summary and within the relevant chapters. **A full list of all recommendations is included in Annex A (first assessment, with responses) and Annex B (second assessment).**

The next SCCAP is currently under development and this report is a key feed-in to that project. In spring 2018, the Scottish Government sought the advice of the CCC on adopting an outcomes based approach to climate change adaptation in Scotland for the next SCCAP.<sup>18</sup> The advice of the CCC has been applied in developing the proposed framework and a period of stakeholder engagement and consultation on the next programme is underway. This report will add to the findings from the consultation and engagement activities to inform the next programme, which is due to be published later in 2019.

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<sup>18</sup> CCC (2018) *Letter from the CCC to the Scottish Government*, <https://www.theccc.org.uk/publication/asc-writes-to-scottish-government-about-outcomes-based-approach-for-the-sccap/>



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## Chapter 2: Natural environment





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## 2.1 Key messages - Natural environment

**There is continued evidence of actions being taken that will help reduce vulnerability to climate change, including restoring larger areas of degraded peatlands than planned, achieving EU water quality objectives and the designation of new Marine Protected Areas.**

Semi-natural habitats need to be in good condition in order to give species the best chance of adapting naturally as the climate changes. Measures that aim to protect and enhance the resilience of Scotland's natural environment are well embedded in key policies and strategies, with monitoring frameworks in place to assess progress. Extensive research has been conducted to quantify coastal change.

**Some indicators of vulnerability are moving in a positive direction, for example Scotland's coastal waters are in good ecological condition and the condition of lochs is relatively stable with 64% of lochs in Scotland meeting Good Overall Status in 2016.** The proportion of woodland features in favourable condition remains stable after an initial improvement in long-term condition.

**Efforts in some policy areas have slowed since the first assessment and a number of indicator trends are negative.** Progress with restoration of native woodland is not sufficient to meet current Scottish Government targets. There has been a scaling back of ambition for improvements in freshwater habitat condition since the publication of the River Basin Management Plans (RBMPs) due to resource constraints. Meanwhile the number of freshwater habitat features with invasive non-native species identified as a pressure is increasing. The presence of pests and diseases in Scotland's forests is increasing, and Dothistroma Needle Blight (DNB) in particular now appears to be endemic. Populations of seabirds and some specialist breeding farmland birds are in decline, though populations of other terrestrial breeding birds are increasing. The ecological status of estuaries in Scotland is poor and is not showing signs of improvement - 15% of estuaries did not meet Good Overall Status in 2016.

**Conclusions cannot be made about vulnerability in some areas where there is a lack of data or gaps in understanding of the risks. For example, there is a lack of research or appropriate metrics to assess the vulnerability of Scottish soils to climate impacts and a recent review concluded that the full extent of erosion or compaction is not currently known.** Updated information on the species mix and rate of planting of vulnerable forest species is also not available.

## 2.2 SCCAP outcome and objectives

The SCCAP contains a high-level outcome: "A Scotland with a productive, healthy and diverse natural environment which is able to adapt to change". There are three objectives for the Natural Environment theme:
















- **Objective N1:** Understand the effects of climate change and their impacts on the natural environment.
- **Objective N2:** Support a healthy and diverse natural environment with capacity to adapt.
- **Objective N3:** Sustain and enhance the benefits, goods and services that the natural environment provides.

To enable a robust assessment of these high-level principles and objectives, the CCC has identified five adaptation priorities for the Natural Environment theme - these priorities are

consistent with those identified in the first assessment. The progress being made in respect of each of these adaptation priorities is assessed in the remainder of this chapter.

## 2.3 Summary of progress

Table 2.1 sets out the summary findings of the analysis set out in this chapter. The criteria applied to determine the overall rating and the RAG scores are set out in Chapter 1.







Table 2.1. Summary assessment - Natural environment				
Adaptation priority	Overall rating	RAG assessment		
		Is there a plan?	Are actions taking place?	Vulnerability assessment
Terrestrial species & habitats	Mixed progress	 Green	 Green	 Amber
Forestry	Mixed progress	 Green	 Green	 Red
Soils and agriculture	High concern	 Amber	 Amber	 Grey
Freshwater rivers & lochs	High concern	 Amber	 Amber	 Red
Marine & coastal ecosystems	Mixed progress	 Amber	 Amber	 Amber

## 2.4 Assessment of progress

### Terrestrial species and habitats

CCC rating	Reason for rating
Mixed progress	Targets for habitat condition and species abundance have been published and monitoring is in place. Notable successes have occurred in meeting peatland restoration targets, with 10,300 ha restored (against a target of 5,100 ha by 2020). Indicators of species abundance and distribution are moving in the wrong direction, suggesting that despite the action underway, the vulnerability of terrestrial species and habitats is increasing.

## Summary RAG assessment

Table 2.2. Summary RAG assessment - Terrestrial species and habitats		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	The Scottish Government's Biodiversity strategy and the National Performance Framework continue to set goals, provide guidance and put in place monitoring for protection of habitats and species.  Peatland restoration targets for 2020 have been exceeded, with £8 million of new funding awarded for the Peatland Action project in 2017/18.	Is there a plan?  Green
Are actions taking place?  Amber		Are actions taking place?  Green
Is progress being made in managing vulnerability?  Amber	The condition of some designated sites is improving.  Populations of 19 out of 23 terrestrial breeding bird populations are increasing. Some specialist breeding farmland bird species are in decline, while generalist species appear to be performing better.	Is progress being made in managing vulnerability?  Amber

### Why is it a priority for adaptation?

The CCRA identifies a number of risks and some potential opportunities to terrestrial species and habitats in Scotland, including changes in climate space<sup>19</sup>, seasonal shifts and changes in phenology, pests and diseases and non-native species. For example:

- Habitats classified as unfavourable will be more susceptible to the pressures from climate change.** The ability of habitats in unfavourable condition to respond quickly enough to changes in climate will be limited. Large habitats with few or minor existing pressures and strong supporting natural processes are more likely to maintain their key functions in the face of climate change than small, fragmented and isolated areas facing additional pressures.
- Climate change could lead to changes in terrestrial biodiversity and ecosystem functions, which not only affect the natural environment, but also have knock-on impacts for society and the economy.** Populations of species under pressure are less likely to be able to adapt to climate change.<sup>20</sup> The geographical location where different species are able to survive is, in part, associated with climate, particularly with temperature. As

<sup>19</sup> Climate space refers to the climatic conditions of an area.

<sup>20</sup> Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborne, S., Leaf, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.J., Tew, T.E., Varley, J., & Wynne, G.R. (2010) *Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra*, <https://webarchive.nationalarchives.gov.uk/20130402170324/http://archive.defra.gov.uk/environment/biodiversity/documents/201009space-for-nature.pdf>

temperatures increase the geographical locations where species are able to survive shifts, usually northwards and to higher elevation. Unless species are able to adapt to the new climate *in situ*, they need to move, tracking suitable habitats. Species that are habitat specialists, are geographically restricted or encounter geographical barriers are least likely to be able to move across the landscape and are potentially the most at risk.

- **Farming is an important economic activity in Scotland, strongly influencing the landscape and providing habitat for many wild species.** Intensification has led to a reduction in suitable areas for wildlife such as birds, butterflies and bees. Projected climate change is likely to provide an opportunity for increased agricultural productivity in Scotland and may further increase agricultural intensification and/or the area of land set aside for agriculture, thereby affecting wild species and adding to pressures on farmland birds. While a lengthened thermal growing season could support increased production without intensification, other negative impacts could include changing flood risks due to vegetation cover changes in the context of changing rainfall patterns, new or emerging pests and diseases, and a shift in the availability of resources for wild species such as birds and pollinators.

The impact of pests and diseases on the forestry sector is considered in the Forestry section of this chapter.

#### *Progress of policies and actions*

The Adaptation Committee made the following recommendation related to terrestrial species and habitats in its 2016 report, encouraging the Scottish Government to strengthen the climate change focus of the Scottish Biodiversity Strategy:

**PREVIOUS RECOMMENDATION 2:** The Scottish Government and Scottish Natural Heritage should by the end of 2017 develop the 2020 Route Map into a clear action plan setting out how the outcomes in the Scottish Biodiversity Strategy will be delivered in the context of climate change.

**RESPONSE:** The Scottish Biodiversity Strategy: 2020 Challenge for Scotland's Biodiversity recognises the need to help nature adapt to climate change, for example through reducing pressures on ecosystems, habitats and species, and making space for natural processes. Ecosystem restoration priorities include peatlands, coastal sand dunes, native woodlands and establishment of saltmarsh to improve resilience to climate change. The Route Map to 2020 sets out large-scale, cooperative actions that will improve ecosystem health so helping nature to adapt to climate change. The second annual report identified that 96% of actions are on track to 2020; with over 10,000ha of peatland under restoration, additional funding allocated for native woodland planting and continued restoration of 19 river Special Areas of Conservation (SACs) through riparian planting to reduce water temperature fluctuations. While the Strategy progress report to Parliament showed many species and habitats improving it also identified the need to focus on particular groups such as seabirds. Future priorities for action will take account of biodiversity pressures including climate change.

The monitoring and reporting framework surrounding the Scottish Biodiversity Strategy aims to ensure transparency in the progress of targets and actions, and the annual progress reports have provided useful evidence for this report. Peatland restoration was identified as a particular area of concern in the CCC's first assessment:

**PREVIOUS RECOMMENDATION 4:** The Scottish Government and Scottish Natural Heritage should by the end of 2017 establish a target in the Scotland National Peat Action Plan for the area of peatland that will be under restoration by 2030 and introduce and monitor a delivery programme for meeting this target.

**RESPONSE:** As per the Climate Change Plan, The Third Report on Proposals and Policies 2018-2032, published February 2018, which set out targets for the restoration and management of Scotland's peatlands of 250,000 hectares of degraded peatlands by 2030. The aim is to make significant progress on achieving restoration of degraded peatlands, from the 1990 baseline, to restore 50,000 hectares of degraded peatland to a healthy state by 2020 and 250,000 hectares by 2030. Restored areas will help mitigate flood risk and improve water quality, as well as helping to increase biodiversity in restored areas.

### **Peatland restoration projects are priorities in Scotland's Biodiversity Route Map to 2020.**

**According to the second annual progress report,** the original goal of restoring 5,100 ha of peatland has been exceeded and over 10,300 ha peatland have now been restored.<sup>21</sup> The Scottish Government's Climate Change Plan sets targets to restore 50,000 hectares of degraded peatland by 2020, increasing to 250,000 hectares by 2030.<sup>22</sup> The Flow Country Peatland Restoration project in northern Scotland continues to establish an international benchmark for good practice, as Europe's largest area of blanket bog. This 'forest-to-bog' restoration is expected to benefit biodiversity, both within restored areas, and by reducing forestry impacts on adjacent bogs. It should also help mitigate climate change, by improving the protection of the peatland stores of soil carbon. Funding is in place from the Heritage Lottery Fund, Peatland Action and the Scottish Rural Development Plan to restore approximately seven square miles of degraded peatlands.

The Peatland Action project has actively promoted restoration of both designated and un-designated peatland habitats, working to promote mitigation and adaptation to climate change. The project continues in 2018/19 with £8 million of new funding.<sup>23</sup> It is understood that a review of peatland restoration is underway by the James Hutton Institute, though the findings of that review are not yet available.

#### *Climate change vulnerability assessment*

**Progress in improving the condition of protected sites and abundance and distribution of species has been mixed. While peatland habitats are improving, there have been declines in the abundance of specialist farmland bird species.**

In March 2018, according to updated indicators produced by ClimateXChange using data from Scottish Natural Heritage (SNH), 79.3% of designated terrestrial sites were in favourable condition, compared with 80% in 2016. There has been a decline of approximately 5.5% in the proportion of notified habitat features in unfavourable condition since 2011. Between 2015 and 2018, the proportion of habitat features in favourable condition increased by 1.7%. During the same period, the proportion of species features in positive condition decreased by 3.6%.

<sup>21</sup> Scottish Natural Heritage (2019) *Scotland's Biodiversity A Route Map to 2020, Second Annual Progress Report 2016/17*, <https://www.nature.scot/sites/default/files/2018-03/Biodiversity-Route-Map-2nd-year-report-29-March-2018.pdf>

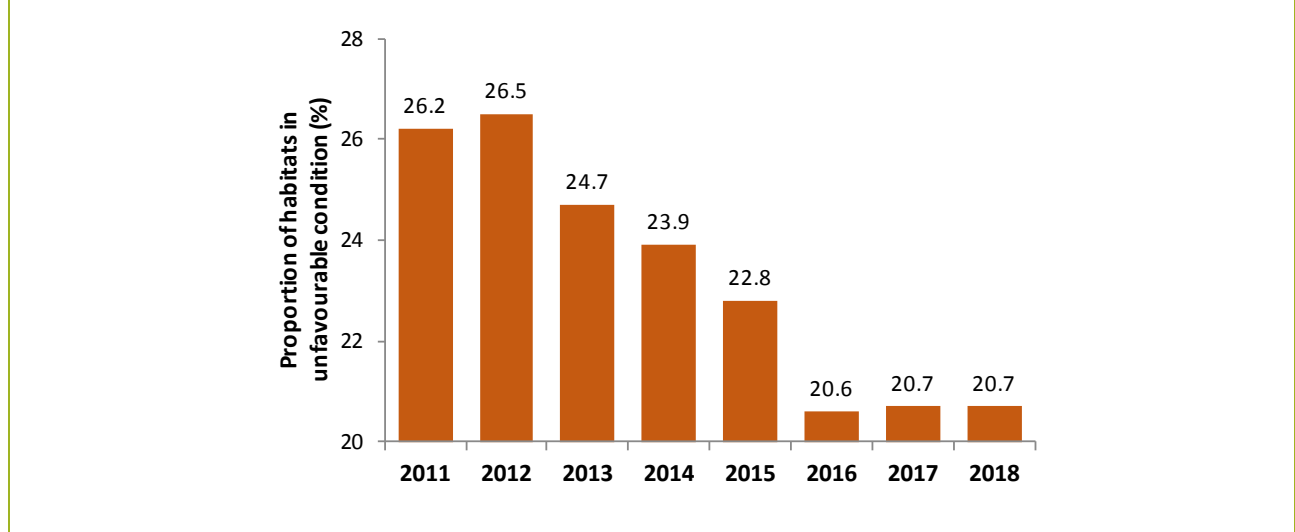
<sup>22</sup> The Scottish Government (2018) *Climate Change Plan, The Third Report on Proposals and Policies 2018-2032*, <https://www2.gov.scot/Resource/0053/00532096.pdf>

<sup>23</sup> Between financial years 2014/15 to 2016/17 the total budget allocated was £7.26 million.



There has been a fall in the number of notified habitats identified as being in unfavourable condition since 2011/12 (Figure 2.1 and 2.2).

**Figure 2.1.** Proportion of notified habitat features in unfavourable condition (2011-2018)



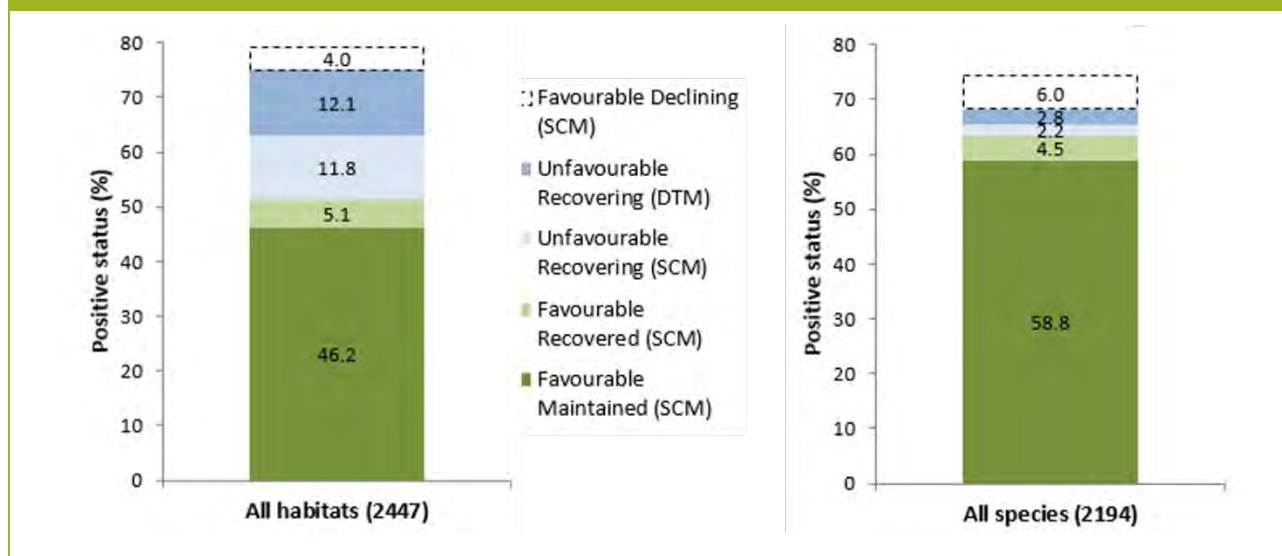
**Source:** ClimateXChange (2018) *Indicator NB12 Condition of key habitats: Proportion of notified habitats in unfavourable condition.*  
[https://www.climatechange.org.uk/media/3444/nb12\\_notified\\_habitats\\_unfavourable\\_2018.pdf](https://www.climatechange.org.uk/media/3444/nb12_notified_habitats_unfavourable_2018.pdf)  
**Notes:** Data derived from Scottish Natural Heritage published statistics.

**Table 2.3.** Proportion of notified habitat features in unfavourable condition (2018)

Habitats	Proportion in unfavourable condition (%)								Change 2011-2018 (%)
	2011	2012	2013	2014	2015	2016	2017	2018	
Coastal (334)	14.5	14.2	13.9	13.8	13.2	11.4	11.1	11.7	-2.8
Grasslands (222)	40.8	38.4	33.3	29.1	27.5	26.1	26.6	24.8	-16.0
Heath (380)	36.2	37.0	32.3	31.3	28.4	24.7	23.9	21.6	-14.6
Upland (346)	20.6	21.5	18.1	17.7	18.5	15.7	16.5	18.5	-2.1
Wetland (348)	23.2	24.1	21.9	19.1	18.8	14.7	14.1	13.5	-9.7
Woodlands (483)	33.3	32.9	34.4	34.3	31.8	30.9	31.9	33.3	0.0

**Source:** ClimateXChange (2018), *Indicator NB12 Condition of key habitats: Proportion of notified habitats in unfavourable condition.*  
[https://www.climatechange.org.uk/media/3444/nb12\\_notified\\_habitats\\_unfavourable\\_2018.pdf](https://www.climatechange.org.uk/media/3444/nb12_notified_habitats_unfavourable_2018.pdf)  
**Notes:** Brackets show total number of habitats.

**Figure 2.2.** Proportion of all notified habitat and species features in positive condition (2018)



**Source:** ClimateXChange (2018) *Indicator NB19 Proportion of notified habitats and species in 'positive' condition* - [https://www.climatechange.org.uk/media/3427/nb19\\_positive\\_conditionpdf.pdf](https://www.climatechange.org.uk/media/3427/nb19_positive_conditionpdf.pdf)

**Notes:** DTM - 'Due to management'; SCM - 'Site Condition Monitoring'. Total number of habitat features in brackets on the x-axes. Data derived from Scottish Natural Heritage published data.

**The majority of measured populations of terrestrial breeding birds are increasing.** The recently published Index of Abundance for Scottish Terrestrial Breeding Birds shows increases in 19 of 23 woodland bird species, and an overall increase since 1994 of around 69% in the woodland species included in the index – contrasting sharply with downward trends in Scottish seabirds, upland and farmland birds, and with woodland birds in other parts of the UK and Europe.<sup>24</sup> Some key woodland species, notably trans-Saharan migrant song birds such as pied and spotted flycatcher, redstart and wood warbler, are currently not encountered often enough in areas monitored by volunteer ornithologists in Scotland to be included in this woodland bird Indicator. There is compelling evidence that European populations of such migrant birds have declined in recent decades, often to a greater degree than resident or short-distance migrants.<sup>25</sup> Scottish Environment LINK supports ambitions to include more species in the Scottish woodland bird indicator in future, as volunteer ornithologists, coordinated by the British Trust for Ornithology, increase the number of surveyed areas in Scotland.

**Some species of specialist breeding farmland birds are in decline; generalist species appear to be performing better.** In 2015 to 2016 (the short-term change), the unsmoothed Index of Abundance for Scottish Farmland Birds declined by 16%. Overall numbers of farmland birds have fallen from the peak seen in 2008, but are above the 1994 baseline level. Trends for individual species indicate that 14 species (out of 27 recorded species) increased in abundance (between 1994 and 2016). This included goldfinch, their increasing numbers being attributed in part to additional sources of food, such as nyjer seed in bird feeders. One species remained

<sup>24</sup> SNH (2018) *Index of Abundance for Scottish Terrestrial Breeding Birds, 1994 to 2017, An Official Statistics Publication for Scotland*, <https://www.nature.scot/information-library-data-and-research/official-statistics/official-statistics-terrestrial-breeding-birds>

<sup>25</sup> JA Vickery et al. (2013) *The decline of Afro-Palaearctic migrants and an assessment of potential causes*. *Ibis* 156 pp1-22.

stable and twelve decreased in abundance, with long term decreases recorded for lapwing, greenfinch, linnet, skylark and kestrel. Seed eating birds have increased in abundance, although since 2007 the trend has been flat. Farmland waders have undergone a steep decline between 1995 and 2010.

Agricultural intensification is a major driver in the long-term decline of a number of species, due to changes such as draining wetlands, sowing cereals in autumn and increased fertiliser and pesticide use. Declines in other species are associated with disease outbreaks, such as trichomonosis in greenfinches. Declines in farmland waders are driven by a range of factors including land-use change. Different species of waders require different habitat conditions for successful breeding and predation has also been shown to be reducing breeding success of waders.<sup>26</sup>

Monitoring systems for the condition of sites and species were identified as areas of concern in the first SCCAP assessment in 2016 and are currently under review by SNH:

**PREVIOUS RECOMMENDATION 3:** Scottish Natural Heritage should commit to developing a monitoring system before the next SCCAP which can measure (a) the impact of climate change on the condition of sites and species and (b) the effectiveness of conservation interventions, thereby enabling the tracking of progress towards favourable ecological condition.

**RESPONSE:** Site Condition Monitoring as we currently operate it will not be with us very much longer. In line with the Protected Areas 2020 project, specialists are currently working on realigning our protected areas related monitoring to better fit with an ecosystem approach and thereby better contribute to Scottish Biodiversity Strategy delivery. In particular, we are considering how we best go about detecting the large scale drivers of change – whether that be climate change or nitrogen deposition.

**Invasive non-native species (INNS) are the most common pressure affecting protected areas in Scotland (Figure 2.3).**<sup>27</sup> INNS impacts are increasing at world scale<sup>28</sup>, at continental scale<sup>29</sup>, and at UK scale.<sup>30</sup> Climate change and INNS have negative synergistic effects.<sup>31</sup> Climate change facilitates the spread and establishment of many alien species and creates new opportunities for them to become invasive. Invasive alien species (IAS) can reduce the resilience of natural habitats. The IUCN recommends that 'it is essential that IAS be incorporated into climate change policies'.<sup>32</sup>

<sup>26</sup> ClimateXChange (2018) *Indicator NA5: Trends in breeding farmland birds*, [https://www.climateexchange.org.uk/media/3402/na5\\_farmland\\_birds\\_aug2018.pdf](https://www.climateexchange.org.uk/media/3402/na5_farmland_birds_aug2018.pdf)

<sup>27</sup> Scottish Natural Heritage (2018) *The Proportion of Scotland's Protected Sites in Favourable Condition 2018: An Official Statistics Publication for Scotland*.

<sup>28</sup> McGeoch, M.A. et al. (2010) *Global indicators of biological invasion: species numbers, biodiversity impact and policy responses*. *Diversity and Distributions* 16, 95–108; Seebens H et al. (2017) *No saturation in the accumulation of alien species worldwide*. *Nature Communications* volume 8, Article number: 14435 (2017).

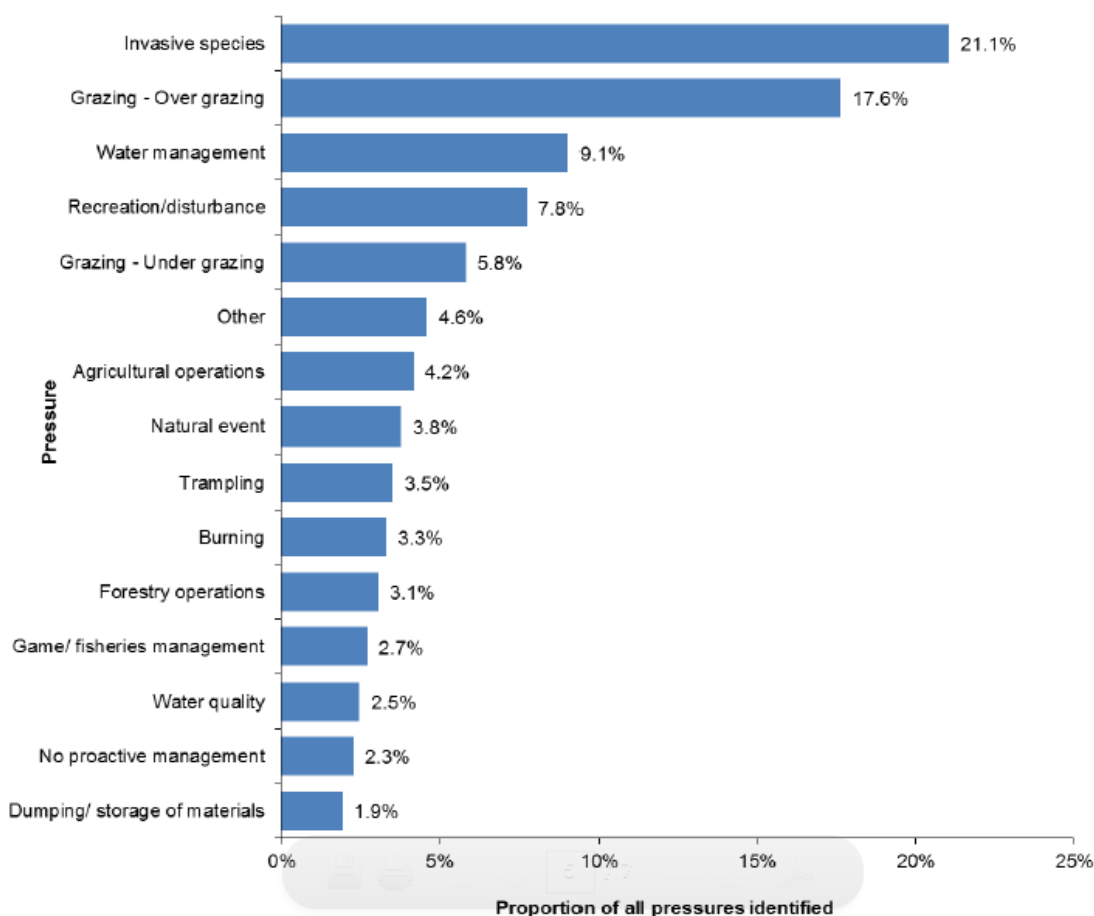
<sup>29</sup> Hulme, PE, Pysek, P Nentwig, W Vilà, M (2009) *Will Threat of Biological Invasions Unite the European Union?* *Science* 324, 40–41.

<sup>30</sup> Roy, HE et al. (2012) *Non-Native Species in Great Britain: establishment, detection and reporting to inform effective decision making*.

<sup>31</sup> Vilà, M, JD Corbin, JS Dukes, J Pino, and SD Smith. (2007) *Linking plant invasions to global environmental change*, in J.Canadell, D.Pataki, and L.Pitelka, editors. *Terrestrial ecosystems in a changing world*. Springer-Verlag, New York.

<sup>32</sup> IUCN Issues Brief, <https://www.iucn.org/resources/issues-briefs/invasive-alien-species-and-climate-change>

**Figure 2.3.** Summary of the main negative pressures on natural features on protected sites









**Source:** Scottish Natural Heritage (2018) *The Proportion of Scotland's Protected Sites in Favourable Condition 2018: An Official Statistics Publication for Scotland.*

**Notes:** Data correct as of 31st March 2018. Pressures are recorded for all natural features assessed in all conditions.

## Forestry

CCC rating	Rationale for rating
Mixed progress	Whilst SCCAP policies and actions are progressing, the CCC has continuing concerns about the increasing prevalence of pests and diseases, including Dothistroma Needle Blight which is now considered endemic. Goals for woodland restoration are not being met. Further urgent efforts are needed in the second SCCAP to consider how to reduce vulnerability to pests and diseases through increasing the diversity of tree planting, moving away from vulnerable pine species, and publishing updated statistics. The establishment of the Centre of Expertise in Plant Health is a positive step and the next SCCAP should include specific actions to address the concerns raised.

## Summary RAG assessment

Table 2.4. Summary RAG assessment - Forestry		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Green</p>	<p>Scotland's Forestry Strategy is currently under review. The consultation report signposts the high level adaptation priorities being proposed in the strategy for 2019 - 2029.</p> <p>The UK Forestry Standard was updated in 2017, though adaptation measures remain voluntary.</p>	<p>Is there a plan?</p>  <p>Green</p>
<p>Are actions taking place?</p>  <p>Green</p>	<p>The Generic Contingency Plan for Plant Health in Scotland is under revision and a Centre of Expertise in Plant Health was launched in 2018.</p> <p>Decision support tools for forest managers have been upgraded and include climate change projections.</p> <p>The Scottish Windblow Contingency Plan was published in October 2018.</p>	<p>Are actions taking place?</p>  <p>Green</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>The proportion of designated woodland features in favourable condition remains stable after an initial improvement in long-term condition.</p> <p>Targets for woodland restoration are not being met.</p> <p>The presence of Dothistroma Needle Blight is increasing and an updated Planted Forest Tree Species Diversity Index is not available.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Red</p>

### Why is it a priority for adaptation?

#### Scottish forestry contributes nearly £1 billion to Scotland's economy every year - £771

million comes from forestry and timber processing and £183 million comes from forest recreation and tourism.<sup>33</sup> The sector is also a growing employer, with more than 25,000 full-time equivalent (FTE) working in the sector in 2015.

#### The evidence in the UK Climate Change Risk Assessments identifies a number of key risks and opportunities for Scottish Forestry from climate change.<sup>34</sup>

#### Scotland has the highest proportion of woodland area in the UK with over 1.2 million ha.

Under Scotland's Climate Change Plan, there is a target to increase forest area from 18% in 2016 to 21% by 2032, increasing the planting rate over time to 15,000 hectares per year from

<sup>33</sup> CJC Consulting (2015) *The economic contribution of the forestry sector in Scotland*, <https://scotland.forestry.gov.uk/images/corporate/pdf/economic-contribution-forestry-2015.pdf>

<sup>34</sup> DEFRA et al. (2012) *A climate change risk assessment for Scotland*; CCC (2016) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*.



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2024/25.<sup>35</sup> Under Scotland's National Planning Framework there is a further policy aspiration to increase the proportion of woodland cover to 25% by 2050. The warming climate could allow for a potential expansion of land used for forestry in Scotland with likely increases in tree growth rates in some areas because of a lengthened and warmer growing season.<sup>36</sup> However, there are also a number of risks to forestry as a result of a changing climate, set out in the CCRA.

**There has been a rise in recorded non-native species in Scotland, with an estimated 1,160 non-native species sub-species now established in the wild.** Invasive species like rhododendron are already causing substantial problems, affecting ground and understorey flora, competing for water and nutrient resources and inhibiting natural tree regeneration. Invasive species were present in 19% of Scottish native woodlands surveyed in 2014, with well over half (65%) of these being rhododendron.

**Pests and diseases pose a significant risk and there are a number of pests and diseases of concern for forestry in Scotland, including Xyella, Phytophthora, Chalara (ash dieback) and Dothistroma Needle Blight (DNB). There has been a rapid increase over recent years in the potential exposure of Caledonian pinewood to DNB.** As pine woodland comprises about one quarter of the total forest area in Scotland, DNB represents a significant threat to the forest resource. There is some evidence to suggest that increased rainfall in spring and summer, coupled with a trend towards warmer springs, is optimising conditions for spore dispersal and infection.

**Wind and snow storms cause approximately half of all damage to forests.** Storms cause immediate damage (loss of timber stock, costs of clear-up), disruption to markets and processing and can increase subsequent risk of damage to trees from insects, pests and wildfires. Predicting future changes in storm tracks is highly uncertain, but warmer autumns with consequent later leaf loss, are likely to increase the risk of damage in deciduous species.

**Wildfire can damage woodlands with loss of timber, habitat and ecosystem services, cause short-term disruption to local populations and infrastructure and may cause health risks.** When organic soils, particularly peat, are affected by fire the damage can be widespread in depth and extent because of the large fuel supply and difficulties of suppression. Recent events in the UK such as the wildfire at Saddleworth Moor in June 2018 show the extent of damage that such fires can cause.<sup>37</sup> Projected increases in drier summers and higher soil moisture deficits would be expected to lead to a large increase in the number of fires and the area affected. Increased tree mortality from droughts and from pests and diseases may in turn increase wildfire risk.<sup>38</sup>

### *Progress of policies and actions*

**Scotland's Forestry Strategy is currently under review and the consultation report signposts the high-level adaptation priorities being proposed in the strategy for 2019 -**

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<sup>35</sup> The Scottish Government (2018) *Climate Change Plan, Third Report on Proposals and Policies 2018-2032 (RPP3)*, <https://www.gov.scot/publications/scottish-governments-climate-change-plan-third-report-proposals-policies-2018-9781788516488/>

<sup>36</sup> For example, Sitka spruce growth rates may increase by up to 2.8 m<sup>3</sup> per hectare per year for each 1°C warming, if water is not limiting.

<sup>37</sup> RSPB (2018) Blog post, <https://community.rspb.org.uk/ourwork/b/martinharper/posts/the-saddleworth-fire-and-the-importance-of-restoring-our-peatland-habitats-in-tackling-climate-change>

<sup>38</sup> CCC (2017) *UK Climate Change Risk Assessment 2017 Evidence Report*, Ch 3 p. 83.

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**2029.**<sup>39</sup> These are to protect forests and woodlands from damage caused by new or existing pests and diseases, promote the sustainable management of wild deer and build resilience to support adaptation to climate change.

**The UK Forestry Standard for sustainable forest management was reviewed in 2017.** While the two climate change adaptation measures in the standard remain voluntary, compliance with these good practice guidelines is a requirement for the approval of long term Forest Plans by Forestry Commission Scotland (FCS). FCS has published guidance on how to create and improve forest plans, and completed plans are subject to scrutiny by FCS as part of the approvals process.

**Restoration of native woodland is a priority project under Scotland's Biodiversity Route Map to 2020, however two of the woodland restoration targets are not on track for 2020.**<sup>40</sup>

Progress with restoration of native woodland is assessed in the latest biodiversity route map progress report as currently not sufficient. Two of the three targets may not be achieved by 2020. To further stimulate planting, new funding support from FCS is available for woodland creation, including native woodlands in the Cairngorms National Park and new grant rates are available specifically for native woodlands in remote areas of the Highlands. Additional funding and support from SNH is being made available to support improved deer management planning. FCS continues to work closely with the Association of Deer Management Groups and the Lowland Deer Network Scotland to make improvements in identifying and reducing negative deer impacts in woodland, which in turn will improve overall condition of the habitat.

**Progress with restoration of native woodland is currently insufficient to meet the targets set in the Scottish Government's Biodiversity Route Map.** Two of the three targets may not be achieved by 2020:

- **Target 2:** Increase the amount of native woodland in good condition (upwards from 46%) is **on track**. The percentage of woodland features in protected areas in favourable condition increased from 66% in 2014 to 68% in 2017, though it fell back to 67% in 2018.
- **Target 3:** 3,000 to 5,000 ha new native woodland creation per year - **insufficient progress**. An area of 8,981 ha of new native woodland has been created by land managers in the three years between April 2014 and April 2017.
- **Target 4:** Restore approximately 10,000 ha of native woodland into satisfactory condition in partnership with private woodland owners through Deer Management Plans - **insufficient progress**. Since 2015, the annual management grants for native woodlands which include a deer management plan and control component is 7,244 ha. Applications covering a further 2,400 ha for the development of deer management regimes to improve woodland condition are being assessed.

**The Scottish Government is currently revising the Generic Contingency Plan for Plant Health Incidents in Scotland and is planning a contingency planning exercise later in 2018/19.** A Centre of Expertise in Plant Health was launched in February 2018 and a Chief Plant Health Officer for Scotland was appointed in February 2017. Horizon scanning for new pest and disease threats continues for the UK Plant Health Risk Group. This includes the Forestry

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<sup>39</sup> The consultation draft of the 2019-29 strategy is available at [https://consult.gov.scot/forestry/scotlands-forestry-strategy-2019-29/user\\_uploads/sct08184172781.pdf](https://consult.gov.scot/forestry/scotlands-forestry-strategy-2019-29/user_uploads/sct08184172781.pdf)

<sup>40</sup> Scottish Natural Heritage (2019) *Scotland's Biodiversity: A Route Map to 2020, Second Annual Progress Report 2016/17*.

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Commission's Crossborder Plant Health team, with input from Scottish Government and FCS staff, developing specific contingency plans for a number of forest pests.

**The Statutory Group on Non-Native Species, chaired by SNH, continues to develop capability in Scotland to respond to invasions, track responses and learn from them.** FCS has published guidance that details the responsibilities of forest owners and managers, and offers advice on how to reduce the risk of invasive spread through forest planning and management. In particular and to support this work, FCS have published an approach to prioritise control of rhododendron in Scotland, and guidance for delivering control projects of Invasive Non Native Species (INNS). The Action Group also supports the delivery of relevant parts of the Scottish Biodiversity Strategy Route Map Priority Projects.

**The Scottish Wildfire Forum (SWF) is a partnership between the Scottish Fire and Rescue Service (SFRS) and major stakeholder representatives,** including land owners, forming partnerships with colleagues in England, Wales and Northern Ireland to ensure members can share experiences, tactics and training opportunities. SFRS and SWF encourage tourists and communities to help reduce the number of wildfires by considering the impact of their actions.

Work is ongoing to refine the wildfire warning messages. The 2017 edition of the UK Forestry Standard requires that the risks from fire are considered as part of forest planning and management responses to climate change. In addition, FCS is working with the Scottish Government to investigate the opportunity presented by satellite imagery to speed up assessment of the scale of impact should there be a catastrophic event. This work has been commissioned and was due to report in late spring 2018 (not yet published).

**Online forest management tools have been upgraded and their use is increasing in the short term.** The Ecological Site Classification (ESC) tool was upgraded in 2017 and incorporates future climate change projections for 2050 and 2080 to allow users to incorporate future tree species suitability into planting decisions. The number of uses of the tool in the UK increased from 23,186 in 2016 to 39,375 in 2017. The ForestGALES tool for estimating the probability of wind damage has also been recently updated. The number of uses of ForestGALES increased from 1,320 in 2016 to 3,662 in 2017.<sup>41</sup> Whilst it is positive that use of these tools in the UK is increasing, data for Scotland is not available and it has not been possible to assess longer term trends in numbers of uses and users of the tools.<sup>42</sup> Further, effectiveness of the tools, i.e. whether use of the tools improved decision making from a climate change adaptation perspective, cannot be assessed from use trends alone.

**The Scottish Windblow Contingency Plan was published in October 2018, and sets out the approach to planning for and responding to catastrophic wind events in Scottish Forests.**<sup>43</sup> Forest Research have concluded that winds of greater than 90 mph are likely to cause incidents of catastrophic windblow and therefore winds of this level are the key trigger for the contingency plan to come into force.<sup>44</sup> Responses to such an event are led by the Regional Resilience Partnerships (RRPs) or Local Resilience Partnerships (LRPs), dependent on the scale of the event, as well as the Strategic Windblow Action Committee (SWAC).

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<sup>41</sup> The figures only represent online use of Forest GALES. The tool is also available for download with a greater range of functions. The total use of ForestGALES is therefore under estimated in the figures presented.

<sup>42</sup> Due to changes in data collection, the number of users of the tools is no longer tracked.

<sup>43</sup> Forestry Commission Scotland (2018) *Scottish Windblow Contingency Plan: A strategy for dealing with catastrophic windblow events in Scottish forests*, <https://scotland.forestry.gov.uk/images/corporate/pdf/Scottish-Windblow-Contingency-Plan.pdf>

<sup>44</sup> *Ibid.*

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## *Climate change vulnerability assessment*

**The proportion of designated woodland features in favourable condition remains stable after an initial improvement in long-term condition.**<sup>45</sup> In March 2018, 67% of these woodland features were in favourable or recovering condition. This represents a small decline from 2017 (68%) but a longer term increase from 59% in 2005. There is currently no evidence of any condition improvement in undesignated woodland.

**Targets for woodland restoration are not being met.** Scotland's Biodiversity Route Map sets a target to achieve the restoration of approximately 10,000 ha of native woodland through deer management plans by 2020. This target is currently not on track. At present, SNH are unable to calculate the area of native woodland with active, approved deer management plans. However, since 2015, the annual management grants for native woodlands that include a deer management plan and control component is 7,244 ha. Applications covering a further 2,400 ha for the development of deer management regimes to improve woodland condition are being assessed. All of these plans would need to be implemented in order to achieve the restoration target. In an effort to get progress back on track, new funding support from FCS is available for woodland creation, including native woodlands in the Cairngorms National Park and new, more attractive grant rates are available specifically for native woodlands in remote areas of the Highlands. Additional funding and support from SNH is being made available to support improved deer management planning. A 2016 Report on deer management showed that much of Scotland's native woodland is protected from deer impacts by deer fences which are ageing, with at least 3,000 km of fences greater than 17 years old around designated woodlands alone.<sup>46</sup>

Lack of deer management is only one of the reasons for woodland restoration targets not being met. More data is needed and action to address the under-management of native woodland, including to address the control of Rhododendron and other invasive non-native species.

**New native woodland planting targets have not been met.** Scotland's Biodiversity Route Map sets a target for the creation of between 3,000 and 5,000 ha of new native woodland per annum and 8,981 ha of new native woodland was created by land managers between 2014 and 2017. Planting rates are expected to increase following additional measures that have been put in place over the last year to respond to the outcomes of the Mackinnon review<sup>47</sup> and targets in the Scottish Government's Climate Change Plan. However, the recent Scottish Forestry Strategy consultation did not propose any new actions to meet this target or increase the target. New native woodland planting is important in reducing vulnerability by allowing native species populations to increase and become more robust, and to allow species to move through greater connectivity.

**The presence of Dothistroma Needle Blight (DNB) in Scotland is increasing and updated data on the rate of planting of vulnerable species is not available.** Although DNB infections have not been found in Scottish forest tree nurseries since 2014, the disease remains a major cause of concern to the forest tree nursery sector, not only from a business risk perspective but also in relation to future plant supply requirements from the wider forestry sector. The latest statistics from Forestry Commission Scotland show that the presence of Dothistroma Needle

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<sup>45</sup> Sites are designated for their woodland features (habitats) or woodland-related species under EU or national designations.

<sup>46</sup> SNH (2016) *Deer Management in Scotland: Report to the Scottish Government from Scottish Natural Heritage 2016*, <https://www.nature.scot/deer-management-scotland-report-scottish-government-scottish-natural-heritage-2016>

<sup>47</sup> The review looked at the current arrangements for the consideration and approval of forestry planting proposals and to make recommendations for improvements to the process.

Blight (DNB) is increasing in all species surveyed. Extensive surveys on the national forest estate since 2006 have indicated the presence of DNB in 11,000 ha of pine woodland on the national forest estate representing 76% of surveyed Corsican pine sub-compartments<sup>48</sup> (up from 71% in CCC's first assessment), 27% of lodgepole pine (up from 26% in first assessment) and 26% of Scots pine sub-compartments (up from 21% in first assessment). The distribution of these sites indicates that the disease is now endemic.<sup>49</sup>

**Increasing the diversity of tree species and reducing mono-culture planting in Scotland has the potential to increase woodland resilience to pests and diseases, as well as delivering other benefits such as climate change mitigation and supporting a wider market.**

The introduction of more exotic non-native species into forestry could exacerbate pressures on native wildlife and habitats. An updated planted forest tree species diversity index for Scotland has not been available for this assessment. The index was last updated in 2016 and showed that overall species diversity has increased between 1995 and 2014 but there has been minimal change in the conifer species mix over that time.<sup>50</sup> There also remains minimal evidence that diversity in the stock of new trees ordered for planting in Scotland is increasing.<sup>51</sup>

The spread of pests and pathogens in Scottish Forests was identified as an area of concern by the Adaptation Committee in the first assessment report:

**PREVIOUS RECOMMENDATION 9:** Forestry Commission Scotland should consider by the end of 2017 whether additional action is needed to reduce the spread of pests and pathogens, particularly where they threaten native Caledonian pinewoods, and whether further action to increase species diversity in the National Forest Estate would be beneficial in order to build resilience to climate change.

**RESPONSE:** Through the Land Management Planning Process, Forest Enterprise Scotland regularly reviews all plans to make sure they are fit for a changing climate and for the threat of pests and diseases. Key planning principles include planning at a landscape scale to include connectivity and improve tree species diversity - refer to page 13 ref 5 of FES Restocking Strategy. Through the Resilience Programme, Forest Enterprise Scotland is developing a decision making framework to inform decisions about species choice, recognising the importance of maintaining productivity but also the need to prepare for a changing climate and threats of pests and diseases. Alternative species and mixture of species are being considered and used in Land Management Plans to help reduce the impact of catastrophic events on single trees species. To address windthrow risk, in large upland forests (where possible), Forest Enterprise Scotland aims to design coupes so that if one coupe suffers catastrophic wind damage the adjacent coupe can be independent and unaffected and can have a different intervention/fell date.

<sup>48</sup> A sub compartment is an area of land that has similar land use, species, habitat composition, age, thinning and harvesting operations and needs to be managed as a single unit. Each sub-compartment has a range of attributes in relation to land use and if forested, tree species composition and management.

<sup>49</sup> Forestry Commission Scotland (2017) *Dothistroma Action Plan for Scotland*, <https://scotland.forestry.gov.uk/images/corporate/pdf/dothistroma-needle-blight-action-plan-scotland-2017.pdf>

<sup>50</sup> ClimateXChange (2016) *Indicator NF5 Planted forest tree species diversity index*, <https://www.climatechange.org.uk/research/indicators-and-trends/indicators/nf5-planted-forest-tree-species-diversity-index/>

<sup>51</sup> In 2012, Sitka spruce accounted for 75% of the 25 million new conifer trees ordered for planting.



Given the lack of progress against targets and the increasing presence of pests and pathogens noted above, greater effort is required to increase resilience of Scottish forests to climate change:





**NEW RECOMMENDATION 4:** Increase efforts to manage and reduce the spread of disease in order to increase resilience to climate change, including Dothistroma Needle Blight (DNB) and other pests and pathogens.

## Soils and agriculture



CCC rating	Rationale for rating
High concern	A number of key targets and actions for soil conservation and sustainable land management are not on track and there are insufficient data and metrics to assess the vulnerability of soils to climate impacts. The Committee feels that sufficient progress has not been made over the first SCCAP period in better understanding and addressing soil health, given its critical role as a fundamental natural asset.

### Summary RAG assessment

**Table 2.5.** Summary RAG assessment - Soils and agriculture

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Amber	The Scottish Government's Land Use Strategy 2016 – 2021 continues to set the policy direction for greater integration of land use and the delivery of multiple benefits from land. There is no action plan for delivery and a lack of tangible action taking place.  Sustainable Land Management is a priority project in the Scottish Biodiversity Strategy Route Map to 2020, but not all actions are on track.  Targets to support biodiversity under the Common Agricultural Policy are not currently on track. The extent to which soil management will be covered in post-CAP policy is not yet known.  No action has been taken to deliver the vision in the Scottish Soils Framework that “soils are safeguarded for existing and future generations”.	Is there a plan?  Amber
Are actions taking place?  Green		Are actions taking place?  Amber

**Table 2.5. Summary RAG assessment - Soils and agriculture**

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is progress being made in managing vulnerability?</p>  <p>Red</p>	<p>There is limited data available to assess the vulnerability of Scottish soils to climate impacts - a report by the James Hutton Institute for ClimateXChange has collated the current state of knowledge for soil compaction and erosion in Scotland.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Grey</p>

*Why is it a priority for adaptation?*

**Currently around 6% of Scotland’s land is considered to be 'prime land'**.<sup>52</sup> Analysis using UK climate projections, both UKCIP02 and UKCP09, indicates a potential climate-driven increase in the area of prime land by 20 - 40% by the 2050s.<sup>53</sup> That would amount to an increase of between 1.2% and 2.4% of Scotland's total land area.

The potential for an increase in productivity due to a larger area of higher grade agricultural land is, however, at least partially dependent on maintaining soil quantity and quality in the future (as well as water availability and quality).

**Soil erosion can lead to the loss of soil organic material, resulting in reduced soil fertility and the loss of soil carbon, releasing stored carbon to the atmosphere thereby increasing greenhouse gas emissions.** Soil erosion is also detrimental to watercourses, leading to increased sedimentation and, in the case of soil erosion on arable land, increased pollution by fertilisers and pesticides. Rates of soil erosion may increase with increasing rainfall intensity. Climate projections for Scotland indicate more heavy rainfall days and an increase in winter rainfall.

*Progress of policies and actions*

**The Scottish Government's Land Use Strategy 2016 – 2021 continues to set the policy direction for greater integration of land use and the delivery of multiple benefits from land. There is no action plan for delivery and a lack of tangible action taking place.** The new Strategy contains a number of policies and proposals relating directly to the need for a more integrated approach, for example exploring regional land use partnerships and the scope for regional land use frameworks. There is no commitment or assessment of progress, on the roll out of regional land use frameworks.

<sup>52</sup> DEFRA et al. (2012) *A climate change risk assessment for Scotland*. Based upon the established Land Capability for Agriculture (LCA) system, the best quality land for agriculture is defined as prime land. Note this refers to potential, not actual, land use (see ClimateXChange indicator NA2 Area of Prime Agricultural Land - Land Capability).  
<sup>53</sup> Brown, I., Towers, W., Rivington, M. & Black, H. (2008) *Influence of climate change on agricultural land-use potential: adapting and updating the land capability system for Scotland*. *Climate Research*, 37, 43-57; Gimona, A. & Castellazzi, M. (2011) *Climate change, drought risk and land capability for agriculture: implications for land use in Scotland*. *Regional Environmental Change*, 11, 503-518 (see ClimateXChange indicator NA2 Area of Prime Agricultural Land - Land Capability).

## **Sustainable Land Management is a priority project in the Scottish Biodiversity Strategy**

**Route Map to 2020.** It includes a target to promote measures to support biodiversity under the Common Agricultural Policy. In the most recent progress report, five actions towards this target were reported as on track, two have insufficient progress and one has no significant progress:

- the Ecological Focus Area (EFA) CAP greening measure has been successfully implemented.
- a commitment to implement a compulsory Nutrient Management Plan for grassland farmers has not been implemented.
- approximately 38 farms and estates have achieved accreditation under The Wildlife Estates Scotland (WES) Initiative but the rate of progress is slower than anticipated.
- the Scottish Rural Development Programme Environmental Co-operation Action Fund (ECAAF) scheme was withdrawn following the first year due to audit concerns. No contracts were awarded.

The Scottish Government's 2016 – 2021 Strategic Research Portfolio is investing around £48 million a year in a portfolio of strategic science and research. In 2017 – 2018 this strategic research investment was used to support three major five year research programmes on Natural Assets, Productive and Sustainable Land Management and Rural Economies and Food, Health and Wellbeing.

**No action has been taken to deliver the vision in the Scottish Soils Framework that 'soils are safeguarded for existing and future generations'.** This was identified as an area of concern by the CCC in its first assessment report and the Scottish Government have indicated that this will be addressed in the next iteration of the SCCAP:

**PREVIOUS RECOMMENDATION 8:** The Scottish Government should take action to deliver the vision in its Soils Framework that “soils are safeguarded for existing and future generations”. An action plan should be published before the next SCCAP, which includes proposals for: establishing a scheme to monitor the health of agricultural soils and the uptake of soil conservation measures, and taking enforcement action where poor management practices are found.

**Response:** Currently no action has been taken forward in developing an action plan, however further consideration will be given to this area in the new SCCAP.

### *Climate change vulnerability assessment*

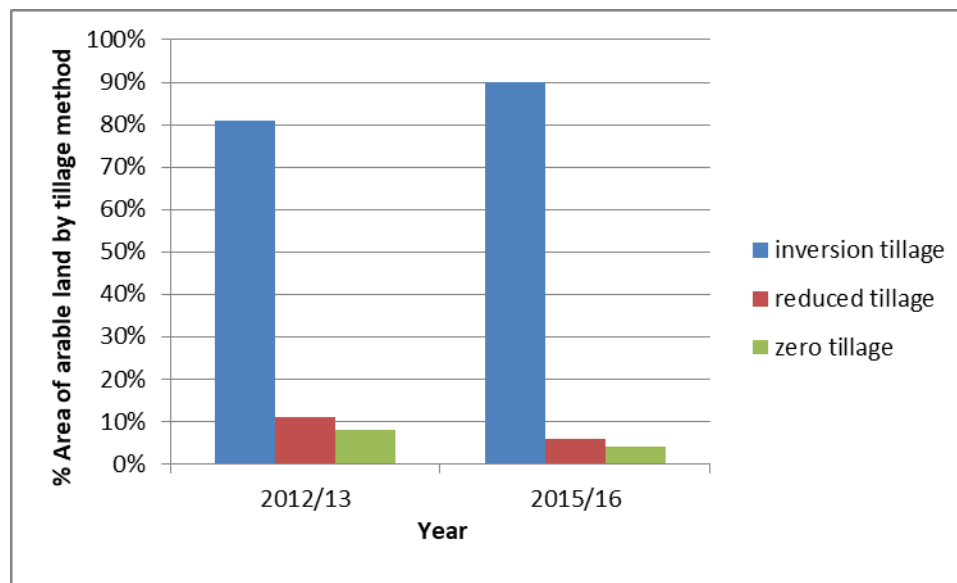
#### **There is limited data available to assess the vulnerability of Scottish soils to climate**

**impacts.** A recent report by the James Hutton Institute for ClimateXChange has collated the current state of knowledge for soil compaction and erosion in Scotland.<sup>54</sup> The report concludes that the full extent of erosion or compaction in Scotland is not currently known. Current models allow us to assess risk to help minimise impact but more information is needed on the interaction between climate and soils (and compaction and erosion) to improve predictions of when, or if, a soil erodes or becomes compacted.

<sup>54</sup> Lilly, A., Baggaley, N.J., Loades, K.W., McKenzie, B.M. and Troldborg, M. (2018) *Soil erosion and compaction in Scottish soils: adapting to a changing climate*, <https://www.climatechange.org.uk/research/projects/soil-erosion-and-compaction-in-scottish-soils-adapting-to-a-changing-climate/>

While long term trends cannot currently be assessed, there is some evidence on the use of agricultural production methods that reduce erosion risk. Useful statistics have been collected through ClimateXChange on different tillage methods for arable land in Scotland. Reduced and zero tillage was used less in 2016 than in 2013 (down from 19% combined in 2013 to 10% combined in 2016) (Figure 2.4), which may suggest an increased risk of soil erosion. The reason for the reduction in use is not known.

**Figure 2.4.** Area of arable land in Scotland by tillage method (2012/13 and 2015/16)



**Source:** ClimateXChange (2018) *Indicator NA12: Agricultural production methods which reduce erosion risk (Proportion of arable land using reduced/zero tillage; soil cover)* - [https://www.climatexchange.org.uk/media/3408/na12-agri-production-methods\\_2018\\_ir.pdf](https://www.climatexchange.org.uk/media/3408/na12-agri-production-methods_2018_ir.pdf). Data from Scottish Survey of Farm Structure and Methods, 2013-2016.

The area of agricultural land being left bare decreased from 17% in 2013 to 13% in 2016.<sup>55</sup> Land left bare over winter is often as a result of autumn ploughing, allowing the frost and weather to break down the bare soil, which creates an erosion risk. Plant residues and stubbles also declined in this period, whilst winter cropping, which may also leave soil vulnerable to erosion as it relatively more bare, increased. Long term trends cannot be assessed, but it will be useful for this assessment to continue to monitor these trends in the future.

**An update on the soil carbon content of arable land in Scotland is not available**, since the Countryside Survey has not been completed since 2007. Between 1998 and 2007 there was a 9% decline in the mean soil carbon concentration in arable and horticultural soils in Scotland, from 36 g/kg in 1998 to 32 g/kg in 2007.<sup>56</sup> The drivers of this reduction were reported as including climate change, nutrient deposition, agricultural intensification, increasing atmospheric CO<sub>2</sub>

<sup>55</sup> The Scottish Government (2016) *Scottish Survey of Farm Structure and Methods, Scottish statistics from the EU Farm Structure Survey 2016*, <https://www.gov.scot/publications/scottish-survey-farm-structure-methods-2016/>

<sup>56</sup> ClimateXChange (2015) *Indicator NA11 Soil carbon concentration in arable soils*, <https://www.climatexchange.org.uk/research/indicators-and-trends/indicators/na11-soil-carbon-concentration-in-arable-soils/>

concentrations, and land use management changes. Overall, agricultural intensification was considered likely to be the dominant factor.<sup>57</sup>

**Available evidence on pests and disease risks to the agriculture sector is patchy.** Future climate change is predicted to have a significant impact on prevalence of infection, changing the epidemiology and increasing incidence of disease. There is some evidence of increasing livestock diseases, which are expected to become more prevalent under climate change. Liver fluke is a common parasite that affects sheep and cattle in the UK. It is thought that fluke costs UK agriculture at least £300 million a year through direct losses, but real costs are probably much higher. Fluke has become much more common over the past 10 years, attributed partly to changing weather patterns (the parasite favours wet summers and mild winters). In a recent study, Moredun Research Institute found that 75% of dairy herds had evidence of fluke infection.<sup>58</sup> Increased cattle movements and changes to both farm management and environmental schemes are exacerbating the problem.

**NEW RECOMMENDATION 1:** Work with partners to measure rates of soil erosion including the uptake of soil conservation measures by farmers

A lack of monitoring and evaluation is highlighted in several places throughout this report and was identified as an area of concern in the Adaptation Committee's first assessment of the SCCAP in 2016:

**PREVIOUS RECOMMENDATION 1:** In preparing the next SCCAP the Scottish Government should: address all of the urgent risks and opportunities for Scotland identified in the 2017 UK Climate Change Risk Assessment; identify a senior owner for each objective that can be held accountable for delivery; list the specific actions that will be taken to achieve each objective together with appropriate milestones and timescales; introduce an effective monitoring and evaluation regime, to allow the impact of actions and delivery of each objective to be fully assessed; and co-ordinate the actions being taken within each sector especially where they appear within different themes of the SCCAP.

**RESPONSE:** The Scottish Government is developing the next SCCAP for publication in 2019. A programme of external engagement is currently underway. The outcome based approach that is planned will address the urgent risks and opportunities identified in the UK CCRA. We are engaging with policy sectors throughout government and individual sectors will contribute and approve policies within their sector. We have appointed a Programme Board at senior level which will decide the governance arrangements for the new programme. When the development of the new programme is complete, we will be able to list specific actions however these are not confirmed as yet. A Monitoring and Evaluation regime is being developed to address all levels of the new programme from outcomes to actions. The engagement workshops currently underway include a monitoring and evaluation exercise to gather views and information from stakeholders.

The draft second SCCAP currently out for consultation proposes an integrated approach to monitoring and evaluation and sets out principles and governance arrangements for such a

<sup>57</sup> Emmett et al. (2010) *Countryside Survey: Soils Report from 2007*. Technical Report No. 9/07 NERC/Centre for Ecology & Hydrology 192pp. (CEH Project Number: C03259).

<sup>58</sup> Moredun Research Institute (2018), *Improving the control of liver fluke infection in cattle in the UK*, <https://gtr.ukri.org/projects?ref=BB%2FK015346%2F1>







framework.<sup>59</sup> This is based on a research project by ClimateXChange and was initiated following the Adaptation Committee's first independent assessment of the SCCAP. The research project included an assessment of significant gaps in the current indicators.<sup>60</sup>

## Freshwater rivers and lochs

CCC rating	Rationale for rating
High concern	Targets and objectives are defined and progress of the actions set out in the SCCAP is on track, however there has been a scaling back of ambition for improvements in freshwater condition. Water quality in almost half of Scottish rivers is poor and not improving, and pressures on freshwater habitats from invasive non-native species are increasing, which suggests that current targets and actions may not be sufficient to address the rising risk. Loch condition remains relatively stable with 64% of lochs in Scotland meeting Good Overall Status in 2016.

### Summary RAG assessment



**Table 2.6.** Summary RAG assessment - Freshwater rivers and lochs

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	Actions to achieve water quality objectives under the European Union Water Framework Directive are reported as achieved or on track but there is a lack of a specific plan related to climate change adaptation.  There has been a scaling back of ambition for improvements in freshwater condition since the publication of the River Basin Management Plans (RBMPs) due to resource constraints.  SEPA's rural diffuse pollution work is to be scaled up.	Is there a plan?  Amber
Are actions taking place?  Amber		Are actions taking place?  Amber

<sup>59</sup> The Scottish Government (2019) *Climate Ready Scotland: Scottish Climate Change Adaptation Programme 2019-2024, A Consultation Draft, February 2019*, [https://consult.gov.scot/energy-and-climate-change-directorate/adaptation-programme-2019-2024/user\\_uploads/sct01194804201-1.pdf](https://consult.gov.scot/energy-and-climate-change-directorate/adaptation-programme-2019-2024/user_uploads/sct01194804201-1.pdf)

<sup>60</sup> Moss, A. for ClimateXChange (2018) *Integrating monitoring and evaluation in the Scottish Climate Change Adaptation Programme*, <https://www.climateexchange.org.uk/research/projects/monitoring-and-evaluation/>

**Table 2.6.** Summary RAG assessment - Freshwater rivers and lochs

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>The ecological status of lochs is stable. There has been no change in overall water quality of Scottish rivers between 2008 and 2016 and 46% of Scottish rivers do not meet Good Overall Status.</p> <p>The number of freshwater notified habitat features with invasive non-native species identified as a pressure is increasing.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Red</p>

*Why is it a priority for adaptation?*

**Climate change presents a range of risks to freshwater resources and habitats in Scotland, both in terms of water quantity and quality.**

Scotland's substantial freshwater resource represents around 90% of the volume of surface freshwater in the UK. Less snow, wetter winters, drier summers and an increased risk of flooding in some areas will affect a range of functions and ecosystem services that are important to people. Increased weather variability, with both highs and lows becoming more extreme (for example the number of days of intense rainfall is increasing), present potentially damaging impacts:

- Lower flows, higher temperatures and flooding will have impacts on the condition of habitats and the conservation status of freshwater species, with some long-term changes in rivers and lochs already being observed. Water bodies not in good environmental condition are likely to be less resilient to the pressures from climate change.<sup>61</sup>
- An increase in the frequency and intensity of heavy rainfall events (particularly following periods of drought) could decrease water quality in rivers and lochs. Increasing water temperatures also have implications for water quality as well as increasing the potential for water-borne diseases.<sup>62</sup> The CCRA2 Evidence Report for Scotland also identified a risk of reduced water availability in some catchments.
- Changes in hydrology and temperature impact upon ecological patterns and processes and alter the suitability of habitats for certain species. This can lead to loss of native fauna and flora, as well as potentially altering the distribution of native species, in particular economically and culturally important species such as Atlantic salmon.
- Weather and hydrological changes can facilitate the establishment of non-native species and increase the invasive tendency of some. A number of species are causing serious threats to Scotland's freshwater bodies including North American signal crayfish (*Pacifastacus*

<sup>61</sup> Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborne, S., Leaf, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.J., Tew, T.E., Varley, J., & Wynne, G.R. (2010) *Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra.*

<sup>62</sup> DEFRA et al. (2012) *A climate change risk assessment for Scotland.*

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*leniusculus*), Japanese knotweed (*Fallopia japonica*), and Curly waterweed (*Lagarosiphon major*).<sup>63</sup>

Other potential impacts include greater pressures on hydro-electric power generation (due to changes in precipitation and temperature), water resources, and agricultural irrigation, which could have a direct impact on ecosystem services as well as impacting habitats and species. The potential impact of these has not yet been quantified.

### *Progress of policies and actions*

**All actions to achieve the water quality objectives under the European Union Water Framework Directive are reported as achieved or on track, but there is no specific plan related to climate change adaptation.**

Scotland's Biodiversity Route Map has a target to achieve agreed ecological water quality objectives under the European Union Water Framework Directive (WFD) of river and lake bodies and to contribute to meeting conservation objectives (including Natura 2000 sites) through scoping improvements to physical modifications. The EU WFD requires all water bodies to be in good ecological condition by 2027.<sup>64</sup> In the most recent progress report on the route map, two actions for this target were reported as achieved and the remaining four as on track.

**There has been a scaling back of ambition for improvements in freshwater condition since the publication of the River Basin Management Plans (RBMPs).**

The purpose of the RBMP process is to protect and improve the condition of the water environment in Scotland. The second RBMPs set out Scotland's objectives for protecting and improving water bodies up to 2027. In the second cycle (2016 - 2021) the plans include objectives to improve the physical condition of 52 water bodies and ease fish passage across 76 historic barriers to fish migration. The plans recognised that this would require a significant increase in funding.

In the River Basin Management Planning update 2017, SEPA reported a reprioritisation of projects for delivery based on a reduced level of funding. Current funding levels will not enable a number of ongoing projects to continue through to completion as originally planned. Short-term efforts are focussed on barriers to fish migration and urban morphology projects.

Increasing connectivity will enable cold-water fish species like salmon to move into cooler parts of the river system, if there are any. SEPA reported that they are still on track to remove over 40 fish barriers, opening up over 800 km of river to migratory fish.<sup>65</sup> In Scotland, man-made barriers to fish migration cut off access to over 4,000 km of rivers. This affects all fish species, but has a particular impact on salmon, sea trout, lampreys and eels. The National Water and Land Unit will work with staff in regional regulatory services and specialists in Evidence and Flooding to scope all fish barriers during the second cycle, to develop an understanding of what can be done to improve fish passage. Experts involved in this review have highlighted that current solutions may not be focussed on the highest ecological priority.<sup>66</sup>

**SEPA's rural diffuse pollution work is to be scaled up.** During the first river basin management period, catchment walks and farm visits in the 14 priority catchments for rural

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<sup>63</sup> Scottish Natural Heritage (2018d) *Aquatic non-natives*. Available online at: <https://www.nature.scot/professional-advice/land-and-sea-management/managing-freshwater/freshwater-non-native-species>

<sup>64</sup> While good ecological status does not directly relate to species populations, it is currently the only metric available.

<sup>65</sup> SEPA (2017) *River Basin Management Planning Update February 2017*, [https://www.sepa.org.uk/media/311287/generic\\_update\\_march\\_2017.pdf](https://www.sepa.org.uk/media/311287/generic_update_march_2017.pdf)

<sup>66</sup> SCCAP report expert review group.

diffuse pollution were completed and 84% of farms were found to be compliant at their first revisit. During the second RBMP, another 43 priority catchments are due to be added to the original 14. Inspections will be targeted in at risk and downgraded waterbodies rather than catchment wide.

The CCC identified the design and operation of the water abstraction regime as an area of concern in the first assessment and a number of actions are underway to address this:

**PREVIOUS RECOMMENDATION 5:** The Scottish Government and the Scottish Environment Protection Agency should, before the next SCCAP, assess whether the design and operation of the water abstraction regime is compatible with the risk of reduced water availability in coming decades, in a context of projected increases in demand.

**RESPONSE:** The River Basin Management Plans allow SEPA to review and manage the impacts of water abstraction. These are reviewed every 6 years with sector groups reviewing the measures during that period. The plans also have a section on managing the water environment and climate change.

SEPA is looking at ways to include better low flow protection in licences which cover sites without physical limitations on the amount of water that can be taken in prolonged low flow periods. This includes links to the National Water Scarcity Plan and lessons learned from 2018. SEPA's National Water Scarcity Plan sets out how they will manage water scarcity during prolonged dry periods and also says that they will continue to build in steps to make sure water users are better placed to cope with a changing climate. Part of this is to ensure they have resilience plans in place to cope with dry weather now and in the future. SEPA also link to the SCCAP in their plan.

SEPA plan to update the Water Scarcity plan and abstraction controls with the output from UKCP18 due later this year. SEPA's Regulatory Evidence Strategy aims to review the information they receive from operators and they collect themselves to demonstrate compliance with licences but to also assess the impacts on the water environment. Having better monitoring of the things we are concerned about will allow us to adapt to climate change impacts in the future. SEPA work closely with Scottish Water to assess their future water needs and manage short term lack of supply through SEPA's fast track licensing procedures.

While positive actions are taking place, it is not yet evident whether the plans and actions noted will reduce the risk of future water scarcity.

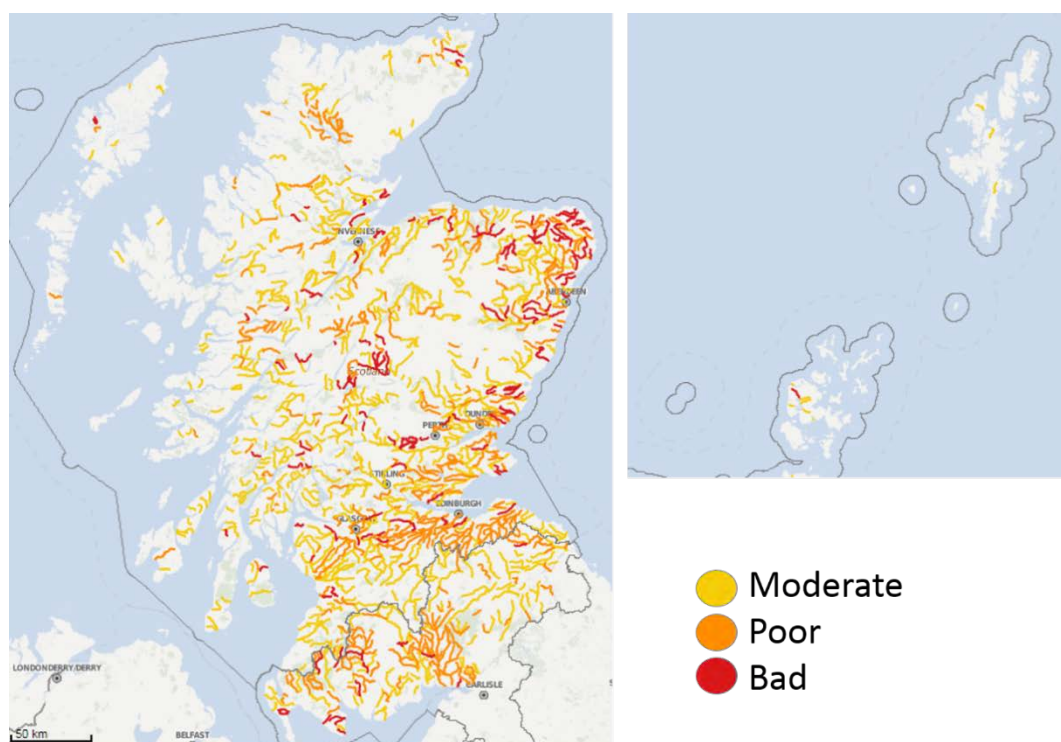
### *Climate change vulnerability assessment*

**Despite a slight improvement in recent years, there has been no change in overall water quality of Scottish rivers between 2008 and 2016.** In 2016, 46% of Scottish rivers did not meet Good Overall Status as defined under the Water Framework Directive (Figure 2.5).<sup>67</sup> Some areas show greater improvement than others, with three areas showing a large (over four percentage points) increase in the proportion of rivers in good status - Argyll, Solway and North Highland. The greatest improvements over this period were in the Tweed, North East Scotland and Forth areas. Despite these improvements, over three quarters of rivers in the Forth area remain at less than good condition.

<sup>67</sup> Proportion is based on the number of sites rather than the length of rivers.



**Figure 2.5.** Scottish rivers at less than Good Overall Status (2016)



**Source:** ClimateXChange (2018), *Indicator NB24 Proportion of water bodies not meeting Good Overall Status*, [https://www.climatexchange.org.uk/media/3534/nb24\\_waterbodies\\_not\\_gos\\_2018update.pdf](https://www.climatexchange.org.uk/media/3534/nb24_waterbodies_not_gos_2018update.pdf)

**The ecological status of lochs is stable, with 64% of lochs in Scotland meeting Good Overall Status in 2016.**<sup>68</sup> This represents a slight increase of 1.5% from 2012 - 2016 and long term increase of 1.7% from 2008 - 2016. Regional changes are inconsistent with the changes in water quality of rivers, with an increase in the proportion of lochs assessed to be in less than good condition in North Highland, Tay and North East Scotland. The rest of the areas all show an overall improvement during this period, though the Solway, Clyde and Forth regions still have the highest proportions of lochs at less than good status.

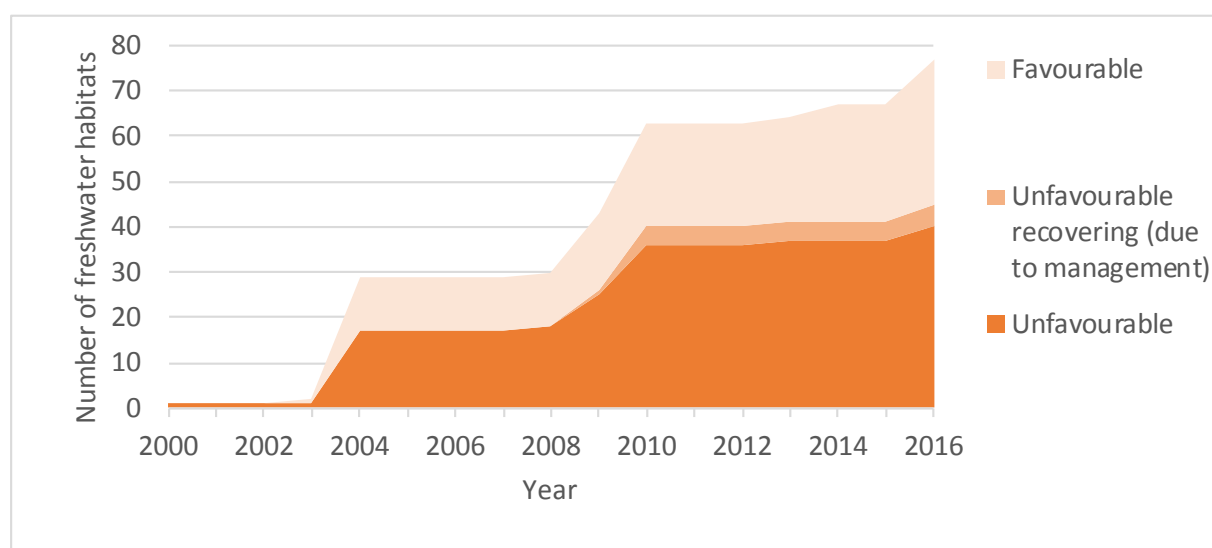
**The number of freshwater notified habitat features with invasive non-native species is increasing.** There are currently 77 freshwater notified habitat features with invasive non-native species as an identified pressure under Site Condition monitoring (Figure 2.6). This represents approximately 35% of all notified freshwater habitat features in Scotland (but includes 22 features where it is not specified if the invasive species are native or non-native).<sup>69</sup>

Figure 2.6 shows that over half of the freshwater habitat features that have been identified as under pressure from invasive species are also in unfavourable overall condition.

<sup>68</sup> ClimateXChange (2018) *Indicator NB24 Proportion of water bodies not meeting Good Overall Status*, [https://www.climatexchange.org.uk/media/3534/nb24\\_waterbodies\\_not\\_gos\\_2018update.pdf](https://www.climatexchange.org.uk/media/3534/nb24_waterbodies_not_gos_2018update.pdf). Proportion is based on the number of sites rather than the length of rivers.

<sup>69</sup> Not all features are visited and monitored every year, or every monitoring cycle. The sample generated by the model results in approximately 52% of features being monitored during the current monitoring cycle.

**Figure 2.6.** Cumulative number of notified freshwater habitats with invasive non-native species identified as a pressure (2000-2016)



**Source:** ClimateXChange (2018), *Indicator NB39 Freshwater habitats with reported presence of key invasive non-native species (INNS)* -







[https://www.climatechange.org.uk/media/3417/nb39\\_freshwater\\_inns\\_2018update\\_v02.pdf](https://www.climatechange.org.uk/media/3417/nb39_freshwater_inns_2018update_v02.pdf)

**Notes:** Colours indicated reported overall status of the habitats.

## Marine and coastal ecosystems

CCC rating	Rationale for rating
Mixed progress	<p>SCCAP coverage of policies and progress of actions is mixed. Importantly, targets have been met to designate 10% of coastal waters as protected areas, and coastal waters are recorded as being in good condition. There has been a focus on research to develop a better understanding of coastal change. Some indicators show positive trends, but the ecological status of estuaries is not showing signs of improvement (15% of estuaries did not meet Good Overall Status in 2016) and declines in seabird populations are a serious cause for concern – seabird numbers have declined by 38% between 1986 and 2016 and climate change is considered to be one of the main reasons for the decline.</p>

## Summary RAG assessment

Table 2.7. Summary RAG assessment - Marine and coastal ecosystems		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>Implementation of the National Marine Plan was reviewed and a report published in 2018.</p> <p>The Dynamic Coast National Coastal Change assessment was launched in 2017.</p> <p>No additional Marine Planning Partnerships have been established and no Regional Marine Plans have been adopted.</p> <p>Targets for Marine Protected Areas have been met and work is underway to better understand vulnerability of marine protected areas to climate change.</p>	<p>Is there a plan?</p>  <p>Amber</p>
<p>Are actions taking place?</p>  <p>Amber</p>		<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>Coastal waters in Scotland are in good ecological condition – less than 1% do not meet Good Overall Status.</p> <p>The ecological status of estuaries in Scotland is less favourable than coastal waters and is not showing signs of improvement.</p> <p>Mean numbers and breeding success of seabirds are declining.</p> <p>Inputs of hazardous materials into marine environments have decreased (UK-wide).</p> <p>Some key fish stocks have been at historically low levels in recent years, however the proportion of large fish is increasing, indicating a decrease in fishing pressure.</p> <p>Targets for Total Allowable Catches being set in accordance with scientific guidance to achieve Maximum Sustainable Yield (MSY) are not being met, however the number of stocks set in line with MSY is increasing.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>

### Why is it a priority for adaptation?

**Shallow marine and coastal habitats are vital for the country's economy.** In 2016 the Scottish marine economy generated £3.8 billion<sup>70</sup> accounting for 2.9 % of the overall Scottish economy and provided employment for 75,300 people. While the oil and gas services sector is the biggest contributor to the marine economy, marine tourism provides 10% of the GVA and

<sup>70</sup> Gross Value Added.

37% of the employment to the marine economy.<sup>71</sup> Many of Scotland's industries, including tourism and aquaculture rely on well-maintained coastal habitat. The characteristic biodiversity found is a result of different tidal habitats, many which support unique ecosystems. Fishing is an economic mainstay in many parts of Scotland, with important fish markets in Peterhead, Aberdeen and Troon. Approximately 60% of the total UK catch is landed in Scotland, and shifts in the location of fish stocks could lead to significant consequences for the Scottish commercial fishing industry. In 2016 fishing generated £296 million GVA: accounting for 0.2 % of the overall Scottish economy, and 8% of the marine economy.<sup>72</sup>

**As with other habitat types, external pressures on the marine and coastal environment are likely to make it harder for habitats and species to adapt naturally to climate change.**

Pollution by hazardous heavy metals and pesticides can have adverse effects on the marine environment and biodiversity, and could exacerbate the projected impacts of climate change on water quality. A change in coastal water quality could adversely affect marine habitats and species as well as lead to an increase in the incidence of human disease (e.g. from *Vibrio* species) via bathing and also through the consumption of infected seafood. Pollutants enter coastal waters either directly from point sources on UK coasts and estuaries or are carried via rivers.

**If fisheries are not resilient to current pressures, such as overfishing, they are likely to be vulnerable to the increased pressures expected as a result of climate change.** Achieving and maintaining healthy fish stocks is vital to allow those stocks to recover from local pressures and to move as climate change alters their 'climate space'. The state of the stock is the vulnerability aspect to the indicator, while actions to reduce overfishing pressure are also relevant as an action indicator.

Rising average water temperatures could result in faster growth rates for some species which are more tolerant of higher temperatures but prolonged periods of warmer summer temperatures may adversely affect some cold water species. Some seabird species, particularly those dependent on sand eels such as puffins, are especially vulnerable to the effects of warming seas which are projected to have reduced food availability. A decreasing population due to any pressure will be less resilient to the future effects of climate change. Seabirds are also a good indicator of the overall health of marine environments.

### *Progress of policies and actions*

**Implementation of the National Marine Plan was reviewed and a report published in 2018.**<sup>73</sup> Some key issues raised in the report which were considered to merit further investigation include:

- Evidence identified in the review suggests that there are some areas of statutory function in which the Plan is not being addressed, or it is being addressed without consistency.
- Voluntary measures may not be sufficient, or regulatory mechanisms not available, to effectively implement some policies in the Plan.

<sup>71</sup> The Scottish Government (2018) *Scotland's Marine Economic Statistics*, <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics-publication/2018/10/scotlands-marine-economic-statistics/documents/00541740-pdf/00541740-pdf/govscot%3Adocument>

<sup>72</sup> *Ibid.*

<sup>73</sup> The Scottish Government (2018) *National Marine Plan Review 2018: Three Year Report on the implementation of Scotland's National Marine Plan*, <https://www.gov.scot/publications/national-marine-plan-review-2018-three-year-report-implementation-scotlands/>



- As further detail on the UK's future relationship with the EU emerges, the implications for the Plan will be further assessed to inform both the development and timing of future marine plans.

**No additional Marine Planning Partnerships have been established and plans are yet to be adopted by those that are already established.** The first two partnerships were developed for Shetland in 2016 and Clyde in 2017. The National Marine Plan sets out guidance for regional marine planners to consider and incorporate climate change adaptation. The Scottish Government have published the reason in a letter to the ECCLR Committee: "we're operating in a very different set of financial circumstances than existed when the Marine Act was adopted, and we need to be increasingly prudent about the use of resources – not only ours, but also those who will become involved in regional planning."<sup>74</sup>

**The Scottish Government launched its Dynamic Coast project in August 2017, which quantified the coastal changes between the 1890s, 1970s and the modern shoreline.** The second phase (2018 to 2022) is investigating the anticipated impact of climate change on future coastal erosion and coastal flooding. It also is developing Mitigation, Adaptation & Resilience Plans at seven sites.

The first assessment made a recommendation to set a long-term target and policy mechanisms for creating intertidal habitat through managed realignment:

**PREVIOUS RECOMMENDATION 7:** The Scottish Government should, by the end of 2017, set a long-term target for the area of intertidal habitat to be created through managed realignment in Scotland and introduce appropriate policy mechanisms to achieve it.

**RESPONSE:** Although evidence suggests that intertidal habitat loss in response to rising sea levels is occurring in some areas, we still have a very partial picture of changes in Scotland. Whilst the Dynamic Coast project has informed our understanding of coastal changes to the upper shore, knowledge of lower coastal changes is currently insufficient to inform specific policies or targets for habitat creation. SNH is funding research to improve the evidence base on Scottish intertidal habitat change. This work will support policy development to conserve our important intertidal habitats and the benefits they provide to society.

The Scottish Government and SNH have identified a need for further research to improve the evidence base before policies or targets can be set. The Scottish Government should ensure this remains a priority in the next SCCAP.

**Targets for Marine Protected Areas have been met and work is underway to better understand vulnerability of marine protected areas to climate change.** The target in Scotland's Biodiversity Strategy that 10% of Scotland's seas be incorporated in nature conservation Marine Protected Areas has been met and all actions are on track. However, the network is currently incomplete in relation to some species such as marine birds, whales, dolphins and basking sharks. Sites for these are expected to be brought forward in 2019. During 2016 SNH began work to improve understanding of the vulnerability of marine protected areas to climate change and a report is due to be completed in 2018. It will look at which features of

<sup>74</sup> The Scottish Government (2018) *Letter from Roseanna Cunningham to ECCLR Committee*, [http://www.parliament.scot/S5\\_Environment/General%20Documents/20180725\\_CS\\_to\\_Conv\\_re\\_Marine\\_Inquiry.pdf](http://www.parliament.scot/S5_Environment/General%20Documents/20180725_CS_to_Conv_re_Marine_Inquiry.pdf)

inshore protected areas are most vulnerable to climate change, the potential connectivity between MPAs designated for the same features and any gaps that might exist. It will also build on the current project that seeks to highlight the places where blue carbon resources are most vulnerable and what management may be required.

The UK Marine Climate Change Impacts Partnership (MCCIP) published its 10 year report card in 2017 which summarises how the understanding of marine climate change impacts has developed.<sup>75</sup> The report card examines what was reported in 2006, and how this has changed. The work of MCCIP has helped to deliver on the previous recommendation made by the CCC in the first SCCAP assessment:

**PREVIOUS RECOMMENDATION 6:** The Scottish Government should assess by the end of 2017 the implications of increases in marine water temperatures and acidity (both actual and projected) for marine ecosystems, the MPA network, and the commercial fisheries and aquaculture sectors.

**RESPONSE:** Marine Science Scotland (MSS) contributes significantly to the UK Marine Climate Change Impact Partnership (MCCIP) climate change impact assessment process. MSS provides environmental and ecological monitoring data, assessments and research output to MCCIP products, and co-authors them. MCCIP report cards summarise the latest evidence relating to temperature, salinity and ocean acidification change and impacts. It also assesses current and future impacts on the aquaculture and fishing industries, and on the conservation of marine features and the MPA process. MCCIP reports were updated in 2017 and work is underway to update the full set for 2019. MSS research and monitoring programme aims to support the MCCIP process, and is addressing specific identified knowledge gaps. The report cards can be found at: <http://www.mccip.org.uk/impacts-report-cards/> and were extensively cited by the UK CCRA Evidence Report (2017). MSS additionally publishes climate change impact related evidence (research and monitoring) in peer-reviewed Journals.

While this response notes a number of actions intended to monitor marine water temperatures and acidity, it is not yet clear whether an assessment of implications has been completed.

**A number of actions have been completed to support environmentally sustainable commercial fishing and aquaculture.** The Technical Standard for Scottish Finfish Aquaculture (STS) was reviewed by the Scottish Government in 2018. The aim of the standard is to help ensure all fish farms have equipment that is appropriate to prevent escapes by 2020 at the latest. The Scottish Government and industry have match funded up to £22 million to establish the Scottish Aquaculture Innovation Centre (SAIC) to help the sector enhance its environmental performance and growth potential through innovation and the application of research.

Scotland has established a Scottish Marine Invasive Non-Native Species Working Group which is developing policies and strategies to take forward management, monitoring and response to marine INNS. An INNS strategy for Scotland will be developed in 2018/19 to provide a framework for monitoring, surveillance and sectoral actions to minimise introduction and spread.

The Scottish Government has established a Blue Carbon Forum and a programme for research into Blue Carbon habitats through the Climate Change Plan. Blue Carbon habitats, such as saltmarsh and seagrass beds, have potential to support climate mitigation objectives but there

<sup>75</sup> Marine Climate Change Impacts Partnership (2017) *10 year report card*, <http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2017-10-yearreport-card/>

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are clear benefits in terms of adaptation to climate change from restoring and recreating these habitats around Scotland's coast.

### *Climate change vulnerability assessment*

**Coastal waters in Scotland are in good ecological condition.** Water bodies not meeting Good Overall Status are likely to be more vulnerable climate change pressures. In 2016, less than 1% of coastal waters in Scotland did not meet Good Overall Status.<sup>76</sup> This represents a decrease of 2.2% between 2012 and 2016 and a longer term decrease of 6.1% since 2008.<sup>77</sup>

All but two areas (Forth and Clyde) have had all their coastal water bodies assessed as in good condition or better in 2016. The greatest improvement over this whole period occurred in the Clyde region which now has only one coastal stretch assessed as less than good.

**The ecological status of estuaries in Scotland is less favourable than other water bodies and is not showing signs of improvement, with 15% of estuaries not meeting Good Overall Status in 2016.**<sup>78</sup> There has been no change in this indicator since 2008.

**Numbers of the 12 regularly monitored species of breeding seabirds in Scotland have declined by 38% between 1986 and 2016 and there is evidence that climate change is contributing to the decline.** The average breeding success of seabirds in Scotland has also declined. There is significant regional variation in seabird numbers and breeding success across Scotland, with the Northern Isles seeing the most serious declines. Current breeding numbers are 62% of the 1986 baseline, however there is considerable variation in the trends among the 12 species assessed for breeding numbers. Arctic skua has experienced the largest decline, 77% since 1986. Common tern is the only species to have increased numbers in 2016, at 159% of the 1986 level, after a long trend of declining numbers.<sup>79</sup>

As identified in the CCRA, climate change is considered to be one of the main drivers of seabird decline. Warmer winter sea temperatures have resulted in major changes in abundance and species composition of plankton that have in turn contributed to the reduction in abundance and quality of seabird prey species such as sandeels, with knock-on effects for seabirds.<sup>80</sup> In addition, increasing incidence of extreme storm events has resulted in frequent seabird 'wrecks' i.e. dead seabirds washed up on beaches. In winter 2013/14, persistent gales caused prolonged poor foraging conditions at sea, resulting in tens of thousands of seabirds, mainly auks (half of which were puffins) being washed up emaciated on the UK's Atlantic shores.

**While data for Scotland is not available, the UK index for input of hazardous substances shows that the combined inputs of six hazardous materials into marine environments have decreased 80% since 1990.** Levels of all six substances declined over the period 1990 to

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<sup>76</sup> Proportion is based on number of sites not area.

<sup>77</sup> ClimateXChange (2018) *Indicator NB24 Proportion of water bodies not meeting Good Overall Status*, [https://www.climateexchange.org.uk/media/3534/nb24\\_waterbodies\\_not\\_gos\\_2018update.pdf](https://www.climateexchange.org.uk/media/3534/nb24_waterbodies_not_gos_2018update.pdf)

<sup>78</sup> Proportion is based on number of sites, not area.

<sup>79</sup> ClimateXChange (2018) *Indicator NB6a/NB17a: Numbers and breeding success of seabirds*, [https://www.climateexchange.org.uk/media/2479/nb6a\\_nb17a\\_breeding-seabirds\\_2018\\_v2\\_210618.pdf](https://www.climateexchange.org.uk/media/2479/nb6a_nb17a_breeding-seabirds_2018_v2_210618.pdf). Sufficient data is available to identify trends in breeding numbers for 12 of 24 species, and breeding success for 12 species.

<sup>80</sup> MacDonald, A., Heath, M., Edwards, M., Furness, R., Pinnegar, J. K., Wanless, S., Greenstreet, S. (2015) *Climate driven trophic cascades affecting seabirds around the British Isles*. *Oceanography and Marine Biology - An Annual Review*, 53, 55-79, <https://doi.org/10.1201/b18733-3>

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2016. Inputs of five of these substances show decreases since 2011, however the input of copper has increased by 1% in the short term.<sup>81</sup>

**Fish stock size structures are improving.** In 2016, large fish in the North Sea survey made up 16% of the weight of the fish community. This is close to the value of 20% recorded in 1983 and a noticeable increase from a low of 4% in 2001.<sup>82</sup> Changes in the size structure of fish populations and communities reflect changes in the state of the fish community and a higher proportion of large fish indicates a healthier overall stock as fish are reaching a more mature age before being caught.

**Targets for Maximum Sustainable Yield of fish are not being met but performance is improving.** The reformed Common Fisheries Policy aims to ensure fisheries are managed in a way that is consistent with attainment of maximum sustainable yield (MSY), and that this should be implemented where possible by 2015 and by 2020 at the latest. The Scottish Government aims for 70% of commercial fish stocks to have quotas set in line with scientific guidance. For 2018, of the 13 stocks the Scottish Government measures its sustainability performance against, 9 stocks (67%) have been set in line with the maximum sustainable yield (MSY). This is an increase from 62% in 2017.

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<sup>81</sup> Joint Nature Conservation Committee (2018) *UK Biodiversity Indicators 2018, Indicator B5 Pressure from pollution (B5b. Marine pollution)*, [http://jncc.defra.gov.uk/pdf/UKBI2018\\_F\\_B5b.pdf](http://jncc.defra.gov.uk/pdf/UKBI2018_F_B5b.pdf)

<sup>82</sup> Joint Nature Conservation Committee (2018) *Biodiversity Indicators 2018, D1. Biodiversity and ecosystem services (D1a. Fish size classes in the North Sea)*, <http://jncc.defra.gov.uk/page-4248>



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# Chapter 3: Buildings and infrastructure networks





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### 3.1 Key messages - Buildings and infrastructure networks

**There is continued action to support resilience of buildings and infrastructure networks to flooding, such as the consideration of climate change in design and location of new infrastructure. More work is needed to assess and plan for coastal risks.** The Scottish Environment Protection Agency (SEPA) published the second National Flood Risk Assessment (2018 NFRA) in December 2018, which uses an updated methodology to give a better understanding of current levels of risk from river, coastal and surface water flooding. The assessment identifies 284,000 homes, businesses and services which are currently vulnerable to river, coastal and surface water flooding in a 0.5% (1 in 200) annual probability event. Scotland's National Coastal Change Assessment - Dynamic Coast - was launched in 2017 and Phase 2 (2018 - 2022) will investigate the anticipated impact of climate change on future coastal erosion and coastal flooding. Currently less than 10% of Scotland's shoreline is covered by a Shoreline Management Plan (SMP) and with 19% of Scottish coastline identified as erodible, this means not all areas of erodible coast are covered by a SMP, let alone the additional areas that are also at risk from coastal flooding. Better linkage of research is required so that priorities for SMP development are based on the research findings.

**Investment in resilient energy, transport and water services continues to be encouraged and indicators of vulnerability show good progress in a number of areas including energy and water supply resilience.** Flooding is at present a very minor factor in energy supply interruption, accounting for just 0.03% of all Customer Interruptions in 2016. The resilience of transport networks is included in the National Transport Strategy and public sector reporting on climate adaptation measures by Transport Scotland and local transport partnerships ensures transparency. Scottish Water's 25 year Water Resources Management Plan includes actions that could be taken to improve the resilience of public water supplies. The number of unplanned interruptions to water supply, non-domestic water consumption and leakage from the public water supply continues to decrease and leakage targets are being met.

**Up to date building standards are in place for flood resilience, moisture penetration from heavy rain, heating and ventilation, but there is no strategy for retrofitting existing buildings with adaptation measures and only limited guidance is available on overheating in buildings.** Levels of domestic building disrepair have declined over the last ten years though there has been no significant change in the number of homes showing dampness since 2002 – around 4% in 2016. Measures to protect Scotland's significant historic estate and risks to cultural heritage have been included in the new National Flood Risk Assessment but it is not yet possible to determine whether they are effective steps. There is limited reference to overheating in technical building standards.

**Gaps remain in the policy framework for flooding and for digital infrastructure; there are opportunities for the next SCCAP to strengthen effort.** There is no national assessment of whether actions identified in Flood Risk Management Strategies are sufficient to prevent flood risk increasing, or to identify the flood risk management interventions and investments needed. There is no national target to reduce the number of properties at risk of flooding. Local Flood Risk Management Plans do not monitor and report the number and location of new homes and other properties built in areas of flood risk. There are also no specific actions in the SCCAP for resilience of digital infrastructure and whilst investment in resilience through Ofgem is positive, the key SCCAP actions for energy sector resilience have not been taken up. Information on the extent to which data and telecoms facilities and services are exposed to extreme weather impacts is still hard to gather. There is also no evidence of specific measures taken to minimise

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risks of cascading failures between infrastructure sectors (transport, energy, digital and water) to improve systems resilience in Scotland, which is of particular importance in the context of rural communities where weather impacts can cause greater disruption.

**A lack of metrics and targets against which to assess vulnerability continues to be an issue, particularly in relation to the design and location of new infrastructure and the use of sustainable drainage.** There is still no evidence collected on whether new infrastructure is designed and located according to the sustainability and adaptation principles set out in the National Performance Framework. Although KPIs for climate adaptation are under development by Network Rail and Transport Scotland, there are no data available on development in floodplains in recent years. The number and capacity of sustainable drainage systems (SuDS) installed in new developments and other developments retrofitted with SuDS is also not currently recorded.

### 3.2 SCCAP outcome and objectives

The SCCAP contains a high-level outcome for this theme: “A Scotland with well-managed, resilient infrastructure and buildings providing access to the amenities and services we need.” There are three objectives to meet this outcome:

- **Objective B1:** Understand the effects of climate change and their impacts on buildings and infrastructure networks.
- **Objective B2:** Provide the knowledge, skills and tools to manage climate change impacts on buildings and infrastructure.
- **Objective B3:** Increase the resilience of buildings and infrastructure networks to sustain and enhance the benefits and services provided.

To enable a robust assessment of these high-level principles and objectives, the CCC has identified 12 adaptation priorities that relate to the theme of Buildings and Infrastructure Networks. The progress being made with respect to each of these adaptation priorities is reviewed in the remainder of this chapter.

### 3.3 Summary of progress

Table 3.1 sets out the summary findings of the analysis set out in this chapter. The criteria applied to determine the overall rating and the RAG scores are set out in Chapter 1.





































<b>Table 3.1. Summary assessment - Buildings and infrastructure networks</b>				
<b>Adaptation priority</b>	<b>Overall rating</b>	<b>RAG assessment</b>		
		<b>Is there a plan?</b>	<b>Are actions taking place?</b>	<b>Vulnerability assessment</b>
Flooding and coastal erosion risk management	Mixed progress	 Amber	 Amber	 Amber
Surface water and sewer flooding	Mixed progress	 Green	 Green	 Grey
Development in flood risk areas	Mixed progress	 Green	 Red	 Grey
Resilience of buildings to extreme wind and rain	Mixed progress	 Amber	 Amber	 Green
Water demand in the built environment	Mixed progress	 Green	 Green	 Amber
Design and location of new infrastructure	Mixed progress	 Green	 Amber	 Grey
Resilience of infrastructure services				
A) Energy networks - generation, transmission and distribution	Mixed progress	 Green	 Amber	 Amber
B) Public water supplies	Positive progress	 Green	 Green	 Grey
C) Ports, airports and ferry services	Mixed progress	 Amber	 Red	 Grey



Table 3.1. Summary assessment - Buildings and infrastructure networks				
Adaptation priority	Overall rating	RAG assessment		
		Is there a plan?	Are actions taking place?	Vulnerability assessment
D) Roads and the rail network	Positive progress	 Green	 Amber	 Green
E) Digital infrastructure	High concern	 Amber	 Amber	 Grey
Infrastructure interdependencies	Mixed progress	 Green	 Amber	 Grey

### 3.4 Assessment of progress





#### Flooding and coastal erosion risk management

CCC rating	Rationale for rating
Mixed progress	Some positive action has taken place through publication of the updated National Flood Risk Assessment and Flood Risk Management Strategies and Plans. The policy framework could be strengthened in some areas, for example through greater roll-out of Shoreline Management Plans. For the second SCCAP, information needs to be collected on the number and location of properties in flood risk areas and be maintained to record risks and impacts over time.

#### Summary RAG assessment

Table 3.2. Summary RAG assessment - Flooding and coastal erosion risk management		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Amber	Flood Risk Management Strategies and Plans that include consideration of climate change are developed, implemented and updated on a six-year cycle. The second National Flood Risk Assessment (NFRA) was published in	Is there a plan?  Amber

**Table 3.2.** Summary RAG assessment - Flooding and coastal erosion risk management

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Are actions taking place?</p>  <p>Green</p>	<p>2018. Version 1.3 of SEPA’s Flood Maps was also published in 2018.</p> <p>No national assessment has been made of the extent to which actions identified in the strategies are sufficient to adequately manage flood risk as the climate changes, or to identify flood risk management interventions and investments needed.</p> <p>Most of the Scottish coastline is not covered by Shoreline Management Plans. Scotland’s Dynamic Coast Phase 2 (2018 - 2022) will investigate the anticipated impact of climate change on future coastal erosion and coastal flooding with adaptation plans developed for five sites around Scotland.</p>	<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>Around 121,000 properties - 4% - (residential and non-residential) are at risk of river or coastal flooding (based on a 1 in 200 year event) (not including surface water flooding).</p> <p>The second NFRA applies a more comprehensive assessment of flood risk to a range of receptors vulnerable to river, coastal and surface water flooding.</p> <p>Expenditure on flood defences, land drainage and coastal protection has decreased since the last assessment but is in line with agreed funding levels. However, it is not known how this investment is altering flood risk as the climate changes.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>

*Why is it a priority for adaptation?*

**The National Flood Risk Assessment, published in December 2018,** identifies 284,000 homes, businesses and services which are currently vulnerable to river, coastal and surface water flooding in a 0.5% (1 in 200) probability event. Around 229,000 of the properties at risk are homes and 55,000 are businesses and services. This means that 9% of homes and 11% of businesses and services in Scotland are currently at risk from all sources of flooding.

**The latest SEPA assessment indicates that by the 2080s, under a high emissions scenario, the numbers at risk are projected to increase by 110,000.**<sup>83</sup> However, the NFRA estimates do not include assumptions for population growth or the extent of adaptation measures. SEPA have indicated that this will be a consideration for future flood risk assessments.

<sup>83</sup> NFRA climate change projections are based on UKCP09 climate scenarios.



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In a separate analysis for the UK as a whole, research for the 2017 CCRA estimated that residential properties in Scotland at a 0.5% risk of flooding in any given year (1-in-200 year return period) would increase from 129,000 in the present day to 170,000 in the 2080s for a 2°C climate change scenario and to 182,000 in a 4°C scenario. For non-residential properties this would increase from 32,000 in the present day to 37,000 in the 2080s for a 2°C climate change scenario and to 40,000 in a 4°C scenario.<sup>84</sup>

**Scotland has significant infrastructure assets located in coastal areas and hence potentially exposed to flooding from the sea.** Key infrastructure assets located in the coastal zone include power stations, ports, roads, and rail networks. There are 110 ports in Scotland, nine of which are classified as major.<sup>85</sup> Several dozen ports in the Highlands and Islands support lifeline ferry services. Scottish ports in total handle around 96 million tonnes of cargo every year with an estimated trade value of £65 billion.

**According to the National Coastal Change Assessment (NCAA), soft coastline (coasts with the potential to erode) make up 19% (3,800 km) of the Scottish coast.** Between a half and a third of all coastal buildings, roads, rail and water network lie in these erodible sections. Since the 1970s, 870 km of the soft coastline has moved position: 420 km has advanced, 440 km has eroded and the remaining 2,940 km has remained approximately stable.<sup>86</sup>

**If recent erosion rates were to continue in the future, the National Coastal Change Assessment (NCCA) estimates that by 2050 at least 50 residential and non-residential buildings, 1.6 km of railway, 5.2 km of road and 2.4 km of clean water network as well as significant areas of runways, cultural and natural heritage sites would be affected by coastal erosion.**<sup>87</sup> These numbers are likely to be underestimates. If erosion rates increase in the future, as expected with climate change, the NCCA and National Flood Risk Assessment are likely to underestimate the extent of assets at risk from future coastal erosion. Large numbers of assets are sited close to potentially erodible coasts (including 30,000 buildings, 1,300 km of roads and 100 km of railway lines). There are assets worth £13.3 billion within 50 metres of the soft coast of which £340 million worth is expected to be lost through erosion by 2050.

Risks from surface water and sewer flooding are considered under the next adaptation priority - surface water and sewer flooding.

### *Progress of policies and actions*

**Flood Risk Management Strategies and Plans are developed, implemented and updated on a six-year cycle. There is no national assessment to assess the extent to which strategies are sufficient to adequately manage flood risk,** or to identify the flood risk management interventions and investments needed. The Adaptation Committee highlighted this as an area for improvement in its first assessment:

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<sup>84</sup> This assumes low population growth and baseline adaptation measures i.e. no change in level of ambition over and above today. <https://www.theccc.org.uk/wp-content/uploads/2015/10/CCRA-Future-Flooding-Main-Report-Final-06Oct2015.pdf>

<sup>85</sup> Major ports are defined by Transport Scotland as 'those with at least 1 million tonnes of cargo a year'.

<sup>86</sup> Hansom, J.D., Fitton, J.M., and Rennie, A.F. (2017) *Dynamic Coast - National Coastal Change Assessment: National Overview, CRW2014/2*, <http://www.dynamiccoast.com/files/reports/NCCA%20-%20National%20Overview.pdf>. The NCAA estimates past erosion/accretion rates to the Scottish coastline.

<sup>87</sup> *Ibid.*

**PREVIOUS RECOMMENDATION 10:** The Scottish Government should assess the level of flood risk management interventions and investments that are likely to be needed to reduce risks in each part of Scotland to acceptable levels over the next 25 to 50 years, accounting for the impacts of climate change and sea level rise. This assessment should help ensure that the objectives set in the next Flood Risk Management (FRM) Strategies, due in 2021, are compatible with reducing flood risk in the long term.

**RESPONSE:** SEPA's National Flood Risk Assessment and FRM Strategies allow our understanding of flood risk in Scotland to be updated over each six-yearly cycle. The second NFRA for Scotland was published in December 2018. Embedded in it is an assessment of how risks might change due to climate change, which has allowed us to understand which areas might be more sensitive to climate change in future. Further, it embeds current information on flood disadvantage and coastal erosion. SEPA is seeking to develop the data and approaches which will allow us to track the impact of flood risk management actions across and beyond planning cycles, including identifying short, medium and long-term actions to address flood risk. There is a Scottish Government commitment to allocate a minimum of £42 million per annum to Local Authorities for prioritised actions identified and agreed jointly between them, SEPA and Scottish Government. Investment decisions are made on the basis of the NFRA and FRM Strategies.

**The second National Flood Risk Assessment (NFRA) was published in 2018 and provides a better understanding of flood risk to buildings and people from flooding.** With the launch of the new assessment, SEPA stated that “this is our best understanding yet of flood risk in Scotland, with a wider and more detailed national picture than ever before”.<sup>88</sup> Better data and access to improved mapping and modelling has advanced the understanding of the location of properties at risk. The 2018 NFRA has made use of a more comprehensive assessment of flood risk to a range of receptors from river, coastal and surface water flooding. The NFRA enables the identification of areas where flooding was considered nationally significant - the Potentially Vulnerable Areas (PVAs). 2018 PVAs were designated due to both current and future risk due to climate change. This information will be used in the development of the next set of Flood Risk Management Strategies and Local Flood Risk Management Plans (LFRMPs). The FRM Strategies will set out the short to long term ambition for flood risk management in Scotland while the LFRMPs will provide additional local detail on the funding and delivery timetable for actions to address the risk.

There are ongoing updates to SEPA's flood maps, including coastal flood hazard maps. Coastal features which fall under Section 19 of the FRM Act are being mapped under the current coastal mapping contracts.<sup>89</sup> Guidance on climate change application for flood risk modelling studies was published in 2016 to support Local Authorities in embedding climate change into their studies in a way that will enable the inclusion of outputs in national mapping and studies.

**Less than 10% of Scotland's shoreline is covered by a Shoreline Management Plan (SMP).** No new SMPs have been implemented since the CCC's last assessment. According to the NCCA, four of 25 Local Authorities in Scotland have a SMP, which relates to 7% (1,230 km) of Scotland's shoreline. A further two authorities are currently in development and will cover a further 2% (370 km) of the shoreline. Of the 15 authorities that have information, 4 rely on national level policies (for 90 km of the coast or 0.5 % of the national coast) and do not have any specific coastal erosion policies of their own, whereas 5 have a regional policy (12,810 km of the coast or 69 % of

<sup>88</sup> BBC News article on the launch of the NFRA, 21 December 2018, <https://www.bbc.co.uk/news/uk-scotland-glasgow-west-46638329>

<sup>89</sup> Section 19 sets out the requirements for SEPA to prepare maps of artificial structures and natural features.

the national coast). There is a further 4,180 km of coast (22 %) where information on the current policy status is not known.<sup>90</sup>

**The Scottish Government's Dynamic Coast (National Coastal Change Assessment) project quantified the coastal changes between the 1890s, 1970s and the present day.** As noted above, the assessment identified that soft coastline (coasts with the potential to erode) make up 19% (3,800 km) of the Scottish coast (note that other non-erodible areas of coastline can still be at risk from flooding and would also benefit from a SMP). Erosion is expanding in this area and quickening, and the direct implications have been quantified; £13 billion of assets are currently protected by natural coastal defence measures, compared with £5 billion by engineered structures.

**NEW RECOMMENDATION 6:** Work with Local Authorities to identify the areas of coastline that are inhabited, at risk of erosion and/or at risk of flooding and ensure these are all covered by a Shoreline Management Plan.

The NCCA aims to inform existing strategic planning (Shoreline Management Plans, Flood Risk Management Planning, Strategic and Local Plans, National and Regional Marine Planning) and maps and reports are now available to all Local Authorities. It has already been used to support Shoreline Management Planning in North & South Ayrshire. Phase 2 (2018 - 2022) will investigate the anticipated impact of climate change on future coastal erosion and coastal flooding. Adaptation plans will also be developed for five 'super sites' around Scotland. The NCCA outputs were also incorporated into the second NFRA in 2018.

#### *Climate change vulnerability assessment*

**Around 121,000 properties (4%) (residential and non-residential) have been identified as being at risk of river or coastal flooding (based on a 0.5% (1 in 200) probability event) in the most recent National Flood Risk Assessment (Table 3.3) (not including surface water flooding).** The NFRA estimates that this will increase to around 200,000 properties by the 2080s under a high emissions scenario, however population growth assumptions and the extent of adaptation measures have not been considered in developing these estimates.<sup>91</sup> Surface water flooding is considered in the section below – 'Surface water and sewer flooding'.

**The 2018 NFRA applies an improved assessment of flood risk to a range of receptors vulnerable to flooding.** Key changes to property representation and counting within the 2018 NFRA mean there is a difference in property counts between the 2015 Flood Risk Management Strategies and the 2018 NFRA. The changes include the use of building footprints instead of point locations and improved classification of properties using Ordnance Survey data. The use of building footprints has resulted in a 3% increase in residential properties and a 45% increase in non-residential properties in the dataset.

Whilst the methodology changes are positive in that they allow a more comprehensive assessment of flood risk, it means longer-term trends cannot be assessed. It is important that a clear and unambiguous baseline is maintained against which future data can be monitored.

<sup>90</sup> Hansom, J.D., Fitton, J.M., and Rennie, A.F. (2017) *Dynamic Coast - National Coastal Change Assessment: Coastal Erosion Policy Context, CRW2014/2*, <http://www.dynamiccoast.com/files/reports/NCCA%20-%20Coastal%20Erosion%20Policy%20Context.pdf>

<sup>91</sup> Based on UKCP09 projections.

**Table 3.3.** Number of properties at risk of flooding in Scotland (based on a 1 in 200 year event)

	Number of properties at risk			
	River	Coastal	Surface water	Total (any source)
<b>Residential properties</b>	73,200	21,000	171,500	228,700
<b>Non-residential properties (sites)</b>	19,800	7,100	38,400	55,300
<b>Total:</b>	93,000	28,100	209,900	<b>284,000</b>

**Source:** SEPA (2018) National Flood Risk Assessment.

**Notes:** Non-residential property figures count individual sites rather than buildings. For example there could be one university site but 20 flooded buildings within that site.

The 'Total (any source)' column shows the total number of properties at risk from any source of flooding - some properties may be affected by more than one source of flooding. Adding the number at risk from each type of flooding together means that some properties could be counted more than once, in this column the final total is corrected to ensure those properties are only counted once. Total property count for the NFRA is 3,071,086 (2,582,346 residential and 488,740 non-residential).

**Expenditure on flood defences, land drainage and coastal protection is in line with agreed funding levels but it is not known whether current spend is commensurate with the level of risk.**

There is a multitude of data available on flood defence spending in Scotland. In 2016/17, Local Government capital expenditure on flood prevention totalled £45.2 million. Local Government capital expenditure on coastal protection totalled £1.5 million. £42 million of capital funding is allocated for flood defences per year since 2011 and the Scottish Government, in conjunction with the Convention of Scottish Local Authorities (COSLA), have agreed to continue this funding until 2027. Further expenditure can be allocated on discretion or in response to major flood events. For example, as stated in our first assessment, capital expenditure on flood risk management increased from £42 million in 2012/13 to £78 million in 2014/15 (to cover 2 major flood defence schemes in Brechin and Selkirk). Therefore, although the 2016/17 figure of £45.2 million is a significant decrease on the 2014/15 figure, it is consistent with the overall funding trend for the period 2011-2027.

Local Government revenue expenditure on flood defences, land drainage and coastal protection has remained largely consistent with the first assessment, and totalled £10.4 million in 2016/17. Spend declined from £12 million in 2012/13 to £10 million in 2014/15.







Despite good investment data being available, it is not known how this activity is changing the overall level of flood risk in the context of climate change. This is a major gap in understanding given the amount of money being spent on defences.

## Surface water and sewer flooding

CCC rating	Rationale for rating
Mixed progress	There has been positive progress in implementing SCCAP actions and an updated assessment of surface water flood risk has been completed. Monitoring arrangements in the current SCCAP do not appear to be adequate for responsible agencies to implement, for example because there is no timescale for local authorities to map existing sustainable drainage systems (SuDS), and data are not collected on uptake of SuDS in new developments. Further work is needed to collect this information in the second SCCAP.

### Summary RAG assessment

**Table 3.4. Summary RAG assessment - Surface water and sewer flooding**

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Green</p>	<p>The Second National Flood Risk Assessment was published in 2018 and provides an updated assessment of the risk from pluvial (surface water) flooding.</p> <p>SCCAP actions related to surface water flooding are on track or complete. A working group on surface water management has been established under the Scottish Advisory and Implementation Forum for Flooding (SAIFF).</p>	<p>Is there a plan?</p>  <p>Green</p>
<p>Are actions taking place?</p>  <p>Green</p>	<p>Surface water management planning guidance was published in 2018.</p> <p>The Flood Risk Management (Scotland) Act 2009 places a duty on local authorities to map SuDS in their area and to assess and set actions, however there is no statutory timescale for doing this and it is not known how many local authorities do so.</p> <p>Scottish Water produces models on sewer flooding under the Flood Risk Management (Scotland) Act 2009.</p>	<p>Are actions taking place?</p>  <p>Green</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>An updated flood risk assessment has been completed - over 200,000 properties -7%- in Scotland (residential and non-residential) are at risk of flooding from heavy rainfall (based on a 1 in 200 year event).</p> <p>Data on the number and capacity of SuDS installed in new developments and other drainage assets retrofitted with SuDS is not currently recorded. It is not known therefore how vulnerability to surface water flooding is changing.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Grey</p>



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*Why is it a priority for adaptation?*

**Homes, businesses and infrastructure across all sectors is exposed to surface water flooding.** Flooding already accounts for significant losses in infrastructure services, with outages caused by flooding tending to last longer than other weather-related hazards.

**Climate change, population growth and continued urban infill development all have the potential to increase the amount of surface water entering the sewer system.** As only 4% of all UK residential paving sales in 2013 were of permeable design, it is highly likely that the majority of surfaces being used to pave over gardens are impermeable (e.g. concrete block paving, asphalt, etc.).<sup>92</sup> Without additional action being taken, an increase in the amount of surface water entering the sewerage system is likely to lead to increased frequency of the sewerage system exceeding its capacity and increased frequency of surface water flooding when this occurs. CCRA2 highlighted an increased sewer flooding of ~ 50% over the next few decades; increased Combined Sewer Overspills (and associated impact on water quality); reduced capacity for new development (new waste water) in the sewer networks; and increased operating costs (associated with pumping more surface water and waste water treatment).<sup>93</sup>

**The updated National Flood Risk Assessment identified that approximately 210,000 properties (7%) in Scotland (residential and non-residential) are at risk of flooding from surface water** in a 0.5% (1 in 200) annual probability event. Due to the methodology changes described in the previous section, property counts have increased significantly since the last assessment and the biggest increase in flooded property counts comes from surface water flooding. It is not possible to say how much of the increase is attributable to increased physical risk and how much to changes in the methodology.

**By comparison, CCRA2 estimated that there are currently 69,000 residential and 14,000 non-residential properties at risk from surface water flooding (based on a 1 in 200 year event).** This is projected to increase to 90,000 and 16,500 respectively by the 2080s under a two degrees emissions scenario, and to 95,000 and 17,000 respectively by the 2080s under a four degrees emissions scenario.<sup>94</sup>

Widespread flooding in 2007 highlighted that traditional piped sewer systems cannot readily be adapted to deal with increased rainfall, particularly in densely populated urban areas.

The priority adaptation to the risk of increased sewer flooding is to reduce the amount of surface water allowed to enter the sewer network. Reducing surface water in sewers can be achieved with a variety of techniques including 'green' sustainable drainage systems (SuDS) such as swales and ponds that can also bring other benefits. This is likely to be required alongside 'traditional' drainage techniques.

*Progress of policies and actions*

**The 2018 National Flood Risk Assessment, mentioned in the section above, also includes an assessment of risk to home, businesses and services from surface water flooding.** The 2018 NFRA has made use of a more detailed assessment of flood risk to a range of receptors

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<sup>92</sup> CCC (2016) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Committee on Climate Change, London.

<sup>93</sup> *ibid.*

<sup>94</sup> Sayers, P.B, Horritt, M.S., Penning-Rowsell, E and McKenzie, A (2017) *Climate Change Risk Assessment 2017: Projections of future flood risk in the UK*. Projections assume low population growth and baseline adaptation i.e. no change in level of ambition over and above today.

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from flooding. The methodology changes are explained further in the 'flooding and coastal erosion risk management' section above.

**SCCAP actions on surface water management are progressing.** A working group on surface water management has been established under the Scottish Advisory and Implementation Forum for Flooding (SAIFF). It includes representatives of Scottish Water, local authorities, SEPA and the Scottish Government. Surface water management planning guidance was published in 2018, to support responsible authorities in preparation of Surface Water Management Plans (SWMPs) to help with the management of surface water flooding. The Flood Risk Management Strategies and Plans include actions in the first six-year cycle to prepare Surface Water Management Plans.

**The Flood Risk Management (Scotland) Act 2009 places a duty on local authorities to map Sustainable Draining systems (SuDS) in their area, but there is no statutory timescale for doing this.** Local Flood Risk Management Plans were published by Lead Local Flood Authorities in 2016. The Local FRM Plans were the culmination of work during the first FRM planning cycle (2015 – 2021) to improve understanding of climate change flood risk. Under the Water Environment (Controlled Activities) (Scotland) Regulations 2011, it is a general requirement for SuDS to be installed where new developments produce surface water that drains into the water environment in order to protect water quality. Where legally required, SuDS should also manage surface water drainage up to a 1 in 30 year rainfall event and protect water quality. Not all SuDS are required to manage surface water flooding. Surface water drainage in Scotland falls under water company and road authority responsibility for sewers and roads respectively, while surface water flooding falls under the flood authorities.

National promotion of SuDS by the SuDS Working Party is on-going with contributions being made to good practice publications and guidance such as 'Sewers for Scotland'.

**The SuDS Working Party, as well as authorities with responsibilities for surface water, highlighted to the Scottish Government that there were issues with the effectiveness of SuDS implementation in Scotland.** To address these issues the Scottish Government set up a new working group with Scottish Water and local authorities, looking at SuDS implementation. The working group is on-going and is concerned with the adequacy of the installation and subsequent maintenance of SuDS installations.

Representatives from the Society of Chief Officers of Transportation in Scotland (SCOTS) Roads Group, SCOTS Flood Group and Scottish Water with support from the Scottish Government, have worked in partnership to develop a Memorandum of Understanding (MoU) that enables shared sustainable drainage systems designed to treat and convey road drainage and surface water from the roofs and curtilages of buildings. The MoU does not cover all developments where SuDS are required and may not address all issues with delivering effective sustainable surface water management infrastructure in new developments.

**Scottish Water models sewer flooding as required under the Flood Risk Management (Scotland) Act 2009 and has recently published a new storm water strategy to address long-term sewer flooding risk.** The strategy highlights that more effective ways of dealing with storm water above ground will substantially reduce pressure on nearly 32,000 miles of sewer network operated by the utility. The new approach is designed to be more adaptable to climate change and reduce the impact of sewer flooding on householders and businesses. Scottish Water has committed £190 million of investment to tackle sewer flooding in the 2015 - 2021 investment period.

## *Climate change vulnerability assessment*

**The updated National Flood Risk Assessment identified that approximately 210,000 properties (7%) in Scotland (residential and non-residential) are at risk of flooding from surface water in a 0.5% (1 in 200) probability event (Table 3.3).** As noted above, longer term trends cannot be assessed due to methodology changes applied to the latest assessment. SEPA estimate that by the 2080s under a high emissions scenario, the number of properties at risk from surface water flooding will increase to around 275,000 (9%). Population growth and the extent of adaptation measures have not been considered in calculating these estimates.

**Data on the number and capacity of SuDS installed in new developments and other drainage assets retrofitted with SuDS is not currently recorded.** This was highlighted as an area of concern in our first assessment report:

**PREVIOUS RECOMMENDATION 11:** The Scottish Environment Protection Agency should ensure the next Flood Risk Management Strategies monitor and report:

- 1) The impact of local flood risk management plans in reducing surface water flood risk, including in relation to managing urban creep.
- 2) The number and capacity of SuDS installed in new developments and of other drainage assets retrofitted with SuDS.

**RESPONSE:** (1) CREW (Scotland's Centre of Expertise for Waters) is undertaking a project to develop a reproducible method for quantifying urban creep which will include a case study area in Scotland (<https://www.crew.ac.uk/project/quantifying-urban-creep>). Data currently available will allow SEPA to track reductions in surface water flood risk by actions put in place to address the risk, but not to quantify it. SEPA is seeking to develop data and approaches which will allow us to track the impact of flood risk management actions.

(2) SEPA does not monitor uptake of SuDS in new developments. SuDS are implemented where they are a legal requirement (i.e. when discharging to rivers and lochs) and SEPA states that this should be the case in our planning responses.

The Flood Risk Management (Scotland) Act 2009 places a duty on local authorities to map SUDs in their area, although there is no statutory timescale for doing this. Any SuDS (or other actions to reduce the risk of surface water flooding) that are retrofitted for the purposes of flood risk management will be in the Flood Risk Management Strategies and Local Flood Risk Management Plans. If SuDS are retrofitted for other purposes (e.g. water quality) then they may not be in the Flood Risk Management Plans. SEPA does not monitor the implementation of retrofitted SuDS for all purposes. SEPA note that the CCC recommended that the next Flood Risk Management Strategies monitor and report the number and capacity of SuDS installed in new developments and other drainage assets retrofitted with SuDS. However this is work that SEPA does not currently do, and this data is not available from all local authorities, although may be available in some local authority areas.

Additional comments: SEPA have been reporting progress on Scotland's first SCCAP. In these progress reports we have highlighted that we do not think the measure(s) in the first SCCAP relating to Sustainable Drainage Systems are appropriate. SEPA highlighted that the Scottish Government implemented SuDS in Scotland to protect and improve water quality in 2005 under the Water Environment (Controlled Activities) (Scotland) Regulation 2011 (note 2005 regs updated in 2011). They were not implemented to reduce the risk of flooding or provide resilience and adaptation to climate change. As such it is not known how effective SuDS are at managing flood risk and making our new developments adaptable to climate change, as standards for achieving this vary locally. Information on the implementation of SuDS in Scotland should be improved in the second SCCAP.

**Some efforts have been made since the first assessment to address the concerns raised.** A recent report by ClimateXChange explored how information on SuDS are retained by local authorities in Scotland and how this information is used to secure appropriate management, monitoring and maintenance of SuDS components.<sup>95</sup> The report also seeks to know the types of SuDS local authorities are responsible for, the extent to which local authorities know where their SuDS are located and whether they maintain them. The results represent opinions of employees across 12 out of 32 local authorities, and within both SEPA and Scottish Water who have past or present experience working with SuDS. Conclusions of the report include that record keeping of the exact number of SuDS components was limited and monitoring and evaluation is more commonly achieved on an informal, ad-hoc basis and not at regular intervals as recommended by The SuDS Manual.<sup>96</sup>

In light of the findings of the ClimateXChange report and the updated NFRA, the Scottish Government should identify what actions it plans to take or consider, to address these gaps in the monitoring and reporting arrangements for SuDS:

**NEW RECOMMENDATION 1:** Work with partners to measure the use of Sustainable Drainage Systems to help manage surface water flood risks.

**NEW RECOMMENDATION 5:** In preparing the next SCCAP, the Scottish Government should work with SEPA to review monitoring and reporting arrangements for the uptake of Sustainable Drainage Systems. There may be an opportunity to collect information through public sector organisations.







## Development in flood risk areas

CCC rating	Rationale for rating
Mixed progress	While there are requirements to consider flood risk in planning new developments, the policy framework should be strengthened by requiring reporting on the number of new properties proposed and built in areas at flood risk, and trend information is needed on the extent of development in floodplains.

<sup>95</sup> McDonald, R. K., for ClimateXChange (2018) *Sustainable Urban Drainage Systems (SUDS) in Scotland: Assessment of Monitoring and Maintenance within Local Authorities and Scottish Water*, [https://www.climatexchange.org.uk/media/3239/sustainable\\_urban\\_drainage\\_systems\\_in\\_scotland.pdf](https://www.climatexchange.org.uk/media/3239/sustainable_urban_drainage_systems_in_scotland.pdf)

<sup>96</sup> Construction Industry Research and Information Association (2015) *The SUDS Manual C753*.

## Summary RAG assessment

Table 3.5. Summary RAG assessment - Development in flood risk areas		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	Scottish Planning Policy requires local planning authorities to prevent development which would have a significant probability of flooding or increase flood risk elsewhere.  Local Flood Risk Management Plans do not monitor and report the number and location of new homes and other properties built in areas of flood risk.	Is there a plan?  Green
Are actions taking place?  Red		Are actions taking place?  Red
Is progress being made in managing vulnerability?  Grey	There is no data available on the trends in floodplain development.	Is progress being made in managing vulnerability?  Grey

### Why is it a priority for adaptation?

**Developers of property or infrastructure in flood risk areas must be cognisant of flood protection measures to reduce the risk to life and property posed by flooding.** Even where properties are protected by flood defences, vulnerability to flood risk can still increase. Given the recent rate of development in flood risk areas and the last Government's housing target of building one million new homes, there is the potential for 90,000 new homes to be built in the highest risk parts of the floodplain between 2015 and 2020. The actual level of risk to individual developments will depend on whether defences are in place, the standard of protection they provide, and whether additional resilience measures have been adopted. Flood defences that protect new developments will need to be continuously maintained and improved over time if current standards of protection are to be sustained. Even where defences are in place, design standards can be exceeded by extreme weather events. Intensively building behind flood defences means more people and property will be affected by future floods, and increases the exposure of the insurance industry to claims should defences be overwhelmed.<sup>97</sup> The second CCRA identified that "continued development in flood risk areas also commits future generations to increasing investment in flood protection."<sup>98</sup>

<sup>97</sup> CCC (2017) 2017 Report to Parliament – Progress in preparing for climate change, p106.

<sup>98</sup> Kovats, R.S., and Osborn, D., (2016) UK Climate Change Risk Assessment Evidence Report, Chapter 5, People and the Built Environment, p47.



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### *Progress of policies and actions*

**Scottish Planning Policy requires local planning authorities to prevent development which would have a significant probability of flooding or increase flood risk elsewhere.** In 2016 there were 2.45 million households in Scotland, an increase of around 257,000 households (12%) over the last 15 years.<sup>99</sup> By 2041, the number of households is projected to increase by 317,000 to 2.76 million.<sup>100</sup> This amounts to an average of 12,700 more households per year. The land use planning system is essential to ensuring these new homes are not at risk of flooding. Scottish Planning Policy is currently under review and it is imperative that the development of the next SCCAP seeks to align with this process and incorporate specific planning-related adaptation actions as appropriate.

**Local Flood Risk Management Plans do not monitor and report the number and location of new homes and other properties built in areas of flood risk.** Local authorities lead on the preparation of local flood risk management plans, which supplement the national strategies prepared by SEPA and ensure actions are locally targeted and delivered. They also have the ability to plan, design and build flood protection schemes. Local Flood Risk Management Plans were published by Lead Local Authorities in 2016. SEPA's risk maps examined flood risk to residential and non-residential properties, utilities and transport networks amongst other receptors, and this information was used to set objectives and actions in the Local FRM Plans.

All local planning authorities in Scotland are advised to produce a Strategic Flood Risk Assessment (SFRA) to inform their local development plan. Developers must produce site-specific flood risk assessments for planning applications in areas of flood risk. Data is not currently collected on the number of planning application decisions which are approved contrary to SEPA's advice on flood risk.

**The current uptake of property level protection (PLP) in Scotland is unknown but a working group has been established to progress work in this area.** Some local authorities in Scotland provide subsidy/discount schemes for PLP (for example, Scottish Borders Council) and the potential for PLP has also been identified in the FRM Strategies. The Scottish Government is a co-sponsor of CIRIA research project CIRIA RP1055: Code of practice and guidance for property flood resilience and are members of the steering group, as are some local authorities in Scotland.

### *Climate change vulnerability assessment*

The lack of data related to flood plain development was highlighted by the Adaptation Committee in our first independent assessment of the SCCAP in 2016:

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<sup>99</sup> National Records for Scotland (2017) *Estimates of Households and Dwellings in Scotland 2016*, <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/households/household-estimates/2016>

<sup>100</sup> National Records for Scotland (2018) *Household Projections for Scotland (2016-based)*, <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/households/household-projections/2016-based-household-projections>

**PREVIOUS RECOMMENDATION 11:** The Scottish Environment Protection Agency should ensure the next Flood Risk Management Strategies monitor and report:

3) The number of planning applications for new developments in the floodplain that were granted, and within these, the number of applications for which SEPA advice was sought and the number of applications to which SEPA objected;

4) The number and location of new homes and other properties built in areas of flood risk.

**RESPONSE:** (3) There hasn't been progress on this since CREW (Scotland's Centre of Expertise for Waters) completed their report in 2015. We don't routinely get decision notices from local planning authorities so there is no quick and comprehensive means of tracking our involvement through the planning process. Unless we get the information we require, either in the form of individual decision notices or as an aggregated data set, we won't be able to quantify the number of decisions where our advice has been ignored.

(4) Currently this could be tracked at a strategic level via the NFRA and updates to the property dataset every six years, if new development can be identified via the property dataset. However, this misses out small catchments due to the mapping. It could be linked to (3) above if data capture and resourcing is sorted out.







**There remains a pressing need for a better understanding of and accounting for the actual change in flood risk from new development on the floodplain.**

**NEW RECOMMENDATION 1:** Work with partners to measure and address the impact of new development on long-term flood risks and risk management costs.

## Resilience of buildings to extreme wind and rain

CCC rating	Rationale for rating
Mixed progress	There has been good progress in implementing SCCAP actions and the vulnerability of the housing stock to extreme wind and rain is declining. Levels of domestic building disrepair have gone down over the last ten years, though there has been no significant change in the number of homes showing dampness since 2002 – around 4% in 2016. There are limited provisions in building standards for retrofitting existing buildings with adaptation measures for the impacts of extreme wind and rain.

## Summary RAG assessment

Table 3.6. Summary RAG assessment - Resilience of buildings to extreme wind and rain		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>Building standards are in place for flood resilience, moisture penetration from heavy rain, heating, ventilation and condensation and were recently revised.</p> <p>There has been progress in the historic buildings sector; refurbishment of historic buildings with published case studies, and a Climate Change Risk Assessment of the Historic Environment Scotland Estate has been completed.</p> <p>Historic Environment Scotland short guides have been published: Climate Change Adaptation for Traditional Buildings published 2016; Fabric Improvements for Energy Efficiency in Traditional Building 2018.</p> <p>Risk to cultural heritage is included in the new National Flood Risk Assessment.</p> <p>There is no strategy for retrofitting existing buildings to improve resilience to extreme weather.</p>	<p>Is there a plan?</p>  <p>Amber</p>
<p>Are actions taking place?</p>  <p>Green</p>		<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>Levels of domestic building disrepair have declined over the last ten years.</p> <p>There has been no significant change in the number of homes showing signs of penetrating and rising dampness since 2002 – around 4% combined in 2016.</p> <p>The number of homes showing signs of condensation has decreased since 2012 and is now less than 10%.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Green</p>

### Why is it a priority for adaptation?

**Climate change could increase the frequency and intensity of heavy rain storms in Scotland in the future.** Current exposure to wind-driven rain in Scotland ranges from 'Moderate' (some east coast areas) to 'Very Severe' along much of the west coast and Scottish Islands. Rainwater penetration can lead to internal dampness, increased condensation, mould and insect pests, all of which have implications for human wellbeing and health as well as for the building fabric. Penetrating damp is usually the result of a defect in the building fabric, such as damage to the walls or roof, water ingress due to damaged seals on doors or windows or damp as a result of leaking plumbing. Rising damp is less of a problem but any source of dampness will have implications for human health. Rising damp is the result of defective or missing damp proof coursing leading to water leaching into the building fabric.

**Building disrepair increases the likelihood that adverse and extreme weather will have harmful effects on both the building and occupant safety and well-being, and so is a measure of climate vulnerability.** For example it increases the likelihood of wind-driven rain

leading to penetrating damp, and of structural damage following storms or intense rainfall. The costs of repair are likely to be greater if maintenance has been neglected. In addition, internal dampness may lead to the presence of algal moulds, pests and a range of impacts on the health of occupants.

### *Progress of policies and actions*

**Building standards for new homes are in place for flood resilience, moisture penetration from heavy rain, heating, ventilation and condensation and were recently revised.** The Scottish Government reported in their most recent SCCAP progress report that research carried out for the Scottish Government established that current building standards guidance with respect to typical wall constructions are appropriate for the foreseeable future, however it is not clear whether this research considered relevant climate risks.<sup>101</sup> Research has also been carried out in an attempt to develop a simple methodology for sizing gutters and downpipes but the guidance has not changed for some time.<sup>102</sup> Following analysis to determine indoor air quality within dwellings, technical guidance for the building standards calls for additional equipment that has the scope to improve the ventilation of new homes, however such equipment is needed only if a building applicant chooses to prove the airtightness of the building.<sup>103</sup>

**A National Centre for Resilience (NCR) advisory group supports the flood resilient homes action plan project.** The action plan will promote resilient repairs following a flood and property level protection which can reduce the recovery period after a flood.

**Existing homes must be retrofitted to become low-carbon and resilient to a changing climate.** The relevant Technical Standards should be reviewed and tightened via an integrated approach. A key issue is the potential tension between those aspects of building standards that deal with the indoor environment (especially Section 3) and those that deal with energy (Section 6). If best practice is not followed, insulation installation and reduced air change rates may reduce energy consumption but also have the potential to create unintended consequences (such as damp, mould, reduced indoor air quality and overheating). These issues are picked up in more detail in the CCC's recent report on UK Housing.<sup>104</sup>

**There has been notable progress in the refurbishment of historic buildings and a number of case studies and guides have been published by Historic Environment Scotland (HES).**<sup>105</sup> HES has worked with a range of partners to research the physical effects and develop techniques to determine moisture penetration, e.g. green mortars, sandstone heritages and freeze thaw behaviour of sandstone. A Climate Change Risk Assessment has been completed for the HES Estate. A report on *Screening for Natural Heritage Risk to Inform a Climate Change Risk Assessment of the Historic Environment Scotland Estate* was published in January 2018. Results have also informed the new HES Asset Management Plan and Investment Plan. Progress against HES's Climate Change Action Plan (2012 - 2017) is reported in their Sustainability and Public Sector Climate Change Duties Reports. The next iteration of the plan is currently under development. A

<sup>101</sup> The Scottish Government (2018) *Scottish climate change adaptation programme: progress report 2018*, <https://www.gov.scot/publications/climate-ready-scotland-scottish-climate-change-adaptation-programme-fourth-annual/>

<sup>102</sup> Technical Standards still refer to BS EN 12056-3: 2000. Clause 3.3.3 refers to resilience in flood risk areas and refers to guidance dated 2007 and 1966.

<sup>103</sup> The Scottish Government (2018) *Scottish climate change adaptation programme: progress report 2018*.

<sup>104</sup> CCC (2019) UK Housing: Fit for the Future?

<sup>105</sup> Case studies are available at <https://www.historicenvironment.scot/about-us/what-we-do/conservation/refurbishment-case-studies/>

series of short guides have been published, including Climate Change Adaptation for Traditional Buildings (2016) and Fabric Improvements for Energy Efficiency in Traditional Building (2018).

**Risk to cultural heritage were included in the new National Flood Risk Assessment.** In September 2017, The SCAPE Trust (Scotland’s Coastal Archaeology and the Problem of Erosion) delivered “A Review of Heritage at Risk from Coastal Processes in Scotland: Results from the Scotland’s Coastal Heritage at Risk Project”.

### *Climate change vulnerability assessment*

**Levels of domestic building disrepair have declined over the last ten years.** Good repair status is a key factor in the resilience of buildings to adverse and extreme weather events. While disrepair levels increased between 2009 and 2011, steady declines have been observed in all categories since 2011. Levels of disrepair vary according to the degree of maintenance, type of tenure and dwelling age. In 2016, 6% of dwellings in Scotland had extensive levels of disrepair while 48% had critical elements of disrepair (Table 3.7).<sup>106</sup>

**Table 3.7.** Rates of disrepair by category (2015 and 2016)

Year	Any (basic) disrepair		Critical element disrepair	Urgent disrepair	Extensive disrepair
	No disrepair	Some disrepair			
2016	32%	68%	48%	28%	6%
2015	27%	73%	52%	33%	8%

**Source:** ClimateXChange (2018), *Indicator BB16: Building Condition and Disrepair* - [https://www.climateexchange.org.uk/media/3477/bb16-disrepair\\_status\\_of\\_dwellings\\_2018.pdf](https://www.climateexchange.org.uk/media/3477/bb16-disrepair_status_of_dwellings_2018.pdf). Data derived from the Scottish House Condition Survey (SHCS).

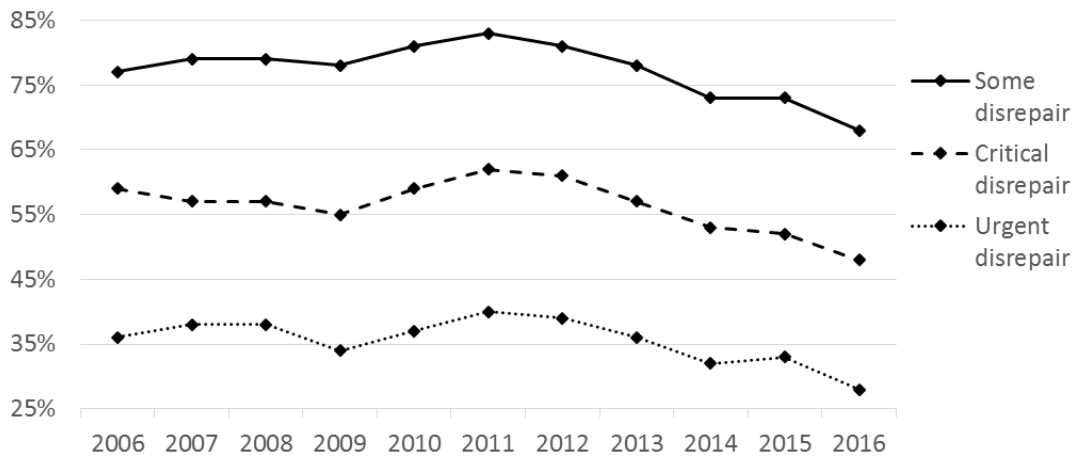
**Notes:** In the SHCS, disrepair is recorded under four different, overlapping categories: Any (or Basic) disrepair - any damage requiring repair beyond routine maintenance; Extensive disrepair - where the damage affects 20% or more of the building element area; Urgent disrepair - requires immediate attention to prevent further damage or safety issues; Critical element disrepair - disrepair to building elements central to weather-tightness, structural stability and preventing deterioration of the property. Full definitions of disrepair categories are given in the SHCS Key Findings Report (The Scottish Government, 2017).

There has been a drop in the proportion of properties with some, critical and urgent disrepair over the last ten years of records (Figure 3.2).

<sup>106</sup> The Scottish Government (2017) *Scottish House Condition Survey 2016*, <https://www2.gov.scot/Topics/Statistics/SHCS>



**Figure 3.2.** Change in levels of building disrepair (2006 – 2016)

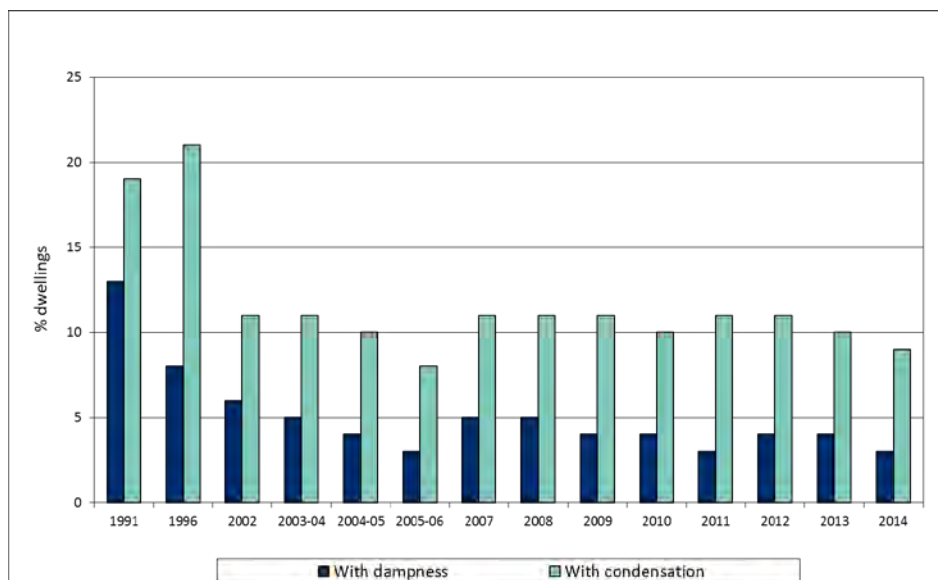


**Source:** ClimateXChange (2018), *Indicator BB16: Building Condition and Disrepair* - [https://www.climatechange.org.uk/media/3477/bb16-disrepair\\_status\\_of\\_dwellings\\_2018.pdf](https://www.climatechange.org.uk/media/3477/bb16-disrepair_status_of_dwellings_2018.pdf)

**Notes:** Data derived from the Scottish House Condition Survey (SHCS).

There have been no significant changes in the number of homes showing signs of penetrating or rising dampness since 2002; around 4% in 2016 (penetrating damp: 3.7%, rising damp: 0.4%).<sup>107</sup> The number of homes showing signs of condensation has decreased since 2012 and is now less than 10% (Figure 3.3).

**Figure 3.3.** Trends in dampness and condensation (1991–2014)



**Source:** The Scottish Government (2016) *Scottish House Condition Survey*.







<sup>107</sup> The Scottish House Condition Survey records a dwelling as having damp or condensation even when just a small area is affected. Levels of dampness and condensation may vary depending on recent weather conditions, therefore single time point measurement may not be representative.

## Water demand in the built environment

CCC rating	Rationale for rating
Mixed progress	Per capita consumption of water in Scotland remains high compared to many other European countries, at just over 150 litres per person per day. Plans are in place to reduce demand through lower consumption and leakage, and actions are underway to test water efficiency measures. The Committee would like to see demand fall further in the next SCCAP period.

### Summary RAG assessment

**Table 3.8.** Summary RAG assessment - Water demand in the built environment

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Green</p>	<p>Water leakage targets are set for the period 2015 - 2021 and monitored regularly.</p> <p>The Scottish Water 'Water Efficiency Plan 2015 - 2021' is in place.</p> <p>Building Standards include a mandatory requirement for water efficient fittings in dwellings.</p>	<p>Is there a plan?</p>  <p>Green</p>
<p>Are actions taking place?</p>  <p>Green</p>	<p>Scottish Water has completed an Efficiency Trial of 2,000 households. They have also distributed 49,000 water saving packs, that include an advice brochure and, depending on suitability, water efficiency devices, though it is not known whether householders have installed the savings measures in the packs.</p> <p>The numbers of homes with water meters appears to have decreased.</p>	<p>Are actions taking place?</p>  <p>Green</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>Leakage from public water supply continues to decrease and leakage targets are being met.</p> <p>Non-domestic water consumption continues to decrease.</p> <p>There has been no significant change in household water use.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>

### Why is it a priority for adaptation?

**If demand for water is reduced in Scotland, it will reduce the vulnerability of the population to lower available water supplies in the future.** Although Scotland is a relatively water-rich country, there are not unlimited resources available for treatment and supply. The combined effect of climate change and the growing population may increase pressures on

available water resources. The pressure is most evident in cases where water resources are distant from areas of population growth, where substantial infrastructure investment would be required to transfer water from available sources to meet rising water demand. Possible climate impacts include changes in the quality and availability of water resources, increased variability in rainfall patterns, and restrictions on discharging wastewater to the environment.

**Improved water efficiency and reduced leakage help to manage future vulnerability to water supply issues.** Ensuring that the available resources are used in a sustainable way is critical to managing the future risks of water scarcity. Reducing water demand is important in order to reduce the risk of loss of supply to customers and meet future demand requirements.

### *Progress of policies and actions*

The issue of water consumption and efficiency was raised in the first assessment:

**PREVIOUS RECOMMENDATION 12:** The Scottish Government should review before the next SCCAP whether further action is required to deliver and sustain reductions in average water consumption per person in Scotland. As part of this review, Scottish Water should publish the outputs of their water efficiency trials, including an assessment of the impact of metering.

**RESPONSE:** While metering is not promoted in Scotland, there is a number of ongoing and planned measures being undertaken by Scottish Water to improve efficiency and reduce water consumption, including a water efficiency trial of 200 households. Water meters were installed to record the impact of various measures/combinations of measures upon water usage. These measures included advice on reducing water consumption, installation of water efficient devices and financial incentives. Following analysis of the data, a report will be produced in late 2018. There is also a Water Saving Pack Project, where between 2017 and 2021 Scottish Water is engaging with 2% of Scottish householders through distribution of 49,000 water saving packs, which include an advice brochure and, depending on suitability, water efficiency devices. The packs are delivered in partnership with the Energy Saving trust, who manage Home Energy Scotland, the customer facing brand of the Scottish Government's energy efficiency programmes. Their network of energy advisors provides both water efficiency and energy advice. Scottish Water hopes to scale up this programme in its next business plan. Since 2013, Scottish building regulations mandate water efficiency measures for new buildings and new work to existing buildings.

**Legislative obligations for water efficiency and leakage management are in place, as are plans to implement water efficiency measures.** The Water Resources (Scotland) Act (2013) continues to place a duty on Ministers to take steps to develop the value of water resources. Scottish Water's Water Efficiency Plan 2015 - 2021 includes measures to educate customers on water efficiency and to reduce leakage in the network.

**A new mandatory standard was introduced in October 2014 requiring water efficient fittings in dwellings.** The standard requires that sanitary facilities with water efficient fittings which are designed for the prevention of undue consumption of water are installed in all dwellings.<sup>108</sup>

**Scottish Water is undertaking water efficiency trials to understand the relative costs and benefits of different measures to manage demand.** They have also distributed 9,000 water saving packs, including an advice brochure and, depending on suitability, water efficiency

<sup>108</sup> The Scottish Government Scottish Domestic Building Standards - standard 3.27.

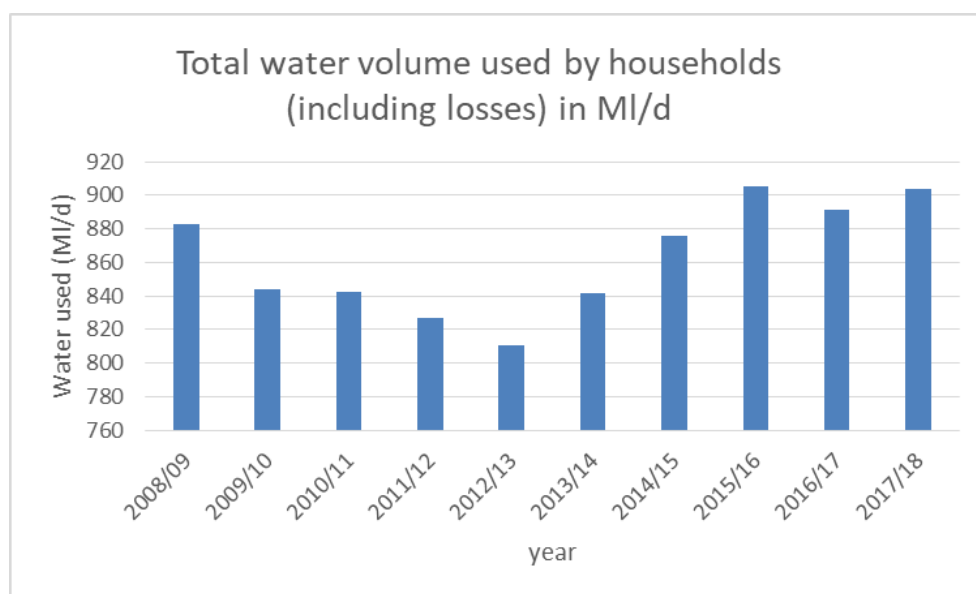
devices. The requirements for Scottish Water's investment programme for 2015-2021 are set out in Ministerial Directions and will address the adaptation needs of water infrastructure in Scotland.

### Climate change vulnerability assessment

#### There is no clear trend in household water use in Scotland over the last ten years.

The total water volume used by Scottish households in 2017/18 was 904 megalitres (MI) per day.<sup>109</sup> There is no clear direction in the long term trend in household water usage (Figure 3.4).

**Figure 3.4.** Total volume of household water delivered (including supply pipe losses) per day (2008/09-2017/18)



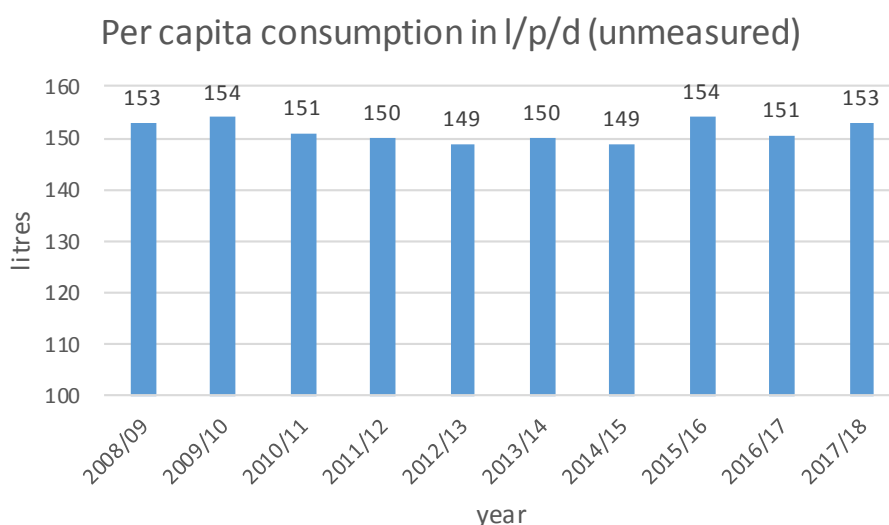
**Source:** ClimateXChange (2018) *Indicator BW8 Domestic water usage* - [https://www.climateexchange.org.uk/media/3506/bw8-household-water-usage\\_2018.pdf](https://www.climateexchange.org.uk/media/3506/bw8-household-water-usage_2018.pdf). Data derived from Scottish Water's Annual Returns (Water Industry Commission for Scotland, 2018).

**Notes:** Vertical axis is not scaled to zero.

**Per capita consumption has remained fairly static since 2008 and consumption in 2017/18 was 153 litres per person per day (Figure 3.5).** Reported per capita water consumption over the period may be influenced by changes in the socio-demographic data, changes in property vacancy levels reported by Local Authorities, changes in the reported numbers of properties connected to the network and variations in the weather year to year. By comparison, per capita consumption in England is currently 139 l/p/d.

<sup>109</sup> Data covers households supplied from the water mains only and does not cover households that use private water supplies. Approximately 3% of the Scottish population uses a private water supply for drinking water.

**Figure 3.5.** Unmeasured per capita water consumption in litres per person per day (2008/09-2017/18)



**Source:** ClimateXChange (2018) *Indicator BW8 Domestic water usage* - [https://www.climateexchange.org.uk/media/3506/bw8-household-water-usage\\_2018.pdf](https://www.climateexchange.org.uk/media/3506/bw8-household-water-usage_2018.pdf). Data derived from Scottish Water's Annual Returns (Water Industry Commission for Scotland, 2018).

**Notes:** Due to the very small number of metered domestic properties (around 400-500, with 2.5 million unmeasured), per capita consumption data presented is based on unmeasured households only. Vertical axis is not scaled to zero.

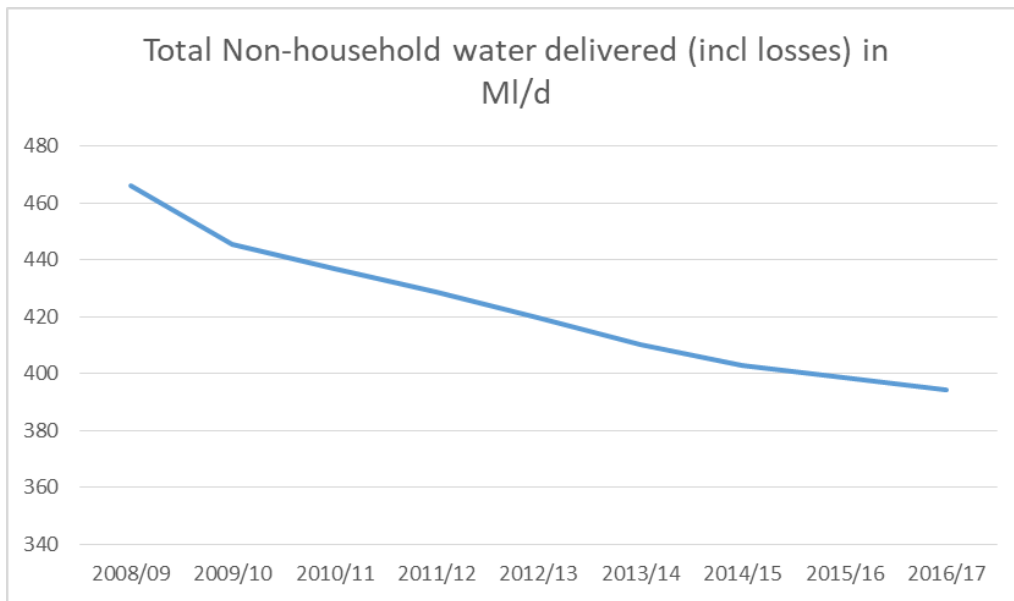
**Non-domestic water consumption has continued to decrease in Scotland, however it is still not possible to assess whether the decrease is attributable to water efficiency measures.**

There has been a sustained decrease in the annual average volume of non-domestic water delivered per day between 2008/09 (466 MI/d) and 2016/17 (394 MI/d) (Figure 3.6).<sup>110</sup>

<sup>110</sup> ClimateXChange (2018) *Indicator BW9 Non-domestic water usage*, [https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic\\_2018.pdf](https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic_2018.pdf)



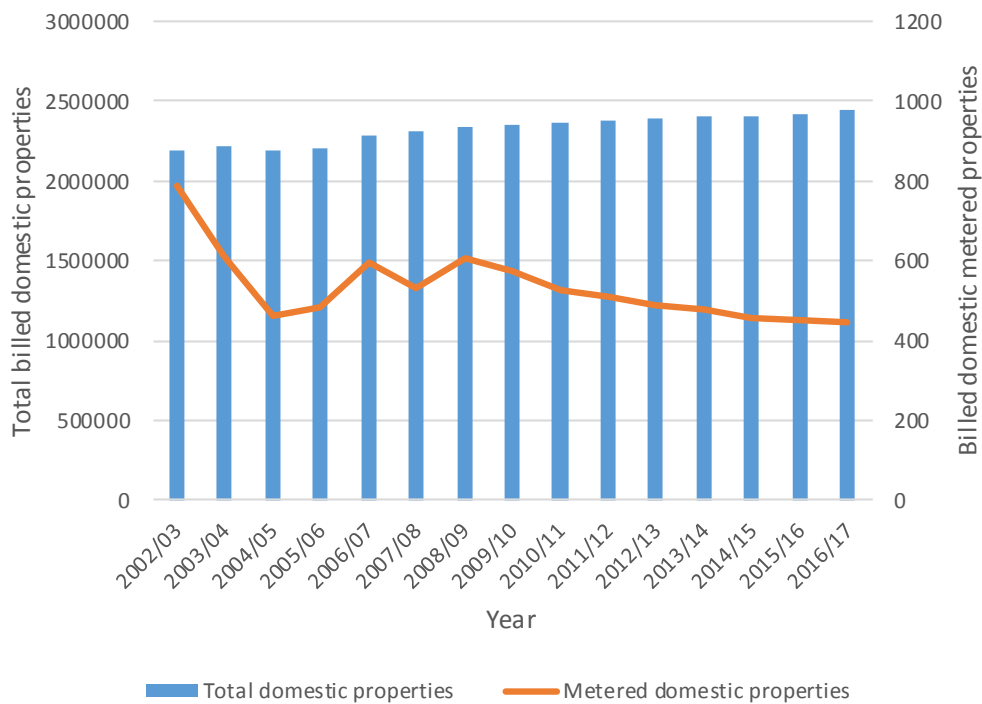
**Figure 3.6.** Trend in total non-household water delivered (2008/09-2016/17)



**Source:** ClimateXChange (2018), *Indicator BW9 Non-domestic water usage* - [https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic\\_2018.pdf](https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic_2018.pdf). Data derived from Scottish Water's Annual Returns (Water Industry Commission for Scotland, 2018)

**The number of properties with domestic metering has decreased (Figure 3.7).** The number of domestic properties with water meters in Scotland is very low - 440 in 2017/18 - and is not constant. The number of properties with water meters has fallen year on year since 2008/09 although this decline has levelled off over the last three years. It is not known why some properties that had meters have lost them. Water metering for domestic properties in Scotland is not actively encouraged as household water and sewerage charges are billed and collected by individual local authorities for Scottish Water and are linked to the Council Tax banding system.

**Figure 3.7.** Uptake of metering by billed domestic properties (2002/03-2016/17)



**Source:** ClimateXChange (2018) *Briefing note: Briefing note: Uptake of water metering by domestic properties / Actions to reduce domestic water use.*

**Notes:** Data derived from Scottish Water’s Annual Returns to the Water Industry Commission for Scotland.







**Leakage from public water supply continues to decrease and leakage targets are being met.** Leakage targets are set for the period 2015-2021 and monitoring reports are published on the Scottish Government website.

In 2016/17, 495 megalitres per day (Ml/d) of water was lost from the water system due to leakage. This amounts to approximately 28% of total water use and is 4.87 Ml/d less than in 2015/16, significantly exceeding the minimum service level (575 Ml/d). It is also below the target level for the end of the 2015 - 2021 regulatory control period, which is 500 Ml/d. The targeted leakage reduction programme was initiated at Scottish Water in 2006 and there has been a decrease in the volume of water lost through leakage each year between 2008/09 and 2016/17.

### Design and location of new infrastructure

CCC rating	Rationale for rating
Mixed progress	There is good coverage of climate change in policies such as the National Planning Framework, and SCCAP actions are progressing. There is a lack of information to assess vulnerability of new infrastructure to future climate risk.

## Summary RAG assessment

Table 3.9. Summary RAG assessment - Design and location of new infrastructure		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	The National Planning Framework (NPF) and Scottish Planning Policy (SPP) continue to require consideration of climate change in design and location of new infrastructure – these policy instruments are currently under review.	Is there a plan?  Green
Are actions taking place?  Amber	The revised Scottish Capital Investment Manual (SCIM) includes sustainability principles and applies to all relevant NHS Scotland projects but there are no specific requirements related to adaptation.	Are actions taking place?  Amber
Is progress being made in managing vulnerability?  Grey	There is still no evidence collected on whether new infrastructure is designed and located according to the sustainability and adaptation principles set out in the latest National Performance Framework.	Is progress being made in managing vulnerability?  Grey

### Why is it a priority for adaptation?

**Decisions on the design and location of new infrastructure can greatly influence whole-life costs.** The second CCRA identifies a number of risks and opportunities to infrastructure in Scotland, including increased flood risk, heat, extreme weather and drought.<sup>111</sup> These sorts of impacts will affect the whole-life costs of infrastructure assets, and could lead to different design decisions where climate change is explicitly considered during the design phase of infrastructure projects. This in turn can help in assessing the need for up front precautionary measures to avoid greater long-term costs from climate impacts, and safeguard future value of assets.

### Progress of policies and actions

**The National Planning Framework (NPF) and Scottish Planning Policy (SPP) continue to require the consideration of climate change in the design and location of new infrastructure.** Included in the outcomes for national developments in the NPF is a strategy for a 'natural, resilient place' which aims to evolve the approach to environmental stewardship, enhance ecosystem services and adapt to the growing impact of climate change. Taking forward the actions in the SCCAP is also embedded in the delivery outcomes for the NPF.

<sup>111</sup> CCC (2016) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Committee on Climate Change, London.

It is imperative that the next SCCAP is designed to accommodate future changes in planning policy in Scotland. The National Planning Framework and Scottish Planning Policy are currently under review with a view to publication of the next version by 2020. The next SCCAP should be structured in a way to accommodate the changes to these policies.

**There are some examples of sustainability being incorporated into infrastructure planning but there is a lack of provision for adaptation specifically.** The revised Scottish Capital Investment Manual (SCIM) will apply to all relevant NHS Scotland projects from the beginning of financial year 2017/18. The revised SCIM provides guidance on the various stages of infrastructure development from inception to post project evaluation and review. It provides a framework for business case development to ensure that at each stage of project development, robust design principles are adhered to. These include requirements related to climate change mitigation but not adaptation. Local and national measurement for quality improvement and performance management related to sustainability are developed by individual NHS Boards. Evidence of guidance for climate adaptation being included in other infrastructure planning such as schools, colleges, prisons and care homes has not been identified.

**There is evidence of a growing interest in collaboration between climate scientists and engineers in the UK,** with a recent study published by the Institution of Civil Engineering Journal of Forensic Engineering which seeks to quantify estimates of future climate change for civil engineers in planning for infrastructure.<sup>112</sup>

#### *Climate change vulnerability assessment*

**There is still no evidence collected on whether new infrastructure is designed and located according to the sustainability and adaptation principles set out in the National Planning Framework (NPF3).** One of the planning outcomes in NPF3 is that "Planning makes Scotland a low carbon place - reducing our carbon emissions and adapting to climate change". The framework notes that a wide range of measures are required for adaptation, including catchment-scale flood management; cross-boundary and multi-sectoral working by planning authorities, integration of flood risk management plans into strategic and local development planning and factoring in a range of issues to planning decisions - changing water supplies, water quality issues, coastal erosion and increased vulnerability of the historic building stock.

#### **Resilience of infrastructure services to extreme weather events**

The first assessment of the SCCAP identified a lack of data on current resilience and reporting mechanisms to monitor progress in managing vulnerability to extreme weather events over time:

**PREVIOUS RECOMMENDATION 13:** The Scottish Government should work with all infrastructure sectors before the next SCCAP to develop consistent incident reporting, together with indicators of network resilience and performance, and the implementation of resilience measures, to allow improvements in resilience to extreme weather events to be measured over time.

**RESPONSE:** Regional Resilience Partnerships (RRPs) are currently undertaking their biennial Risk and Preparedness Assessment. This process gives partnerships (Cat 1 and 2 Responders) an understanding

<sup>112</sup> Abraham et al. (2017) *Briefing: Future climate projections allow engineering planning*, *Proceedings of the Institution of Civil Engineers*, Forensic Engineering, Volume 170 Issue 2, May 2017, pp. 54-57.

**PREVIOUS RECOMMENDATION 13:** The Scottish Government should work with all infrastructure sectors before the next SCCAP to develop consistent incident reporting, together with indicators of network resilience and performance, and the implementation of resilience measures, to allow improvements in resilience to extreme weather events to be measured over time.

of the hazards they may be faced with, including extreme weather events such as low temperature and snow and storms and gales. This assessment is then used to inform their capability to deal with these events and identify the gaps that exist and the work needed to close those gaps. This next cycle will finish in March 2019 and a report for each region will be provided to the Scottish Government Resilience Division. Following that RRP will spend the next 18 months on work to close gaps before they move into another round of risk assessment.

There remains a lack of metrics or indicators against which to assess resilience of infrastructure to extreme weather events over time.



**NEW RECOMMENDATION 1:** Work with partners to measure and address vulnerability to climate change, to secure the performance of infrastructure networks in severe weather.

### A) Resilience of energy networks - generation, transmission and distribution

CCC rating	Rationale for rating
Mixed progress	Whilst a regulatory framework is in place, two key SCCAP actions have not been taken up (Energy Sector Climate Change impacts research programme and Scottish Government Energy Sector Flood Risk workstream) and there is a lack of data to assess trends in electricity supply disruption caused by severe weather events other than flooding.





#### Summary RAG assessment

**Table 3.10.** Summary RAG assessment - Resilience of energy networks

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	The reliability of energy services is governed by Ofgem - Distribution Network Operators (DNOs) are required to report flood risk and mitigation measures for substations.	Is there a plan?  Green



**Table 3.10.** Summary RAG assessment - Resilience of energy networks

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Are actions taking place?</p>  <p>Amber</p>	<p>Investment in resilient energy services is still encouraged through financial reward and penalty regimes.</p> <p>Two SCCAP actions have not been taken up - Energy Sector Climate Change impacts research programme and Scottish Government Energy Sector Flood Risk work stream.</p>	<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Green</p>	<p>Flooding is a minor factor in supply interruption, accounting for just 0.03% of all Customer Interruptions in 2016.</p> <p>Updated trends in electricity supply disruption caused by severe weather events are not available. There is evidence of storms affecting supply during recent events.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>

*Why is it a priority for adaptation?*

**High winds (and lightning strikes) are the most common causes of power disruptions due to trees and branches falling onto power lines, causing 20% of all customer disruption between 1995 and 2011.**<sup>113</sup> Power supply may be compromised by the flooding of power stations or substations. While existing data suggests that less than 4% of substations are located in areas at risk of a 1 in 200 year flood event, some ‘critical’ customers could be affected by this (such as hospitals, water and wastewater pumping stations and underground stations). Many such critical sites and Emergency Service control rooms have back-up capacity – either in the form of diesel generators (hospitals, Scottish Water key sites), or battery back-up (telecoms service providers and some mobile masts).

Gas transmission networks are generally less exposed to climate hazards than electricity networks but any failures with gas transmission can result in serious consequences due to the risk of explosions. The Health and Safety Executive therefore places strong emphasis on gas transmission and distribution operators and National Grid Gas to maintain a safe system.

*Progress of policies and actions*

**The reliability of energy services is governed by Ofgem and Distribution Network Operators (DNOs) are required to report flood risk and mitigation measures for substations.** Ofgem stipulates minimum protection standards for key assets, and also applies financial penalties for service failure. Investment in resilient energy services is still encouraged through financial reward and penalty regimes.

<sup>113</sup> CCC (2016) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Committee on Climate Change, London.

**The key SCCAP actions related to energy network resilience have not been taken up** – an Energy Sector Climate Change impacts research programme and the Scottish Government Energy Sector Flood Risk work stream. It is not known why these have not been taken up and whether alternatives are being implemented for the next SCCAP.

**NEW RECOMMENDATION 7:** Given that two programmes related to energy sector resilience in the current SCCAP were not taken up - Energy Sector Climate Change Impacts research programme and Scottish Government Energy Sector Flood Risk work stream – include actions in the next iteration of the SCCAP to ensure adaptation actions for energy sector resilience continue.

*Climate change vulnerability assessment*

**Flooding is a minor factor in supply interruption, accounting for just 0.03% of all Customer Interruptions in 2016.** There were 12 interruptions to energy supply due to flooding in 2016, resulting in 76,096 customer minutes lost.<sup>114</sup> This represented just 0.03% of all customer interruptions and just 0.07% of annual customer minutes lost in 2016. The number of incidents and related customer minutes lost vary considerably across years. This makes it unrealistic to interpret data over a short time span as an impact indicator, as a single large flood event can have a very marked impact.







**An updated trend in electricity supply disruption caused by severe weather events is not available.** An updated indicator has not been available in time for this assessment. In September 2018, storm Ali brought wind gusts of over 100mph and significant rainfall to parts of Scotland. As a result, Scottish and Southern Electricity Networks reported that around 20,000 homes lost electricity. The areas most affected were Perthshire, Aberdeenshire, Angus and Argyll. SP Energy Networks, which covers the south of Scotland, reported 58,000 households had lost supplies. Scotland’s energy capacity has evolved as a primarily centralised network, which makes it dependent on a relatively inflexible system of critical infrastructural assets.

**B) Resilience of public water supplies**

CCC rating	Rationale for rating
Positive progress	SCCAP policies and actions are progressing well and have a long-term focus. Interruptions to water supply are decreasing. Trends in weather-related disruptions cannot be assessed due to a lack of data, and this could be a focus for the next SCCAP.

<sup>114</sup> ClimateXChange (2018) *Indicator BE4/14 Electricity supply disruption due to flooding*, [https://www.climateexchange.org.uk/media/3488/be4\\_14-disruption-to-power-due-to-flooding\\_2018.pdf](https://www.climateexchange.org.uk/media/3488/be4_14-disruption-to-power-due-to-flooding_2018.pdf)

## Summary RAG assessment

Table 3.11. Summary RAG assessment - Resilience of public water supply		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	Scottish Water's 25 year Water Resources Management Plan includes actions that will be taken to improve the resilience of public water supplies, taking account of climate change.  The Scottish Water 2015 - 2021 investment programme is set out in Ministerial Directions and includes commitments to ensure that no individual Water Resource Zones are in supply deficit by 2027.  Risk assessments have been completed to inform post-2021 investment.	Is there a plan?  Green
Are actions taking place?  Green		Are actions taking place?  Green
Is progress being made in managing vulnerability?  Amber	There are no indicators available to measure the vulnerability of water supplies to climate-related risks. The number of unplanned interruptions to water supply has decreased, however the cause of interruption is not reported therefore trends in weather-related interruptions cannot be assessed.	Is progress being made in managing vulnerability?  Grey

### Why is it a priority for adaptation?

**While Scotland is currently a water-rich country, water supply networks must be resilient to future climate impacts to ensure continued security of supply.** Climate change is expected to restrict the supply of water whilst population growth and warmer temperatures will add to demand. While the impacts are expected to be relatively modest in Scotland, CCRA2 does project deficits for some areas especially in higher warming scenarios, and it is important a good understanding is developed of the current vulnerability of water supplies to external shocks, given the criticality of the service to people. The more resilient assets and people are now, the more resilient they will also be in the future.

### Progress of policies and actions

**Scottish Water's 25 year Water Resources Management Plan includes actions that will be taken to improve the resilience of public water supplies, taking account of climate change.** The Scottish Water 2015 - 21 investment programme is set out in Ministerial Directions and includes commitments to ensure that no individual Water Resource Zones are in supply deficit by 2027.

A risk assessment exercise has been completed to inform the programme for post-2021 investment and is focussed on risks deemed to increase most under climate change and not already addressed through strategic plans. The findings of the risk assessment will be used to

support asset management planning and future strategic decision making for the post-2021 investment programme.

### *Climate change vulnerability assessment*

**Trends in weather-related interruptions to water supply, and hence vulnerability to climate change, cannot be assessed.** In the year to March 2018, 6,396 properties experienced unplanned interruptions to supply lasting more than 6 hours and 552 which lasted more than 12 hours. In the year to March 2016 there were 6,434 unplanned interruptions lasting more than 6 hours and 716 interruptions lasting more than 12 hours. While this shows a short term downward trend in interruptions, there are only two years' worth of data and the cause of interruption is not currently recorded. Therefore it is not possible to tell whether, over time, services are becoming more or less resilient to extreme weather.





The most recent data on unplanned interruptions to water supply is not comparable to pre-2015 data used in the first assessment due to changes in measurement method.

### **C) Resilience of ports, airports and ferry terminals**

CCC rating	Rationale for rating
Mixed progress	There is limited provision in the SCCAP for adaptation actions related to ports, airports and ferry terminals, and there is a lack of data to assess whether steps are being taken to manage climate risk. Given the importance of these services for more remote communities in Scotland, more evidence on the scale of risk and action underway is needed as a priority for the next SCCAP.

### *Summary RAG assessment*

<b>Table 3.12. Summary RAG assessment - Resilience of ports, airports and ferry terminals</b>		
<b>First assessment RAG score</b>	<b>What has changed since first assessment?</b>	<b>Updated RAG score</b>
Is there a plan?  Amber	The Marine (Scotland) Act 2010 and National Marine Plan continue to set the legislative framework for ports, airports and ferry terminals, including adaptation requirements.	Is there a plan?  Amber

Table 3.12. Summary RAG assessment - Resilience of ports, airports and ferry terminals		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
Are actions taking place?  Amber	<p>Transport Scotland and local transport partnerships report on climate adaptation measures through the Public Bodies Duties Climate Change Reporting requirements.</p> <p>The Scottish Maritime Strategy does not consider potential sea level rise risk at Scottish ports. Specific adaptation plans do not exist for ports and airports, and the ferry services plan (2013 - 2022) does not consider the implications of climate change.</p> <p>The Maritime Transport Strategy included in the SCCAP is not being progressed.</p>	Are actions taking place?  Red
Is progress being made in managing vulnerability?  Grey	<p>There are no data on whether the steps being taken by ports, airports and ferry operators will be sufficient to avoid an increase in severe weather impacts and disruption to services in future.</p>	Is progress being made in managing vulnerability?  Grey

*Why is it a priority for adaptation?*

**Scotland has infrastructure in exposed coastal locations, as well as remote and isolated communities reliant on air and ferry services.** There are 18 airports in Scotland, four of which (Aberdeen, Edinburgh, Glasgow and Glasgow Prestwick) account for over 90% of total passengers. There are 13 other airports mainly serving the islands. There were 26.9 million air passengers at Scottish airports in 2016.<sup>115</sup> Scotland has 110 ports, nine of which are classed as major. In 2016 Scottish ports handed 67 million tonnes of freight and the ferry services carried 8.3 million passengers.<sup>116</sup>

**The most recent UK climate projections (UKCP18) estimates that sea level at Edinburgh is expected to increase by up to 60 cm by 2090 compared to a 1990 baseline under a medium emissions scenario.** Sea levels are projected to continue to rise beyond the year 2100 even in lower emission scenarios and several meters of sea level rise within centuries is possible. Sea level projections for other locations in Scotland are not available but are likely to be similar to those for Edinburgh.

*Progress of policies and actions*

**The Marine (Scotland) Act 2010 continues to require marine plans to set economic, social and marine ecosystem objectives and objectives relating to climate change adaptation.**

<sup>115</sup> Transport Scotland (2017) *Scottish Transport Statistics, No 36, 2017 Edition*, Chapter 8: Air Transport in Scotland, <https://www.transport.gov.scot/publication/scottish-transport-statistics-no-36-2017-edition/>

<sup>116</sup> Transport Scotland (2017) *Scottish Transport Statistics, No 36, 2017 Edition*, Chapter 9: Water Transport in Scotland.



The National Marine Plan sets high level requirements for marine planners and decision makers in relation to adaptation, including compliance with the SCCAP. Where appropriate, marine planning authorities should be satisfied that adequate risk management and contingency plans are in place, particularly in relation to potential changes in sea temperatures, sea level rise, storminess and extreme water levels, using the best scientific evidence available at the time.

**There is a lack of provision in national strategies and plans relating to the impacts of climate change on transport infrastructure such as ports and ferry services.** The updated Scottish Government National Transport Strategy (2016) acknowledges the challenges faced by climate change and makes reference to improving the resilience of transport networks. Specific adaptation plans do not exist for ports and airports, and the ferry services plan (2013 - 2022) does not consider the implications of climate change. The proposed Maritime Transport Strategy is not being progressed. The action in the SCCAP to assess potential sea level rise risk at specific Scottish ports has also not been progressed. The most recent progress report on the SCCAP states that it is the responsibility of individual harbour owners and operators to assess the risks posed by sea level rise and consider adaptation requirements, but there is no evidence that this is being carried out.

The National Marine Plan implementation review in 2018 highlighted this issue, recommending that the future plan considers land/sea interactions including investment and integration of transport networks. It was suggested the plan have a chapter on general infrastructure associated with land/sea interactions including investment and integration of transport networks e.g. road, rail, ferries for passengers and freight, and improved connectivity, especially between islands.

Under the Public Bodies Climate Change Duties, public sector organisations including Transport Scotland and local transport partnerships are required to report on climate adaptation measures by Transport Scotland and local transport partnerships. These will have increasing importance, particularly the Highlands and Islands Transport Partnership which will be more exposed to adaptation challenges where remote and isolated communities are reliant on ferry services as well as roads for transportation.

### *Climate change vulnerability assessment*

#### **Indicators to assess trends in vulnerability are not available.**

There are no data to assess whether steps are being taken by ports, airports and ferry operators to manage the increase in severe weather impacts and disruption to services in future. Information that would enable an evidence-based assessment of the vulnerability might include time-series data on the number of disruptions caused by extreme weather events and the level of investment being made in improving standards of resilience.







#### **D) Resilience of roads and the rail network**

CCC rating	Rationale for rating
Positive progress	There are a large number of policies and actions in the SCCAP related to resilience of roads and rail and a number of actions are progressing as planned. Key Performance Indicators for climate adaptation are under development by Network Rail and Transport Scotland. Trends in road condition have remained static and around two thirds of road users are

CCC rating	Rationale for rating
	satisfied with the information provided on extreme weather and road condition.

### Summary RAG assessment

**Table 3.13.** Summary RAG assessment - Resilience of roads and the rail network

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>The National Transport Strategy (2016) guides improved resilience of transport networks.</p> <p>Tomorrows Railway and Climate Change Adaptation (TRACCA) was published in 2016.</p> <p>Quarterly monitoring of Network Rail and ScotRail includes disruption due to the impacts of severe weather.</p> <p>Road maintenance contracts include new requirements to record and report on disruptive incidents.</p> <p>Key performance indicators (KPIs) for climate adaptation are under development by Network Rail and Transport Scotland.</p> <p>Some transport related SCCAP actions have been delayed or not taken up.</p>	<p>Is there a plan?</p>  <p>Green</p>
<p>Are actions taking place?</p>  <p>Green</p>		<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Green</p>	<p>Capital and current expenditure on motorways and trunk roads is estimated at £713 million which is largely consistent with our last report. There have been no significant changes in road condition.</p> <p>The majority of road users are satisfied with warnings and information on severe weather and road condition, based on a recent survey.</p> <p>There is no discernible trend in weather-related interruptions to rail services, however these are regularly monitored and reported.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Green</p>

### Why is it a priority for adaptation?

**Heavy rainfall, high winds and landslides can have significant impacts on railways and roads. Investment in infrastructure such as roads can increase the resilience of the infrastructure network.** Roads that are in better condition and suitably maintained are less susceptible to damage caused by increased rainfall, increasing heavy rainfall events, heating and

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freezing. If roads are closed due to flooding or landslides, long distance road diversions (or complete isolation) may be the only option in many remote locations. Suitable asset management is vital to fully understand the real impact of flooding which must include both social and economic impact.

**Rail is one of the sectors most vulnerable to impacts during periods of high temperatures.**

There is 2,763km of rail network in Scotland and 356 stations, with 94.2 million ScotRail passenger journeys in 2016/17.<sup>117</sup> Average summer temperatures in Scotland are expected to increase by 0.6 - 4.8 °C by the 2070s according to the latest UK climate projections (UKCP18).<sup>118</sup> Hot weather has the potential to cause train service cancellations and speed restrictions, and require de-rating of overhead power lines. High temperatures can also affect what maintenance can be performed, for example making tensioning rail track difficult due to thermal expansion or by new road tarmac drying too quickly.

*Progress of policies and actions*

**There are a large number of policies in the SCCAP related to adaptation of road and rail infrastructure. Actions have progressed in a number of areas.**

The National Transport Strategy was refreshed in 2016 and guides improved resilience of transport networks. The refresh identified a need for a full review of the strategy which is currently underway. AECOM have completed a study of 'Impacts of Climate Change on the Scottish Trunk Road Network', which has identified sections of the network which currently have the highest vulnerability to flooding, high winds, snow/ice and landslides. The report also identified increases and decreases in vulnerability of sections in the future using UKCP09 projections for the 2030s and 2050s.

**The Scottish Road Network Climate Change Study was refreshed by Transport Scotland in 2011 following the publication of the UKCP09 dataset and determined that it continues to represent a reasonable response to the projected changes in the climate.**

These 28 recommendations included a range of short, medium and long term measures. Relevant recommendations being taken forward include the Landslide Action Plan and the High Wind Strategy. The potential for a refresh will be considered following the publication of UKCP18 and the development of SCCAP2.

**Road maintenance contracts include new requirements to record and report on disruptive incidents.**

The next edition of the Road Asset Management Plan (RAMP) was published in 2016. The RAMP incorporates and encourages asset management principles into the planning and execution of maintenance works that include the effects of severe weather with a particular focus on flooding events. Development work has also been done to merge GIS data sets with SEPA maps and 4G data.

**Tomorrows Railway and Climate Change Adaptation (TRACCA) was published in 2016.**

Transport Scotland are engaged in the associated Implementation Strategy which aims to raise the profile of issues and highlight the current progress being made by the rail industry. The outputs from TRACCA are being considered as part of the Scottish Ministers High Level Output Specification (HLOS) for the period 2019-2024 which is currently under development.

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<sup>117</sup> Office of Rail and Road (2017) *2016-17 ScotRail Key Statistics*, Table 2.10, [http://orr.gov.uk/\\_\\_data/assets/pdf\\_file/0015/25116/scotrail-factsheet-1617.pdf](http://orr.gov.uk/__data/assets/pdf_file/0015/25116/scotrail-factsheet-1617.pdf)

<sup>118</sup> Met Office (2018) *UKCP18 Climate change over land*. Under a high emissions scenario, for the 10th-90th percentile range for the 2060-2079 period relative to 1981-2000.

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**Quarterly monitoring of Network Rail and ScotRail services includes disruption due to the impacts of severe weather.** The Office of Rail Regulation continues to publish a Quarterly Monitor on National Rail performance and Transport Scotland manages the performance of ScotRail across all areas including disruption due to the impacts of severe weather. Scottish Ministers also require Network Rail to work with the rail industry to develop and apply suitable KPIs for monitoring the impact and mitigation of climate change upon network disruption and the means of measuring the benefits of adaptation interventions – these KPIs for climate adaptation are under development by Network Rail and Transport Scotland.

**Some transport related SCCAP actions have been delayed or not taken up,** including the 'Wetter weather, public transport/congestion patterns in urban areas' project and the introduction of new guidance on good public transport interchange design to cope with more extreme weather.

### *Climate change vulnerability assessment*

**Capital and current expenditure on motorways and trunk roads was estimated at £713 million in 2016/17. This is largely consistent with our last report.** The 2016/17 spend was £49 million, (7%) more than the 2015/16 figure - a large part of the increase was due to the Forth Replacement Crossing. One-off large scale projects can have a significant impact on expenditure.

**There have been no significant changes in road condition.** In 2017, 7% of all local authority roads and 4% of trunk roads were classed as 'red', meaning the road has deteriorated to the point at which repairs are likely to be required to prolong its future life. 29% of local authority roads and 25% of trunk roads were classed as 'amber', meaning further investigation should be taken to establish if treatment is required. The condition of trunk roads has been improving since 2011 and is currently static. It is not currently possible to estimate the likely future impact of climate change on road condition.

**The majority of road users are satisfied with warnings and information on severe weather and road condition, based on a recent survey.** In 2017, two thirds (67%) of respondents said that, over the last 12 months or so, at least one of their journeys had been affected by severe weather. Around half had experienced disruption due to heavy rain or hail (43%), or snow or ice on the road (43%), and a similar proportion had experienced disruption due to high winds (38%) or floods (34%). Fewer than one in ten (6%) had experienced disruption due to a landslide. These results were in line with those for 2016.<sup>119</sup> Around two-thirds were satisfied with the accuracy of warnings and information about likely conditions before severe weather (67%); and with the availability of up to date information during severe weather (66%). A slightly smaller majority (58%) were satisfied with the availability of information on the condition of roads after severe weather. Fewer respondents – 55% – were satisfied with measures taken to deal with disruptions after severe weather. 50% were satisfied with the availability of alternative routes and diversions.

**There is no discernible trend in weather-related interruptions to rail services, however these are regularly monitored and reported through Network Rail's Weather Resilience and Climate Change Adaptation reporting.** Weather related incidents on Scotland's railways account for approximately 10% of all incidents. In 2017/18, there were just over 236,000 delay minutes attributed to weather.<sup>120</sup> As Figure 3.8 shows, there is no long-term trend in the extent

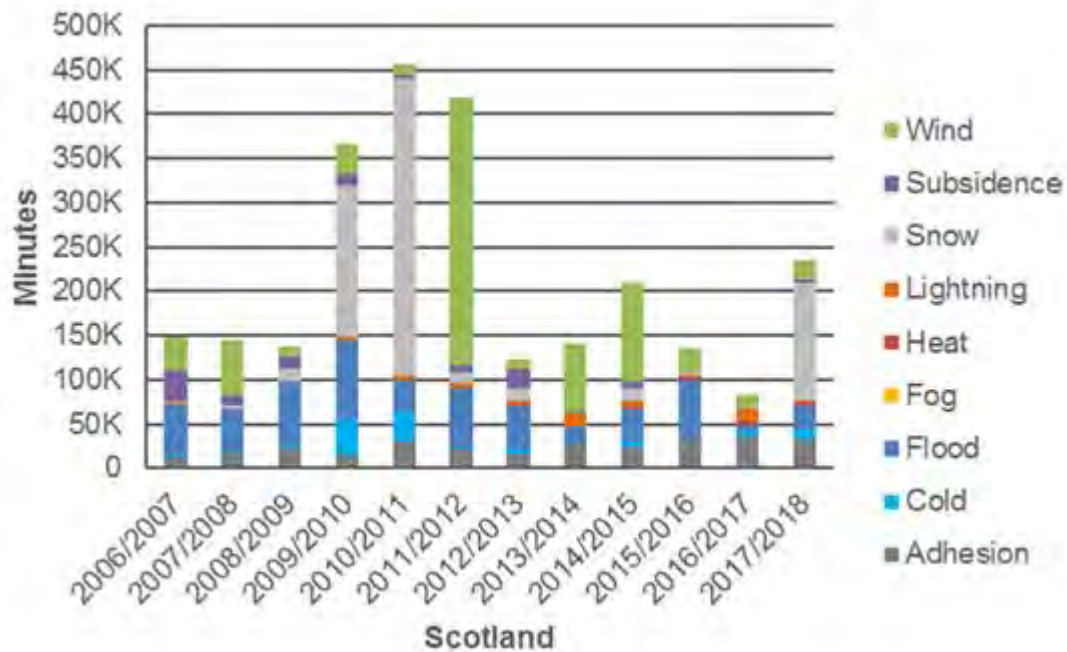
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<sup>119</sup> Ipsos MORI (2017) *Perceptions of Trunk Road Network in Scotland 2017 survey*.

<sup>120</sup> Weather types recorded: Adhesion (slippery rail), cold, flood, fog, heat, lightning, snow, subsidence and wind.

or type of weather-related delays. It is positive that incidents and delay minutes are reported by weather type, to allow longer term monitoring of the impact of changing weather patterns on rail services. This data also allows the comparative impact on services from different types of weather to be considered (e.g. impacts from snow versus wind, both of which have been significant in the past).

**Figure 3.8.** Weather related delay minutes to Scotland rail services (2006/07-2017/18)



**Source:** Network Rail (2019) *Weather Resilience and Climate Change Adaptation reporting*.







**Notes:** Adhesion refers to leaves on the line causing slippery rail.

## E) Resilience of digital infrastructure

CCC rating	Rationale for rating
High concern	There are no specific actions in the SCCAP for digital infrastructure and strategies do not consider disruption from extreme weather. There is no information available to assess the vulnerability of data and telecommunication facilities.



## Summary RAG assessment

Table 3.14. Summary RAG assessment - Resilience of digital infrastructure		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>There are no specific actions in the SCCAP for digital infrastructure.</p> <p>The Communications Act (2003) continues to require telephony and data services to be maintained even in extreme weather.</p>	<p>Is there a plan?</p>  <p>Amber</p>
<p>Are actions taking place?</p>  <p>Grey</p>	<p>The UK National Risk Register recognises risks to telecommunications from power outages caused by extreme weather.</p> <p>TechUK reported under the Adaptation Reporting Power in 2017 on behalf of the ICT sector.</p> <p>Current cyber resilience strategies do not consider disruption to digital infrastructure from extreme weather.</p>	<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Grey</p>	<p>Data on the exposure of data and telecoms facilities and services to extreme weather impacts is limited and vulnerability cannot currently be assessed. It is also important to understand to what extent these services are dependent on other services such as power, transport etc., and vice versa.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Grey</p>

### Why is it a priority for adaptation?

**Climate change risks relevant to digital infrastructure are primarily flooding from increased winter rainfall, changes to temperature and high winds.** CCRA1 highlighted that around 80% of businesses in Scotland are dependent on ICT and that any disruption would have immediate consequences. This would predominantly affect small businesses due to their dependence on a single digital link. The primary risk highlighted was the lack of knowledge of the risks to this sector. The risk relates not only to the direct impact of outages to digital infrastructure, but also to the interdependence on other infrastructure services such as transport (movement of people to rectify issues), and the knock-on effect on other services (such as the use of phones by emergency services).

Risks for smaller companies could be greater, particularly if they are located in relatively remote areas where they may be dependent on single electricity and telecommunications connections. Projections of future impacts of infrastructure losses on business productivity are not available.

### Progress of policies and actions

**There are no specific actions in the SCCAP addressing the adaptation needs of digital infrastructure in Scotland but legislative provisions are in place.** The Communications Act (2003) continues to require telephony and data services to be maintained even in extreme

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weather and communications and data service providers report annually to the Cabinet Office as part of sector resilience planning. There is no overall plan to maintain the resilience of the digital infrastructure sector. Current cyber resilience strategies do not consider disruption to digital infrastructure from extreme weather.

**The UK National Risk Register recognises risks to telecommunications from power outages caused by extreme weather.** It identifies risk mitigation activities including infrastructure investment, particularly by the large telecoms providers, coordination and awareness raising through the industry-run Electronic Communications, Resilience and Response Group (EC-RRG) and the National Emergency Plan for Telecoms which is owned by EC-RRG.

**TechUK reported under the Adaptation Reporting Power in 2017 on behalf of the ICT sector.** TechUK is a membership association which represents more than 900 companies in the UK technology industry. The report identified what the sector considers to be the potential impacts of climate change. Physical impacts include flooding of buildings and other assets, disruption to fleet operations, cable heave from uprooted trees, higher costs of cooling, shorter asset life, reduced reliability and higher operating costs. Non-physical impacts include reputational damage, failure to meet regulatory objectives and customer service level agreements, impacts on staff wellbeing and unbudgeted costs. Climate risks are handled through standard business risk management practices and resilience is a key element of data centre competitiveness. The key areas identified as needing work to improve sector resilience include developing the evidence base to inform future actions, in particular developing better data on how often operators re-examine flood risks and understanding interdependencies.

### *Climate change vulnerability assessment*

While monitoring on the exposure of data and telecoms facilities and services to extreme weather impacts is limited, the TechUK Adaptation Reporting Power report provides useful insights into steps ICT providers across the UK are taking to assess risk and build climate resilience. These include:

- **Managing flood risk in new data centres:** while there are no published standards, advisors and brokers give consistent advice that a location with a flood risk below 1 in 1000 is desirable. It was noted that data centres are generally located in urban areas where the percentage of impermeable surface materials may be high, increasing the risk from surface water flooding.
- **Resilience as a competitive advantage for data centre operators:** with the ultimate objective of avoiding any outages. Whilst all operators aim at 0% downtime, there is nevertheless a market for resilience that loosely (but by no means universally) reflects the criticality of the data that is being managed or the value of the services that are being provided. Some operators provide disaster recovery as a commercial service to third parties.
- **Standards and risk management tools:** although the sector does not have a bespoke standard for climate change resilience, relevant standards and best practices exist within the sector including EN 50600 TR Availability Classes for data centres and ASHRAE (the American Society of Heating, Refrigeration and Air Conditioning Engineers) standards which define temperature and humidity boundaries for reliable operation of servers.







**NEW RECOMMENDATION 2:** Include specific actions in the next SCCAP with regards to the resilience of digital infrastructure. Information on the exposure of data and telecommunication facilities and services to extreme weather impacts is limited and there are no actions in the current SCCAP related to this.

## Infrastructure interdependencies

CCC rating	Rationale for rating
Mixed progress	There has been positive progress in implementing some SCCAP actions, including the establishment of the Critical Infrastructure Resilience Partnership 2017 which provides a strategic policy forum for resilience issues. There is no evidence of specific measures taken across infrastructure sectors to improve systems resilience in Scotland. Some research is underway, which is anticipated to provide useful insights for the next SCCAP.

### Summary RAG assessment

**Table 3.15.** Summary RAG assessment - Infrastructure interdependencies

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	The Scottish Government's Critical National Infrastructure Strategy (2011) continues to set strategic objectives for resilience.  The Critical Infrastructure Resilience Partnership, a strategic policy forum for resilience issues, was established in 2017.	Is there a plan?  Green
Are actions taking place?  Amber		Are actions taking place?  Amber
Is progress being made in managing vulnerability?  Grey	There is no evidence of specific measures taken across infrastructure sectors to improve systems resilience in Scotland.  Some research is underway which is anticipated to provide useful insights.	Is progress being made in managing vulnerability?  Grey

### Why is it a priority for adaptation?

**Infrastructure in Scotland is exposed to range of climate hazards.** Impacts on some assets have the potential to cascade on to others as part of interdependent networks. Flooding poses the greatest long-term risk to infrastructure performance from climate change, but the growing

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risks from heat, water scarcity, high winds and slope instability caused by severe weather could be significant.

**Infrastructure networks do not operate in isolation, with services in particular reliant on power, fuel supplies, and ICT.** Transport links including local roads are important for logistics and to allow staff to travel to work. Vulnerable services such as hospitals are often not aware that, for example, their power supply is at risk via cascading failures. Outputs from various research projects are beginning to quantify the scale of interdependency risks at the national level, but the scale of the risk remains largely unknown.

#### *Progress of policies and actions*

**The Scottish Government's Critical National Infrastructure Strategy (2011) continues to set strategic objectives for resilience.** The Critical Infrastructure Resilience Partnership was established in 2017 and provides a strategic policy forum for resilience issues. Publication of *Keeping Scotland Running - A Guide to Critical Infrastructure Resilience* has been delayed, pending agreement on a new Resilience Strategy and Governance Arrangements which will establish a common vision for resilience in Scotland. According to the Scottish Government's annual reporting on SCCAP progress, this is at an advanced stage of development.

**The Cabinet Office has begun focusing on cross-sector vulnerabilities as part of its annual resilience review.** Individual sectors are also reviewing their dependency on other networks, in particular their reliance on power, ICT, and critical road and rail links.

**The SCCAP committed to introducing new guidance on good public transport interchange design to cope with more extreme weather.** This project has not yet commenced and the most recent annual progress report on the SCCAP noted that engagement is required with sector bodies to establish if the report outcomes are still necessary.

#### *Climate change vulnerability assessment*

**There is no evidence of specific measures taken across infrastructure sectors to improve systems resilience in Scotland. Some NERC funded research is underway which is anticipated to provide useful insights.** This includes a project to understand climate change impacts and adaptation on interdependent infrastructure networks. Using Inverclyde as a case study, the aim is to develop a transferable approach that identifies local scale interactions and interdependencies, and allows diverse infrastructure partners to jointly think of adaptation solutions.<sup>121</sup> Another project aims to model infrastructure interdependencies of three critical infrastructure networks (water, transport, and energy) providing a measure of network resilience in response to hazardous events, in addition to a measure of vulnerability.<sup>122</sup>

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<sup>121</sup> NERC award reference NE/R009023/1, Playing Games to Understand Multiple Hazards and Risk from Climate Change on Interdependent Infrastructure.

<sup>122</sup> NERC award reference NE/R008973/1, DSS: An industry-friendly resilience-based interdependency assessment tool - case study North Argyll.



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# Chapter 4: Society





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## 4.1 Key messages - Society

**Legislative duties and standards for organisational resilience are generally well defined for NHS Boards in Scotland and there is a good level of transparency regarding actions taken by health boards to adapt to climate change.** Regional frameworks are in place to monitor the resilience of emergency services in Scotland. The UK National Risk Register was updated in September 2017, with climate change risks becoming more prevalent and extensive guidance exists for emergency responders in Scotland. New guidance is available in the Climate Ready Business Guide for businesses to increase their resilience against climate change impacts. A range of research projects are also underway to better understand climate risks for business and inform future policy.

**The SCCAP contains a large number of policies and actions aimed at increasing awareness of climate risks but more could be done to make them more specific and to track progress.** 'Adaptation Scotland' is a programme funded by the Scottish Government and delivered by the sustainability charity 'Sniffer'. Support provided by the Adaptation Scotland programme includes capacity building training programmes, support for partnership projects, providing expertise to inform policy relevant research online tools, resources and an enquiry service. Awareness of climate risk appears to be increasing - the proportion of adults in Scotland who view climate change as an immediate and urgent problem has increased by one third between 2013 and 2017, from 46% to 61%.

**There are fewer national targets and a lack of monitoring for the 'Society'-related actions in the SCCAP compared to the other themes.** There are limited provisions in the standards for organisational resilience that extend to social care services, and there are no specific standards for climate resilience that social care providers have to conform to. While a suite of guidance on preparing for and responding to emergencies such as extreme weather exists, there are no national recovery goals or targets. Strategies and guidance for food-borne disease management have been developed. There is still no strategy or plan to reduce the health effects of UV radiation or vector-borne diseases, which could become more prevalent as the climate changes.

**There are some positive trends in reducing vulnerability including fuel poverty (linked to risks to health from cold) in Scotland, which is at its lowest rate since 2005/06.** There is continued evidence of improvements in water efficiency by specific industry sectors, such as food and drink manufacturing and whisky production. Non-domestic water consumption has decreased in recent years. Data are not currently available to assess trends in water abstraction by industry.

**Many indicators of societal vulnerability to climate change are moving in the wrong direction and data limitations prevent assessment of specific actions, such as emergency response and actions to reduce the risk of overheating in buildings.** Average temperatures across Scotland are increasing and the proportion of the population aged 75 and over has increased by 16% between 2007 and 2017. Older people are more vulnerable to climate-related health risks such as an increased risk of illness and death in both hot and cold weather. There is a lack of evidence on the impacts of extreme weather events on long-term health, the effectiveness of recovery plans, and the length of time it takes people and communities to recover. There is still a lack of data to assess the risk of overheating in buildings in Scotland and the extent to which the exposure and vulnerability of the population to pathogens is changing cannot currently be measured.

**The impact of climate hazards on business is not currently known.** There are no specific policies in the SCCAP focussed on business opportunities from climate change and no data to determine the extent to which such opportunities are being realised. Some Scotland-specific research on business opportunities from adaptation is underway to inform the next programme.

## 4.2 SCCAP outcome and objectives

The high level outcome for the Society theme in the SCCAP is “A Scotland with strong, healthy, resilient communities which are well informed and prepared for a changing climate”.










There are three objectives to meet this outcome:

- **Objective S1:** Understand the effects of climate change and their impacts on people, homes and communities.
- **Objective S2:** Increase the awareness of the impacts of climate change to enable people to adapt to future extreme weather events.
- **Objective S3:** Support our health services and emergency responders to enable them to respond effectively to the increased pressures associated with climate change.






















To enable a robust assessment of these high-level principles and objectives, the Adaptation Committee has identified ten adaptation priorities for the Society theme - these are consistent with the priorities identified in the first assessment. The progress being made in respect of each of these adaptation priorities is assessed in the remainder of this chapter.

## 4.3 Summary of progress

Table 4.1 sets out the summary findings of the analysis set out in this chapter. The criteria applied to determine the overall rating and the RAG scores are set out in Chapter 1.

Table 4.1. Summary assessment - Society				
Adaptation priority	Overall rating	RAG assessment		
		Is there a plan?	Are actions taking place?	Vulnerability assessment
Resilience of the population to changes in temperature	Mixed progress	 Amber	 Amber	 Amber
Resilience of people to pathogens, air pollution, UV radiation	Mixed progress	 Amber	 Amber	 Grey
Public understanding of climate-related risks	Positive progress	 Green	 Green	 Green

**Table 4.1.** Summary assessment - Society

Adaptation priority	Overall rating	RAG assessment		
		Is there a plan?	Are actions taking place?	Vulnerability assessment
Health and social care services	Mixed progress	 Amber	 Green	 Grey
Emergency planning and response	Mixed progress	 Green	 Green	 Grey
Recovery from extreme weather events	High concern	 Amber	 Green	 Grey
Business impacts from extreme weather	Mixed progress	 Amber	 Green	 Grey
Business opportunities from climate change	Positive progress	 Red	 Amber	 Grey
Supply chain disruptions	Mixed progress	 Amber	 Amber	 Grey
Water demand by industry	Positive progress	 Amber	 Green	 Green

## 4.4 Assessment of progress







### Resilience of the population to changes in temperature

CCC rating	Rationale for rating
Mixed progress	SCCAP actions are progressing, however there is limited provision for managing risks from hot and cold weather in the current SCCAP. Indicators of vulnerability show mixed results in the context of an ageing population, which is more vulnerable to both hot and cold weather. Fuel poverty is declining, which should be leading to reduced exposure to cold. Average temperatures are increasing and while this should reduce cold-related vulnerabilities, there is a lack of data to assess the corresponding risk of overheating in buildings

CCC rating	Rationale for rating
	under warmer conditions. There is limited reference to overheating in technical building standards.

### Summary RAG assessment

**Table 4.2.** Summary RAG assessment - Resilience of the population to changes in temperature

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>Cold:</p> <p>The draft Fuel Poverty Strategy for Scotland has been published.</p> <p>Fuel poverty and energy efficiency funding commitments are on track.</p> <p>A Route Map for Scotland’s Energy Efficiency Programme (SEEP) has been produced.</p> <p>There is limited reference to overheating in technical building standards but a review of energy standards in the Scottish Building Regulations is underway.</p> <p>Heat:</p> <p>There are no plans or policies in place related to managing the risks from heat, and no actions set out in the SCCAP.</p>	<p>Is there a plan?</p>  <p>Amber</p>
<p>Are actions taking place?</p>  <p>Green</p>		<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>The proportion of Scotland’s population aged over 75 is increasing, which will increase the number of people vulnerable to cold and heat.</p> <p>Cold:</p> <p>Fuel poverty is decreasing, which in turn should reduce total exposure to cold in homes.</p> <p>Heat:</p> <p>Average temperatures across Scotland are increasing.</p> <p>There is still a lack of data to assess the risk of overheating in buildings.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>

### Why is it a priority for adaptation?

**Human health effects of climate change are likely to have the greatest impact on vulnerable people; particularly in Scotland which has an ageing population and also**

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**includes the ten most deprived areas of the UK.**<sup>123</sup> Social and demographic factors such as age, health status, adaptive capacity and the adequacy of community support and services all affect the vulnerability of people to climate impacts.

**There are significant risks to people from cold temperatures, particularly the elderly and those in fuel poverty.** Data on cold-related mortality is not currently available in Scotland. Data on winter mortality is collected, showing that for example there were 23,137 deaths registered in Scotland in the four months of winter 2017/18 (December to March), compared with 20,946 in winter 2016/17.<sup>124</sup> However, many of these deaths are attributable to winter illness such as flu, rather than to cold temperatures per se. Understanding trends in cold-related mortality remains a significant evidence gap therefore.

**While Scotland has lower temperatures relative to other regions of the UK, the population in Scotland is acclimatised to lower temperatures<sup>125</sup> and mortality starts to increase at lower temperatures compared to more southern areas.** At present there are estimated to be around 0.7 heat-related deaths per 100,000 population per year (which with a population of 5.4 million equates to 38 deaths per year).<sup>126</sup> The summer of 2018 was unseasonably warm in Scotland and provisional data from Health Protection Scotland on hospitalisations shows that there were 75 hospitalisations attributed to heatstroke, sunstroke or sunburn in the period January 2018 to October 2018. By comparison, there were 48 hospitalisations attributed to these causes for the calendar year 2017 and the average number of annual admissions from 2010 to 2017 was 43.<sup>127</sup> Heat-related mortality will be much larger than for these conditions alone, as much is related to an increase in heart and respiratory conditions but heat is not recorded as a cause of death. Statistical analysis of trends in overall mortality compared to temperature is required to ascertain the total level of heat-related mortality.

**The risks to health from heat will increase in the future. Heat-related mortality in the 2050s in Scotland is predicted to increase to between 1.3 and 5.2 per 100,000, based on the 2009 UK Climate Projections (UKCP09) medium emissions scenario.** This would equate to 70 – 281 deaths per year, higher if population growth is accounted for.<sup>128</sup>

**While the frequency and severity of cold weather will decrease in the future, it will still remain a risk.** Action is therefore needed to prepare for both hotter temperatures, and cold spells when they occur. The relationship between changes in temperature and corresponding changes in risks to health is complex and requires further research.

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<sup>123</sup> Lloyd, C. D., Catney, G., Williamson, P., Bearman, N. and Norman, P. (2017) *Deprivation Change in Britain*. PopChange Briefing 2. Liverpool: Centre for Spatial Demographics Research, University of Liverpool, [https://www.liverpool.ac.uk/media/livacuk/centreforspatialdemographics/documents/PopChange2\\_DeprivationChange.pdf](https://www.liverpool.ac.uk/media/livacuk/centreforspatialdemographics/documents/PopChange2_DeprivationChange.pdf)

<sup>124</sup> National Records of Scotland (2018) *Winter Mortality in Scotland 2017/18*, <https://www.nrscotland.gov.uk/files/statistics/winter-mortality/2018/winter-mortality-17-18-pub.pdf>

<sup>125</sup> Oertel, A., Emmanuel, R., & Drach, P. (2015) *Assessment of predicted versus measured thermal comfort and optimal comfort ranges in the outdoor environment in the temperate climate of Glasgow, UK*. Building Services Engineering Research and Technology, 36(4), 482–499, <https://doi.org/10.1177/0143624414564444>

<sup>126</sup> Kovats, R.S., and Osborn, D., (2016) *UK Climate Change Risk Assessment Evidence Report: Chapter 5, People and the Built Environment*. Committee on Climate Change. Estimates are based on statistics of total deaths.

<sup>127</sup> Health Protection Scotland (2018) *Hospitalisations with diagnosis of heatstroke, sunstroke or sunburn*. Source: SMR01 as at January 2019, Ref: HPS2018\_29, Scotland, calendar years 2010-2018. 2018 data is provisional.

<sup>128</sup> CCC (2016) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Committee on Climate Change, London.



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**Little is currently known about the extent and effectiveness of adaptation in this area.**

Currently, the majority of the health sector focus is on cold-related health risks rather than the risks from heat. The current and future risk of overheating in homes, hospitals, care homes, schools, offices and prisons in Scotland is currently unknown.

*Progress of policies and actions*

**While some useful research has taken place, there remains a need to consider whether the current policy landscape is sufficient to address current and long-term risks from heat and cold.** In the CCC's first assessment of progress of the SCCAP, current and long-term risks from heat and extreme cold were identified as an area of concern:

**PREVIOUS RECOMMENDATION 16:** The Scottish Government should, before the next SCCAP, review policies that address the current and long-term risks from both heat and extreme cold.

**RESPONSE:** In 2017, with funding from the National Centre for Resilience, the Scottish Government commissioned Health Protection Scotland to conduct a study into health impacts of hot and cold temperatures.

**PREVIOUS RECOMMENDATION 17:** Health Protection Scotland should, before the next SCCAP, carry out new research into the current and future risks to the population from heat and UV radiation, and consider proportionate responses to the risk.

**RESPONSE:** In 2017, ClimateXChange, with support from Health Facilities Scotland and Health Protection Scotland, completed a scoping study to identify how to monitor overheating risk in buildings housing vulnerable people in Scotland.

The Health Protection Scotland work was an initial exploratory study using limited data, of the association between temperature and health outcomes. The aim of the study was to identify evidence that might be used as a basis for designing temperature-based health interventions to mitigate adverse impacts in vulnerable population groups.<sup>129</sup> The findings mirrored previous work that shows that mortality is more strongly associated with temperature among those aged over 65. It also showed that in Scotland, cold temperature is currently far more strongly associated with excess mortality than elevated temperatures, as is the case across the UK. Further research is needed in order to complete a comprehensive analysis of the risks in Scotland. For example, due to the lack of past significant heatwave periods in Scotland it is not possible to estimate what the likely effect of heatwaves (defined as sustained periods of higher than normal summer temperatures) would be. Further research is needed to look at trends in heat-related mortality, for example during the 2018 summer heatwave, and to analyse cold-related mortality year-by-year.

In response to issues including space overheating in new build healthcare facilities, the 'NHS Scotland New Build Health Buildings DSM Modelling Summary' provides recommendations of the next steps the NHS could take to make improvements in the design and construction of new

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<sup>129</sup> Ramsay, C., Robertson, C. and Carragher, R. and Corson, S. (2018) *Associations between ambient outdoor temperature and patterns of morbidity and mortality in Scotland*, <https://strathprints.strath.ac.uk/65834/>

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buildings. It is not known how far these recommendations are being implemented. There also remains a need to consider heat and cold risks in the built environment more generally, such as schools, care homes and other buildings used by more vulnerable groups.

**Provisions for temperature control in buildings are set out in the Building Regulations Technical Handbook.** A review of the energy standards in the Scottish Building Regulations is underway. While the review is focussed on emissions reduction by improving the energy performance of buildings, equipment and form/fabric for cooling purposes is included within the scope of the review. There are potential negative trade-offs in addressing energy efficiency, overheating or ventilation needs in homes in isolation.<sup>130</sup> It is important that measures to address energy efficiency, overheating and ventilation are considered together when retrofitting or building new homes so that measures to improve air tightness do not lead to increased overheating and reduced indoor air quality.

**The Ready Scotland website includes guidance for the public on heatwaves and NHS Inform now includes a section dedicated to outdoor health with regularly updated information on excessive heat.** It is not known at present what the uptake of this guidance is or whether it has any impact on behaviour. Climate change is now specifically noted under long-term trends in the National Risk Assessment (NRA) as a current and future challenge, and the NRA includes information on heatwaves as a potential civil emergency.

**The Draft Fuel Poverty Strategy for Scotland was published in June 2018 and sets a statutory target that by the year 2040 no more than 5% of households in Scotland should be in fuel poverty.** The strategy sets out the overall aims and ambition of the Fuel Poverty (Target, Definition and Strategy) (Scotland) Bill and includes a monitoring and reporting regime to track progress against the long-term target. The Scottish Government reports that they are on track to deliver the 2016 Programme for Government commitment to make £500 million available for fuel poverty and energy efficiency over 4 years to 2021. By the end of 2021 over £1 billion will have been invested since 2009. The Route Map for Scotland's Energy Efficiency Programme (SEEP) sets out how the SEEP will make buildings easier and cheaper to heat and is a further tool to reduce fuel poverty in Scotland.

**NEW RECOMMENDATION 3:** The next SCCAP should commit to more ambitious actions to address current and long-term risks from both heat and cold.

### *Climate change vulnerability assessment*

**Average and extreme temperatures across Scotland are increasing, which is also increasing exposure to heat.** The average annual temperature in the 2000's was 0.90°C warmer than the 1961-1990 average and warmer than any other decade since records began in 1910.<sup>131</sup> In 2016 the average temperature was 7.83°C which is 0.80°C higher than the 1961-1990 average.<sup>132</sup> For the whole of the UK, 2017 was the fifth warmest year since 1910. Nine of the ten

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<sup>130</sup> CCC (2019) UK Housing: Fit for the Future?

<sup>131</sup> The Scottish Government (2017), *High Level Summary of Statistics Trend Last update: Thursday 19 January, 2017, Annual Mean Temperature*. Source: Met Office.

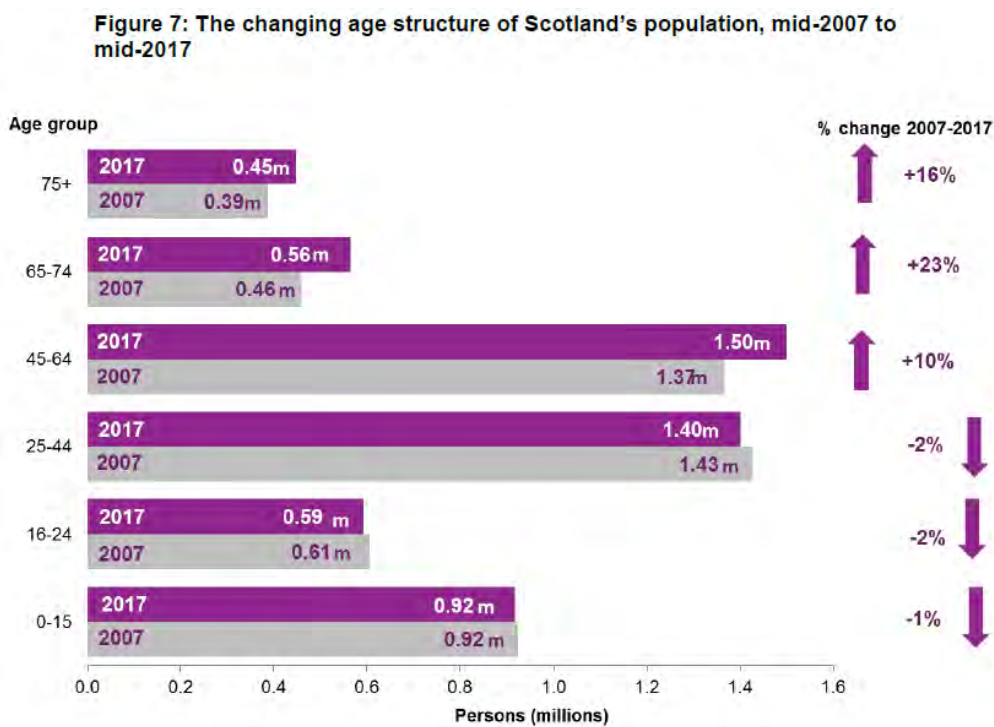
<sup>132</sup> *ibid.*

warmest years for the UK have occurred since 2002 and all the top ten warmest years have occurred since 1990.<sup>133</sup>

**The population of Scotland is ageing and people over 75 are more vulnerable to climate related health risks.**

In 2017, 447,971 persons (8%) were aged over 75 in Scotland. This has increased from around 390,000 in mid-2007. This is partly due to the fact that people are living longer and partly due to the age structure of Scotland’s population. Figure 4.1 shows further details of the changing age structure of the population between mid-2007 and mid-2017. The most significant changes were in the 65-74 and 75+ age groups which have both increased by more than 15% in that time. In contrast, there was a 2% decrease in the population aged 44 and under.

**Figure 4.1.** The changing age structure of Scotland's population (mid-2007 to mid-2017)



**Source:** National Records of Scotland (2017) *Mid-2017 population estimates Scotland*.

**There is still a lack of data to assess the risk of overheating in buildings in Scotland.** Work by the Joseph Rowntree Foundation in the UK care sector highlighted existing risks of overheating in the North and South of England due to the management and operating practices of care homes, for example a tendency to keep the heating on through the summer as well as other issues.<sup>134</sup> Such practices would be exacerbated by a warmer climate. Similar data are not currently available for care homes or other building types in Scotland. Anecdotal evidence is available, for example in the health sector where a recent assessment identified evidence of

<sup>133</sup> Kendon M, McCarthy M, Jevrejeva S, Matthews A, Legg T. (2017), *State of the UK climate 2017*. Int J Climatol. 2018; 38 (Suppl. 2):1–35, <https://doi.org/10.1002/joc.5798>

<sup>134</sup> Gupta, R., Walker, G., Lewis, A., Barnfield, L., Gregg, M. and Neven, L. (2016) *Care provision fit for a future climate*, <https://www.jrf.org.uk/report/care-provision-fit-future-climate>

overheating issues in four out of the five healthcare buildings housing vulnerable people, at least at certain times of year, under specific external conditions or in specific areas (e.g. south facing facades).<sup>135</sup> However, there was a significant lack of data to enable a robust assessment of overheating in in-patient areas. A number of regional studies have been conducted, including a Building Performance Evaluation (BPE) which monitored 26 occupied new-build homes across Scotland over a two-year period. Much broader monitoring is required to enable a robust assessment of the risk and determination of appropriate measures to manage that risk. This should take account of specific risks in different sectors, including to identify whether there are particular issues in settings used by vulnerable groups, such as sheltered housing, residential or extra care facilities, nurseries, schools and prisons as well as hospitals.

**NEW RECOMMENDATION 1:** Work with partners to measure overheating risks in buildings, including monitoring of internal temperatures in hospitals and care homes.

**Fuel poverty in Scotland is at the lowest recorded rate since 2005/06.** Households in fuel poverty in Scotland are identified as those spending over 10% of their income on fuel and power.<sup>136</sup> Following a sustained increase from 2003/04 to 2013, the fuel poverty rate has since fallen year on year. In 2016 it was at the lowest rate recorded since 2005/06. Fuel poverty fell by around 4 percentage points (equivalent to around 99,000 households) from 2015 – 2016. In 2016, 26.5% of Scottish households were in fuel poverty (649,000 households).<sup>137</sup> A report by Paul Watkiss Associates for the Joseph Rowntree Foundation shows that increased temperatures should provide a minor to modest benefit by way of reduced household costs for heating.<sup>138</sup>

While reductions in fuel poverty could be attributed to a number of factors including increasing income, improved energy efficiency of people's homes and reduced energy prices, the number of homes in fuel poverty characterises the number of people vulnerable to cold. Human health effects of climate change are likely to have the greatest impact on vulnerable people such as those on low incomes and/or in poor health; particularly in Scotland which generally has areas of higher deprivation than the rest of the UK.

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<sup>135</sup> BRE (2018) *Assessment of Overheating Risk in Buildings Housing Vulnerable People in Scotland*, Prepared by BRE Scotland for ClimateXChange, Report Number: P107244, Issue: 1.0, <https://www.climateexchange.org.uk/media/3008/overheating-risk-in-buildings-housing-vulnerable-people-in-scotland-scoping-study.pdf>

<sup>136</sup> The Fuel Poverty (Target, Definition and Strategy) (Scotland) Bill proposes a new definition for fuel poverty. Under the proposed new definition, a household must fulfil both the following criteria: Its required fuel costs must be more than 10% of household net income after deducting housing costs and; The remaining household net income after the payment of fuel costs and childcare costs (if any) must also be insufficient to maintain an acceptable standard of living for the household.

<sup>137</sup> There is substantial variability in the distribution of fuel poverty by local authority area. The highest fuel poverty rates were in significantly remote areas such as Orkney Islands (59%); Na h-Eileanan Siar (56%), Shetland Islands (50%); and Moray (45%), while the lowest rates were in City of Edinburgh (20%); Midlothian (22%); Aberdeen City (23%); and Falkirk (24%).

<sup>138</sup> Paul Watkiss Associates (2016) *Climate Change Impacts on the Future Cost of Living (SSC/CCC004), Summary to the Joseph Rowntree Foundation and the Project Advisory Group*, <http://www.paulwatkiss.co.uk/documents/FINAL%20Watkiss%20report%2030032016.pdf>







## Resilience of people to pathogens, air pollution and UV radiation

These communicable diseases and environmental hazards are grouped together in the assessment. While the future impact of climate change on these risks is uncertain, it could be substantial and all pose significant health risks to the population.

CCC rating	Rationale for rating
Mixed progress	Strategies are in place for managing the risks of foodborne illness but there are no firm policy actions in the SCCAP related to the potential increase in risks from air pollution or UV radiation due to climate change. There remains a lack of data against which to assess vulnerability.

### Summary RAG assessment

**Table 4.3.** Summary RAG assessment - Resilience of people to pathogens, air pollution and UV radiation

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Amber	There is a Food Standards Scotland strategy for reducing foodborne illness in Scotland. Food Standards Scotland has also developed the first iteration of classified Scottish Risk Assessment for a major contamination incident.	Is there a plan?  Amber
Are actions taking place?  Green	Health Protection Scotland has produced updated guidance on ticks and Lyme disease, which is projected to increase as the climate changes.  There are no policies or actions in the SCCAP related to risks from air pollution or UV radiation.	Are actions taking place?  Amber
Is progress being made in managing vulnerability?  Grey	The extent to which the exposure and vulnerability of the population to pathogens, air pollution and UV is changing cannot currently be measured.	Is progress being made in managing vulnerability?  Grey

### Why is it a priority for adaptation?

**Vector and food-borne diseases, air pollution and UV exposure all pose health risks to the Scottish population.** While the future impact of climate change on these risks is uncertain, warmer temperatures are likely to make the UK climate more suitable for a range of pathogens,



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and the need for research, monitoring and surveillance remains. The effects of climate change on air pollution and exposure to UV radiation remain highly uncertain.

**The first UK Climate Change Risk Assessment in 2012 noted that the risk of new vector-borne diseases in the UK due to climate change was relatively low, but remains a possibility. The Scottish Highlands have been identified by the National Institute for Health and Care Excellence as a particularly high risk area of the UK for Lyme disease carried by ticks.** The incidence could increase in the future with changing temperatures and rainfall, but projections are uncertain and factors including trends in agriculture, land use, wild animal (host) populations and tourism will play may influence tick prevalence, which determines disease incidence.<sup>139</sup>

**Warmer weather could also lead to an increase in food-borne diseases.** Food Standards Scotland estimate that there are 43,000 cases of foodborne illness in Scotland each year. *Campylobacter* and *salmonella* are the most prevalent food-borne diseases in Scotland, and warmer weather could lead to an increase in such diseases. Future rates of infection will also be heavily influenced by future food hygiene standards.

**Warmer weather could also lead to an increased risk to health from air pollution, though the interaction between temperature and air pollutant concentrations is highly complex.** Wetter weather could also increase algae and spore growth in damp buildings, impacting those with respiratory conditions.

**Exposure to UV radiation causes long-term damage to skin and can lead to skin cancer. Malignant melanoma is the fifth most common cancer in Scotland.** Incidence rates of skin cancer have increased significantly over the last decade.<sup>140</sup> The level of skin cancer could increase in the future if people spend more time outdoors in warm weather, and/or if periods of high UV radiation increase. Projections of this risk are highly uncertain and are strongly dependent on behavioural factors as well as climate change.

### *Progress of policies and actions*

**Strategies and guidance for food-borne disease management have been developed but there is still no strategy or plan to reduce vector-borne diseases in the context of climate change.** Food Standards Scotland (FSS) has published its strategy for reducing foodborne illness in Scotland.<sup>141</sup> This strategy is supported by a research programme aimed at improving understanding of the transmission of contaminants in the Scottish food chain, and the impacts of foodborne diseases such as shigatoxin producing *E. coli* and *Campylobacter* on the Scottish population. The strategy includes interventions aimed at understanding impacts of climate change and agricultural practice on risks to the Scottish food chain.

**Food Standards Scotland (FSS) has developed a risk assessment for a major contamination incident for the first iteration of the classified Scottish Risk Assessment (SRA).** The purpose of the SRA is to help the resilience community in Scotland to understand the disruptive

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<sup>139</sup> Lindgren, E., Andersson, Y., Suk, J. E., Sudre, B. and Semenza, J. C. (2012) *Monitoring EU Emerging Infectious Disease Risk Due to Climate Change*. *Science*, 336(6080), p418-419.

<sup>140</sup> ISD Scotland (2016) *Cancer Incidence Dashboard*, <http://www.isdscotland.org/Health-Topics/Cancer/Publications/2018-04-24/visualisation.asp>

<sup>141</sup> Food Standards Scotland (2017) *A strategy for reducing foodborne illness in Scotland, A refreshed approach for preventing the transmission of contaminants through the Scottish food chain*, version 3.0, [https://www.foodstandards.gov.scot/downloads/A\\_Strategy\\_for\\_reducing\\_foodborne\\_illnesses.pdf](https://www.foodstandards.gov.scot/downloads/A_Strategy_for_reducing_foodborne_illnesses.pdf)

challenges that we may face, and to use this to anticipate, assess, protect, mitigate, prepare, respond and recover.

**Health Protection Scotland published updated information on ticks and Lyme disease in Scotland in 2018, including guidance on prevention and treatment. The risk of other vector-borne pathogens is currently being explored by Health Protection Scotland. A report on this work is expected in March 2019.**

#### *Climate change vulnerability assessment*

**Trends in exposure or vulnerability cannot currently be assessed for any of these areas, but some contextual information is available.**

**The extent to which the exposure and vulnerability of the population to pathogens is changing cannot currently be measured.** While trends cannot currently be identified or associated with climate change, there are some useful data sources which give an indication of the current scale of these issues.

Around 5% of ticks in Scotland are infected with borrelia, the bacteria which triggers Lyme disease in humans. Impacts are known to be increasing - there has been an increase in cases of Lyme disease in Scotland since 2006, and around 200 cases of Lyme disease are now reported in Scotland each year compared to 171 in 2006.<sup>142</sup>

**PREVIOUS RECOMMENDATION 18:** Health Protection Scotland should, before the next SCCAP, assess the changing risks to people from vector-borne diseases, making use of the second UK Climate Change Risk Assessment Evidence Report. This should consider priority areas for future monitoring and surveillance and whether current resources are aligned with the areas of greatest current and future risk.

**RESPONSE:** Health Protection Scotland routinely monitors new, emerging or re-emerging disease epidemiology and considers the role that climate change plays in developments. The report on the vector-borne disease work will be completed by March 2019. It will include comments about gaps in surveillance but the main issues with inadequate surveillance are not related to identifying human illness. The gaps relate more to inadequate monitoring the insect vectors and pathogen carriage.

**In terms of food-related illnesses, while the overall number of salmonella cases is decreasing, the number of cases of campylobacter is increasing across the UK.**<sup>143</sup> Food Standards Scotland estimate that there are 43,000 cases of foodborne illness annually in Scotland. Specific trends for Scotland are not known.

**The future impacts of climate change on air quality are uncertain but warmer weather and/or changing wind patterns could lead to an increased risk from air pollution.** People with existing respiratory illnesses are likely to be more vulnerable to health impacts during episodes of high air pollution. While complete datasets are not available, figures from the NHS Scotland Quality and Outcomes framework indicate that the crude prevalence of asthma in

<sup>142</sup> Data from Health Protection Scotland website - <https://www.hps.scot.nhs.uk/giz/lymedisease.aspx>. It is anticipated that this number is under-reported due to incomplete detection of cases.

<sup>143</sup> CCC (2016) *UK Climate Change Risk Assessment Evidence Report: Chapter 5, People and the Built Environment*.

Scotland has increased steadily over the last ten years starting from 5.5% of the population in 2006/07 to 6.4% in 2015/16.







**Incidence rates for malignant melanoma of the skin have increased significantly over the last decade.** In 2016 there were 1,383 people diagnosed in Scotland, up from around 1,200 in 2014.<sup>144</sup> The primary recognised risk factor for melanoma of the skin is exposure to natural and artificial sunlight, especially but not exclusively at a young age.

### Public understanding of climate-related risks

CCC rating	Rationale for rating
Positive progress	SCCAP actions are progressing and awareness of climate risk is increasing. The proportion of adults in Scotland who view climate change as an immediate and urgent problem has increased by one third between 2013 and 2017, from 46% to 61%.

### Summary RAG assessment

**Table 4.4.** Summary RAG assessment - Public understanding of climate-related risks

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	There is ongoing engagement with communities via Adaptation Scotland work with local authorities and public sector bodies.  Adaptation Scotland have produced 'Theory of Change to Community Engagement', various training and events and input into adaptation research.  Regional Adaptation strategies have been developed and implemented.	Is there a plan?  Green
Are actions taking place?  Green		Are actions taking place?  Green
Is progress being made in managing vulnerability?  Grey	The proportion of adults in Scotland who view climate change as an immediate and urgent problem has increased by one third between 2013 and 2017.	Is progress being made in managing vulnerability?  Green

<sup>144</sup> ISD Scotland (2016) *Cancer Incidence Dashboard*, <http://www.isdscotland.org/Health-Topics/Cancer/Publications/2018-04-24/visualisation.asp>. Most notable increase in males, of 28.7%.

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*Why is it a priority for adaptation?*

**A higher level of awareness of the risks posed by climate change is an important prerequisite to taking action, and should mean that society has an increased ability to respond to extreme weather events.** Raising awareness about the effects of climate change is likely to be most effective when people are already dealing with the effects of extreme weather. Research has shown that awareness is generally raised through experience of extreme events such as floods. Barriers to responding to such events include the costs of taking action and the availability of appropriate solutions. Research into community resilience to climate change found evidence of much more local action on flooding than other aspects of adaptation like heat and water availability.<sup>145</sup>

*Progress of policies and actions*

**The SCCAP contains a large number of policies and actions aimed at increasing awareness of climate risks.** Adaptation Scotland plays a central role in delivering these.

The Scottish Government-funded Adaptation Scotland programme has a role to raise awareness and build the capacity of organisations, businesses and communities to adapt to the impacts of climate change, including extreme weather event impacts. Support provided by the Adaptation Scotland programme includes capacity building training programmes, support for partnership projects, providing expertise to inform policy relevant research online tools, resources and an enquiry service. Adaptation Scotland support and inform those who have a statutory role to engage communities, for example local authorities and the public sector.

Actions taken forward by Adaptation Scotland since the first assessment of the SCCAP include Adaptation Learning Exchange events and training, supporting the Public Bodies Climate Change Duties including a review of the reporting requirements and developing a Theory of Change to Community Engagement which they believe will enable monitoring and evaluation of community engagement on adaptation issues. They have also provided adaptation science input to the National Coastal Change Assessment, the UKCP18 non-government user group, the Infrastructure Operators Adaptation Forum, and the UK Marine Climate Change Impacts Partnership.

**A number of regional climate change adaptation programmes are underway in partnership with local authorities,** including Climate Ready Clyde, Edinburgh Adapts and Aberdeen Adapts. Localised adaptation strategies and plans should encourage greater community engagement with adaptation.

**Box 4.1. Case study - Climate Ready Clyde: A climate risk assessment for the Glasgow city region**

Climate Ready Clyde is a cross-sector initiative funded by the Scottish Government and 12 member organisations to create a shared vision, strategy and action plan for an adapting Glasgow City Region. The initiative is leading the way on embedding climate adaptation into regional development in the UK. Climate Ready Clyde has been working with stakeholders across Glasgow City Region to assess the risks and opportunities posed by climate change, in order to develop an Adaptation Strategy and Action Plan, due in 2020. The assessment of climate risk builds on research from a wide range of organisations including Historic Environment Scotland, SNH, SEPA, Scottish Water, ClimateXChange

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<sup>145</sup> Clare Twigger Ross et al (2015) *Community resilience to climate change: an evidence review*, <https://www.jrf.org.uk/report/community-resilience-climate-change>

**Box 4.1. Case study - Climate Ready Clyde: A climate risk assessment for the Glasgow city region**

and the UK Committee on Climate Change's Adaptation Committee. It supports the wider economic, social and environmental priorities of Glasgow City Region, as well as the outcomes from the Scottish Government's National Performance Framework and the U.N. Sustainable Development Goals.

Some of the key areas for further action in the next five years highlighted by the assessment include developing plans to climate-proof key rail and road infrastructure along the Clyde from storms, heat and coastal erosion, supporting businesses to adapt, and developing new finance options to accelerate action and offset the impact of exiting the European Union. A report summarising the risks and opportunities climate change presents for the city region and indicating where further resources could be directed between 2020 and 2025 to ensure a climate-resilient future is available at

<http://climatereadyclyde.org.uk/wp-content/uploads/2018/11/Climate-Ready-Clyde-Climate-Risk-and-Opportunity-Assessment-Key-findings-and-next-steps.pdf>

**Section 44 of the Climate Change (Scotland) Act 2009 places a duty on public bodies to help deliver the SCCAP in exercising its functions.** This includes an annual obligation to report on adaptation actions taken. Local Authorities in particular have a significant role to play in providing information and services which educate communities about climate change adaptation and help build adaptive capacity in their regions.

*Climate change vulnerability assessment*

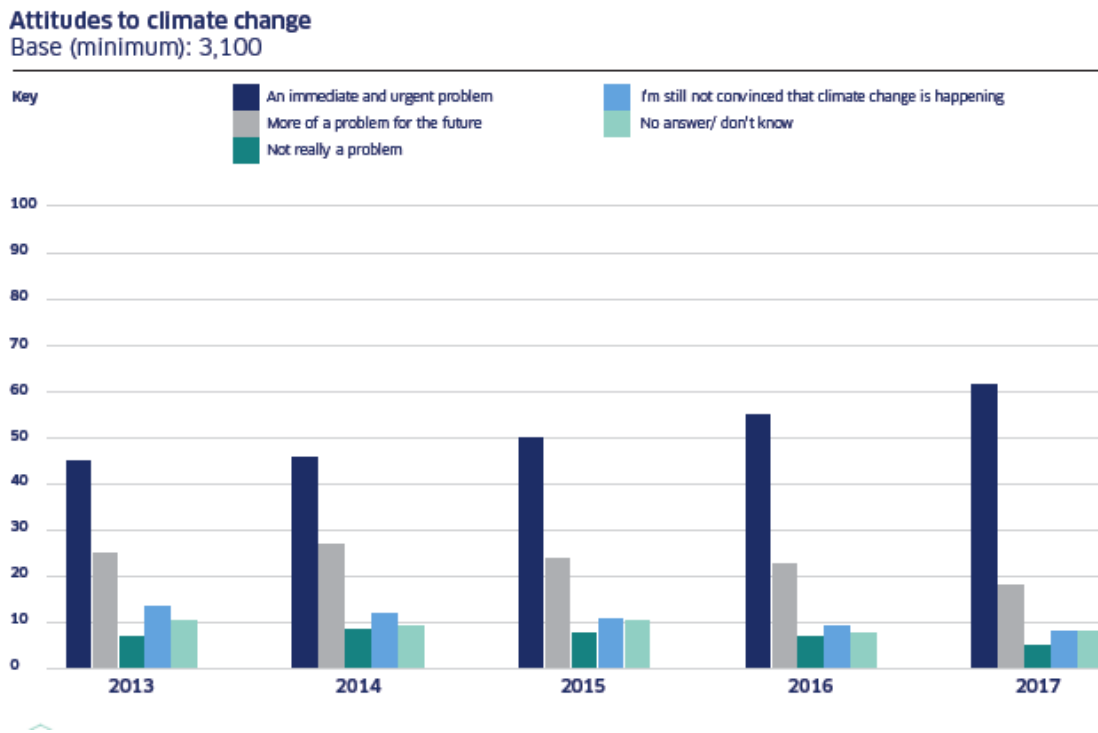
**The proportion of adults in Scotland who view climate change as an immediate and urgent problem has increased by one third between 2013 and 2017, from 46% to 61% (Figure 4.2).**

For the last five years the Scottish Household Survey (SHS) has included a question about perceptions of climate change as a problem. In 2015, the SHS added four new questions to explore people's attitudes relevant to taking action to tackle climate change. There have been corresponding decreases over time in the proportion of people who believe climate change is more of a problem for the future; or who are not convinced that climate change is happening.<sup>146</sup>

<sup>146</sup> The SHS sample size in 2017 was 10,680. For some questions the sample size was reduced and the bases are correspondingly lower.



**Figure 4.2.** Attitudes to climate change in Scotland (2013 - 2017)



**Source:** The Scottish Government (2017) *Scottish Household Survey: Climate Change*.

In the survey, 73% of adults agreed with the statement “I understand what actions people like myself should take to help tackle climate change”, with an increase in strong agreement compared with 2015. There is no distinction between mitigation and adaptation in the survey. The results suggests that a majority of people believe that they know what individual actions they could take, however it does not show whether their understanding of the possible actions is correct or whether they are taking any action in practice.

The Scottish Housing Survey results are relatively consistent with the results of a GB-wide 2017 survey by ComRes commissioned by the Energy and Climate Intelligence Unit, where the majority of British adults (64%) recognised that climate change is happening, and that it is primarily due to human activity.<sup>147</sup> This view has steadily become more prevalent since 2014 (57%) and 2015 (59%).<sup>148</sup> Categories of climate-related risks addressed by the survey were, in descending order of concern, harm to wildlife and nature; increase in flooding; food availability and price and increase in heatwaves.

In the first assessment, the Adaptation Committee identified a need to monitor the uptake and impact of guidance on climate change adaptation:

<sup>147</sup> ComRes (2017) *Energy and Climate Intelligence Unit Climate Change Survey, Survey of British adults on behalf of ECIU on climate change*, <http://www.comresglobal.com/polls/energy-and-climate-intelligence-unit-climate-change-survey/>

<sup>148</sup> ComRes interviewed 2045 GB adults online and data were weighted to be demographically representative of all GB adults and by past vote recall.

**PREVIOUS RECOMMENDATION 19:** The Scottish Government should, before the next SCCAP, review the take-up and impact of guidance and tools for organisations, businesses and communities provided by Adaptation Scotland.

**RESPONSE:** Sniffer submits 6-monthly reports on the activities and objectives of the Adaptation Scotland programme, covering input and output indicators, milestones and impact indicators, which are reviewed by a Programme Board comprising Scottish Government Decarbonisation officials and Directors of the Adaptation Scotland programme.





The uptake and impact of Adaptation Scotland guidance cannot currently be assessed due to the format in which it is circulated. Adaptation Scotland have advised that there are plans to develop more comprehensive monitoring and evaluation for the next version of guidance.

### Health and social care services



CCC rating	Rationale for rating
Mixed progress	Progress is being made in implementing adaptation actions for the healthcare sector but the SCCAP does not address risks to delivery of social care services. There are no indicators to assess the vulnerability of health and social care services to climate change. A research programme is underway which is anticipated to address some of the data gaps.

### Summary RAG assessment

**Table 4.5.** Summary RAG assessment - Health and social care services

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Amber	The NHS Scotland: Standards For Organisational Resilience have been published.  A working group has been established to further develop the NHS Climate Change Risk Assessment tool.  Climate change and sustainability reporting requirements for NHS Boards have been reviewed.  There are no standards for social care resilience.	Is there a plan?  Amber
Are actions taking place?  Green		Are actions taking place?  Green

**Table 4.5.** Summary RAG assessment - Health and social care services

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is progress being made in managing vulnerability?</p> <p></p> <p>Grey</p>	<p>There is no data available to assess the vulnerability of health and social care services to climate change in Scotland. Research has been commissioned on the impacts of climate change on social care that could inform policy development and lead to indicators of vulnerability.</p>	<p>Is progress being made in managing vulnerability?</p> <p></p> <p>Grey</p>

*Why is it a priority for adaptation?*

**Floods, heavy rain and wind, drought, snow, cold and hot weather affect health system infrastructure and service delivery through effects on staff, buildings and equipment.** The 2018 National Flood Risk Assessment identified there are approximately 700 health care facilities in Scotland located in areas at risk of in a 0.5% (1 in 200) probability event. Under the climate change projections used in the NFRA, the number increases to 860 facilities at risk of a 1 in 200 year flood event.<sup>149</sup> While other health-related facilities may lie outside flood risk areas they may still be affected by the impacts of climate change on supporting infrastructure such as road links and electricity supply. Increased demand on health facilities as consequence of climate change can also be expected, for example due to an increase in flooding or heatstroke victims or an increase in emerging infectious diseases.

**Extreme temperatures can cause problems with the functionality of hospitals as well as the thermal comfort and health of patients and staff.** Research indicates that that older (pre-1950) building designs are at less risk of overheating than more modern buildings<sup>150</sup>, though again the level of risk in Scotland is unmeasured. The risk of heat-related mortality is larger in care homes than in the general population, even after accounting for differences in age.<sup>151</sup> Cold spells and snow storms are very disruptive due to staff not being able to travel to work (as observed for example during the cold winter of 2010/11). Cold weather can also affect healthcare infrastructure and increase demand on health services.<sup>152</sup>

*Progress of policies and actions*

**Legislative duties and standards for organisational resilience are generally well defined for NHS Boards in Scotland.** The NHS Scotland Standards for Organisational Resilience set out the minimum standards and related performance criteria for resilience within Health Boards across Scotland. Within the dedicated section on climate change, there is a requirement that

<sup>149</sup> The NFRA uses the high 2080s climate change scenarios from the UK Climate Projections 2009 (UKCP09), however no assumptions for population growth, changes in the number of facilities or the extent of adaptation measures are included.

<sup>150</sup> Lomas, K. J. & Porritt, S. M. (2017) *Overheating in buildings: lessons from research*, *Building Research & Information*, 45:1-2, 1-18, DOI: 10.1080/09613218.2017.1256136, <https://doi.org/10.1080/09613218.2017.1256136>

<sup>151</sup> Hajat, S et al. (2006) *Heat-related and cold-related deaths in England and Wales: who is at risk?* *Occupational and environmental medicine* vol. 64,2 (2006): 93-100, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078436/>

<sup>152</sup> Kovats, R.S., and Osborn, D., (2016) *UK Climate Change Risk Assessment Evidence Report: Chapter 5, People and the Built Environment.*

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Health Boards shall develop and implement a framework of actions to assure the continuity of quality healthcare services before, during and after extreme weather events. It requires that a Climate Risks and Vulnerability Assessment is undertaken using hazard-vulnerability analyses to inform health services and infrastructure planning. It also sets requirements for resilience strategies, organisational policy, processes and training related to extreme weather events, as well as building and infrastructure considerations.

**There are no specific standards for climate resilience that social care providers have to conform to.** There is a process for Health Boards to share the outcome of risk assessment(s) with local Health and Social Care Partnerships, and they must also be involved in training and exercise programmes. The impacts of climate change on social care delivery are not currently well understood and it is anticipated that research commissioned by the Scottish Government through ClimateXChange can inform future policy development for resilience of social care services. This study is due to report in March 2019.

**The NHS Scotland Sustainable Development Strategy supports risk assessment and adaptation planning for the NHS estate.** A working group has been established to further develop the NHS Climate Change Risk Assessment tool for the NHS Scotland estate with representation from six of the territorial NHS Boards. Individual health boards are required to develop individual Climate Change Adaptation Plans in accordance with the NHS Scotland Sustainable Development Strategy.

**There is a good level of transparency regarding actions taken by health boards to adapt to climate change.** The suite of climate change and sustainability reporting undertaken by NHS Boards has been reviewed with the aim of consolidation and the outcome of this review work will inform reporting from 2018 onwards.

**NEW RECOMMENDATION 8:** Include specific actions to understand and improve resilience of health and social care services in the next iteration of the SCCAP. Research such as that currently underway by ClimateXChange to provide data on the direct and indirect impacts of climate change on social care delivery and to understand risks and dependencies is crucial. The next SCCAP should commit to action to take the findings of this research forward.

**NEW RECOMMENDATION 9:** Consider specific actions that can be incorporated into the next SCCAP to link adaptation to National Health and Wellbeing Outcomes. In particular, Outcome 4: 'Health and social care services are centred on helping to maintain or improve the quality of life of people who use those services'.

### *Climate change vulnerability assessment*

**There are no indicators to assess the vulnerability of health and social care services to climate change in Scotland.** Through ClimateXChange, a research project has been commissioned to provide data on the direct and indirect impacts of climate change on social care delivery, as well as understanding the extent of risk for some social care facilities<sup>153</sup> and dependencies on infrastructure such as transport and telecommunications. This research will report in 2019.

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<sup>153</sup> The project will not look at institutional care, only care at home, direct payments and telecare.







**Some data is available, including the NFRA flood risk projections for health care facilities noted above but the extent of risk to health and social care services generally from climate change cannot be assessed.**

### Emergency planning and response

CCC rating	Rationale for rating
Mixed progress	Whilst SCCAP coverage and implementation of actions is positive, particularly in relation to managing flood risk, there remains a lack of information to assess vulnerability of emergency planning and response services.

### Summary RAG assessment

**Table 4.6. Summary RAG assessment - Emergency planning and response**

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Green	Scottish Regional Resilience Partnerships (RRPs) undertake biennial Risk and Preparedness Assessments.  The UK National Risk register was updated in September 2017 and continues to recognise climate risks.	Is there a plan?  Green
Are actions taking place?  Green	Scottish Fire and Rescue Service (SFRS) capabilities were subject to inspection which found that SFRS would be in a position to discharge its statutory responsibilities in relation to a serious flooding incident.  There has been a suite of guidance updates - Responding to Emergencies; Recovering from Emergencies and Dealing with Mass Fatalities; Care for People; Are We Ready; updated risk assessment guidance for RRP's.	Are actions taking place?  Green
Is progress being made in managing vulnerability?  Grey	There is still no data to assess the level of current capability of the emergency planning system and the resources required to be able to cope with current and future extreme weather conditions.  There is some data on past impacts from weather-related emergencies but vulnerability cannot currently be assessed.	Is progress being made in managing vulnerability?  Grey

### Why is it a priority for adaptation?

**Emergency services in Scotland have a responsibility to respond to serious flooding, wildfires, road traffic accidents and search and rescue incidents, and therefore may be**



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**called to act in any weather event.** Multiple incidents can be caused by one weather event, for example severe rainfall can cause flooding, landslides and traffic accidents. The effects of flooding are widespread including risk to life, damage to property, transport disruption, damage to agricultural land and disruption to businesses' premises, operations and supply chains.

**While it is difficult to project precise future changes in extreme weather, demands on the emergency services in Scotland are likely to increase in the future with climate change and population growth.** With fluvial (river) flooding for example likely to increase in frequency and severity in the winter, it is likely that adjacent areas to current floodplains will become flood prone, increasing the number of people at risk. The increase in extreme rainfall may act to increase pluvial flooding, landslides and road traffic accidents, increasing overall pressures on the emergency services, as well as for other weather induced events noted below.

Research shows that the incidence of wildfires will increase significantly in the future<sup>154</sup> and for a few months of the year these may provide a significant workload for the Fire and Rescue Service and could pose a threat to life. These wildfires can often occur simultaneously and over a wide area stretching the emergency services resources as was demonstrated for example in early May 2011, when 29 wildfires were reported at the same time during a period of warm and dry conditions across Scotland.

### *Progress of policies and actions*

The first assessment of the SCCAP identified a gap in understanding of the current level of capability within the emergency response system:

**PREVIOUS RECOMMENDATION 14:** The Scottish Government should, before the next SCCAP, assess the current level of capability within the emergency response system to deal with extreme weather events and take further steps as necessary to prepare for climate change.

**RESPONSE:** Regional Resilience Partnerships (RRPs) are currently undertaking their biennial Risk and Preparedness Assessment. This process gives partnerships (Cat 1 and 2 Responders) an understanding of the hazards they may be faced with, including extreme weather events such as low temperature and snow and storms and gales. This assessment is then used to inform their capability to deal with these events and identify the gaps that exist and the work needed to close those gaps. This next cycle will finish in March 2019 and a report for each region will be provided to Scottish Government Resilience Division. Following that RRPs will spend the next 18 months on work to close gaps before they move into another round of risk assessment.

**Regional frameworks are in place to monitor the resilience of emergency services in Scotland.** Regional Resilience Partnerships (RRPs) are currently undertaking their biennial Risk and Preparedness Assessment. This process gives responders an understanding of the hazards they may be faced with, including extreme weather events such as low temperature, snow, storms and gales. Updated guidance on risk assessment for RRPs was developed with stakeholders and published in December 2017. A risk learning product and toolkit to support RRPs in discharging their responsibility for undertaking risk assessment are being developed.

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<sup>154</sup> Albertson, K., Ayles, J., Cavan, G. & Mcmorrow, J. (2010) *Climate change and the future occurrence of moorland wildfires in the Peak District of the UK*. Climate Research. 45. 105. 10.3354/cr00926.

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**The UK National Risk register was updated in September 2017, with climate change risks becoming more prevalent.**<sup>155</sup> It explains the risks of major emergencies that could affect the UK in the next five years, provides resilience advice and guidance for UK Government and local responders to manage these emergencies. The National Risk Register (NRR) also signposts advice and guidance on what members of the public can do to prepare for these events. The Government's assessment of some of the risks in the 2017 NRR has changed since the previous NRR was published in 2015. The likelihood of emerging infectious diseases has increased, with climate change named as one of the key contributing factors. Climate change is also specifically noted under long-term trends as a current and future challenge and the NRR includes information on both flooding and heatwaves as potential civil emergencies. Community Risk Registers inform members of the public about risks to their local area.

HM Fire Service Inspectorate (HMFSI) carried out an inspection of the Scottish Fire and Rescue Service (SFRS) during the spring and summer of 2015. The inspection considered the manner in which SFRS is carrying out its functions of planning and preparing for a serious flooding incident. Overall, HMFSI found that a significant number of flood and water rescue resources were available to the SFRS and that crews had been trained to a good level, so that SFRS would be in a position to discharge its statutory responsibilities in relation to a serious flooding incident.

**A number of elements of the 'Preparing Scotland' suite of guidance have been updated.** 'Preparing Scotland' is the guidance for responders to assist them to assess, plan, respond and recover to emergencies. It establishes good practice based on professional expertise, legislation and lessons learned from planning for and dealing with major emergencies at all levels.

Since 2016, updated guidance covering 'Responding to Emergencies', 'Recovering from Emergencies' and 'Dealing with Mass Fatalities' has been published. The revised Care for People and the Are We Ready guidance has also been updated. The Resilience Learning Programme for Scotland was also updated in 2017.

### *Climate change vulnerability assessment*

**It is still not possible to assess how vulnerability to weather-related emergencies is changing because it is not currently clear what the current level of capability of the emergency planning system is, and what is needed to cope with current or future extreme weather.** This information is needed to understand the extent to which the current system will be able to cope with changes in the frequency and intensity of extreme weather events with climate change. While it is positive that regional preparedness assessments are conducted regularly, there is not currently a combined view available of the capability of the emergency planning system as a whole in Scotland.

**Data on the impact of severe weather events provides an understanding of the impact of weather-related incidents on fire and rescue services.** In 2016/17, Scottish Fire and Rescue Services responded to 1,004 flooding incidents. This represented 8% of all non-fire related incidents during that time, down from 11% in 2013/14 and 17% in 2009/10. As this is the only data available, it is not possible to draw conclusions on the vulnerability of emergency services to current and future flood risks.

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<sup>155</sup> Cabinet Office (2017) *National Risk Register Of Civil Emergencies*, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/644968/UK\\_National\\_Risk\\_Register\\_2017.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/644968/UK_National_Risk_Register_2017.pdf)

The uptake of flood warnings and guidance acts as a partial measure of resilience to flooding. Improving people’s ability to prepare for a flood event could potentially lessen the impact of flood events on emergency services. There has been a notable increase of nearly 4,000 users of SEPA’s Floodline alerts and warning service since December 2015.<sup>156</sup> The effectiveness of flood warnings is dependent on the extent to which people take preparatory action in response to a flood warning or alert. A report by CREW<sup>157</sup> in 2017 investigating the effectiveness of the Floodline service, found that 82% of those who received messages from the service reported taking preparation action in response.<sup>158</sup>

## Recovery from extreme weather events

CCC rating	Rationale for rating
High concern	Some positive actions have taken place to improve recovery capabilities, however there is a lack of national targets for recovery from extreme weather events and a lack of evidence on the impacts of extreme weather events on people, and the effectiveness of recovery plans.

### Summary RAG assessment



Table 4.7. Summary RAG assessment - Recovery from extreme weather events		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Amber	The Cabinet Office completed a post-implementation review of contingency planning regulations which was published in 2017.  A suite of guidance has been published/updated: recovering from emergencies; care for people affected by emergencies; psychosocial and mental health response.	Is there a plan?  Amber
Are actions taking place?  Amber	A good practice framework for flood risk communities is under development.  There is a lack of national targets for recovery.  Efforts are focussed on resilience rather than recovery.	Are actions taking place?  Green

<sup>156</sup> It is anticipated that greater numbers of people access SEPA’s flood warning services and products digitally during a flood event, via both SEPA’s own website and also partner information channels such as the Met Office, local authorities and the BBC however social media use is not currently tracked.

<sup>157</sup> Scotland’s Centre of Expertise for Waters.

<sup>158</sup> Geddes, A., Cranston, M., Ambler, A. and Black, A. R. (2017) *Assessing the effectiveness of Scotland’s public flood warning service: Summary report CRW2016\_12*, [https://www.crew.ac.uk/sites/www.crew.ac.uk/files/sites/default/files/publication/Assessing%20of%20the%20effectiveness%20of%20Scotlands%20public%20flood%20warning%20service\\_summary.pdf](https://www.crew.ac.uk/sites/www.crew.ac.uk/files/sites/default/files/publication/Assessing%20of%20the%20effectiveness%20of%20Scotlands%20public%20flood%20warning%20service_summary.pdf)

**Table 4.7.** Summary RAG assessment - Recovery from extreme weather events

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is progress being made in managing vulnerability?</p> <p></p> <p>Grey</p>	<p>There remains a lack of evidence on the impacts from extreme weather events on long term health, the effectiveness of recovery plans, and the length of time it takes people and communities to recover.</p>	<p>Is progress being made in managing vulnerability?</p> <p></p> <p>Grey</p>

*Why is it a priority for adaptation?*

**Recovery from extreme events includes not only physical recovery of assets and services, but also from socioeconomic and wellbeing impacts, such as loss of jobs, impacts on mental health and other social disruption.** Research undertaken for the Scottish Government in 2015 to map flood disadvantage identified that an estimated 100,000 people in Scotland are acutely or extremely flood disadvantaged and that social vulnerability to flooding has a strong urban component.<sup>159</sup> While remote small towns and remote rural areas tend to be vulnerable due to social and physical isolation combined with older populations, flood disadvantage is concentrated in urban areas in Scotland. Extreme weather events can have negative impacts on wellbeing, for example through financial losses associated with property damage, emotional stresses and uncertainty.

**The remote nature of Scotland’s population presents challenges in recovering from other extreme weather events such as high winds and prolonged periods of snow and ice.** With 9.5% of the population being defined as living in remote towns or rural areas in 2012<sup>160</sup>, providing assistance for recovery from extreme weather events can be more challenging in these remote areas.

The first UK Climate Change Risk Assessment projected that the number of people experiencing mental health impacts in Scotland after a flood could increase by about 800 by the 2080s. There is no present-day baseline as monitoring after an event does not take place. Some localised data is available, such as the results of the CREW study which looked at the immediate and longer term effects of flooding in Aberdeenshire in 2015-16.<sup>161</sup> In that study, people reported feelings of stress for a number of reasons including seeing a home or community destroyed by flooding, staying in temporary accommodation and heavy rainfall invoking feelings of worry. Other aspects of mental and physical health included feelings of "survivor guilt", felt by those whose homes were and were not flooded.

<sup>159</sup> Kazmierczak, A., Cavan, G., Connelly, A. & Lindley, S. (2015) *Mapping Flood Disadvantage in Scotland 2015: Main Report* - <https://beta.gov.scot/publications/mapping-flood-disadvantage-scotland-2015-main-report/>

<sup>160</sup> As defined in the Scottish Government Urban Rural Classification, <http://www.gov.scot/Topics/Statistics/About/Methodology/UrbanRuralClassification>

<sup>161</sup> Philip, L., Currie, M., Dowds, G., and McKee, A. (2018) *Impacts of winter 2015/16 flooding in and around Ballater and in the Garioch: overview of findings from Project Year 1*, <https://www.crew.ac.uk/publication/impacts-winter-201516-flooding-and-around-ballater-and-garioch-overview-findings-project>

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## *Progress of policies and actions*

**The UK framework for civil contingency planning was reviewed in 2017 and was deemed to be still fit for purpose.** The Cabinet Office recently conducted a review of the Civil Contingencies Act 2004 (Contingency Planning) Regulations 2005.<sup>162</sup> This was a statutory review and was not driven by the climate change agenda, though understanding the level of preparedness for extreme events today is a useful starting point to assessing vulnerability to future extreme weather. The review considered whether current governance arrangements for civil contingencies were sufficient and concluded that the legislative framework remains fit for purpose. The review found that while there was some inconsistency in interpretation of requirements by responders in different areas, the current approach whereby local responders retain the ability to make decisions in the light of local circumstances and priorities continues to be the best approach.

**While a suite of guidance on preparing for and responding to emergencies such as extreme weather exists, there are no national recovery goals or targets.** The Preparing Scotland Care for People Guidance<sup>163</sup> includes a supplement on psychosocial needs<sup>164</sup> and is intended to assist Category 1 responder organisations to prepare and implement effective responses to the psychosocial and mental health needs of people who are affected by emergencies. Separate guidance for responder agencies on recovering from emergencies was also published in 2017, but none of these sources contains recovery goals or targets.<sup>165</sup>

**The current policy effort focusses on both building resilience to extreme events and minimising the recovery effort in the aftermath of events such as flooding.** The National Centre for Resilience (NCR) has commissioned work from the Scottish Flood Forum to create a Good Practice Framework aimed at supporting engagement with flood risk communities before, during and after a flood event. The NCR has also set up an Advisory Group which aims to produce guidance for homeowners about flood resilience including property level protection, which can reduce the recovery period after a flood. The NCR is contributing funds to a UK CIRIA (Construction Industry Research and Information Association) project which will produce guidance for the building and insurance industries and homeowners to help identify the most resilient repairs.

## *Climate change vulnerability assessment*

In the first assessment, the Adaptation Committee identified a lack of data to assess the impact on people, businesses and communities arising from flood events, including persistent health and wellbeing effects:

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<sup>162</sup>The Cabinet Office (2017) *Report of the post implementation review of the Civil Contingencies Act (2004) (Contingency Planning) Regulations 2005*, [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/607046/post\\_implementation\\_review\\_civil\\_contingencies\\_act\\_web.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/607046/post_implementation_review_civil_contingencies_act_web.pdf)

<sup>163</sup> The Scottish Government (2017) *Preparing Scotland, Scottish guidance on resilience, Care for people affected by emergencies*, <https://www.readyscotland.org/media/1441/care-for-people-affected-by-emergencies-november-2017.pdf>

<sup>164</sup> The Scottish Government (2013) *Preparing Scotland, Responding to the psychosocial and mental health needs of people affected by emergencies*, <https://www.readyscotland.org/media/1406/responding-to-the-psychosocial-and-mental-health.pdf>

<sup>165</sup> The Scottish Government (2017) *Preparing Scotland, Recovering from emergencies in Scotland*, <https://www.readyscotland.org/media/1418/preparing-scotland-recovering-from-emergencies-published-version-september-2017.pdf>



**PREVIOUS RECOMMENDATION 15:** The Scottish Government should, before the next SCCAP, co-ordinate with local authorities to assess the impact on people, businesses and communities arising from flood events, including persistent health and wellbeing effects, and consider what further steps might be taken to help communities recover from extreme weather events more quickly.

**RESPONSE:** We have commissioned a 3 year study to assess the long term social impacts of the flood events in Aberdeenshire during the winter of 2015/16. Findings from the study will feed into work with a range of stakeholders to develop an action plan to promote flood resilient properties. Flood resilience measures can help people return to their homes quicker after a flood event and lessen the social and economic impacts of a flood event.

The approach to prioritise Flood Risk Management actions currently being developed by SEPA will include improved consideration of social vulnerability to flooding as well as health and wellbeing.

**There is a lack of evidence on the impacts of extreme weather events on long term health, the effectiveness of recovery plans, and the length of time it takes people and communities to recover.** Data on the time it takes for people to return to their homes after a flood is not systematically collected, however the above study to assess the long term social impacts of flood events should provide useful insights. There are no datasets to evaluate interventions for psychosocial impacts of such events. The psychosocial needs guidance makes specific recommendations on systems for recording interventions by mental health professionals after extreme weather events, both at the time as well as ongoing support over the longer term. There are currently no data sets that could support evaluation.

A recent UK level study assessed the present day social vulnerability to flooding and resulting flood disadvantage across the UK and how this may change in the future in response to a number of influences including climate change, population change and flood management policy.<sup>166</sup> The study found that those living in flood prone areas in Scotland experience the highest Expected Annual Damage (EAD) per person of any area in the UK (on average £113 per person); this is over double that of England (on average £50 per person). This is forecast to increase to £183 per person by the 2080s under high climate and population growth scenarios, with the risk in socially vulnerable neighbourhoods increasing twice as quickly as elsewhere. When income and insurance penetration are considered, the 'relative economic pain' associated with flooding is significantly higher in the most socially vulnerable neighbourhoods (a consistent finding across the UK). Although many vulnerable people living in the floodplain are in urban settings, those in rural settings are, on average, exposed to more frequent flooding. This may reflect a combination of the varying natural geographies of rural and urban floodplains and the higher standards of protection typically provided in urban settings (and the technical difficulties in providing higher levels of protection in rural settings). The study concluded that further work is needed to formalise approaches that help vulnerable people to reduce their flood risk, which may include targeting of investment towards helping vulnerable people in a way that recognises the context of the communities in which they live.







<sup>166</sup> Sayers, P., Penning-Rowsell, E., Horritt, M. (2017) *Flood vulnerability, risk and social disadvantage: Current and future patterns in the UK*. Journal of Regional Environmental Change, <https://doi.org/10.1007/s10113-017-1252-z>

## Business impacts from extreme weather

CCC rating	Rationale for rating
Mixed progress	The risks to businesses from climate change are increasing and the current SCCAP is light on adaptation actions for business. Research has been initiated since the first assessment to address gaps in data availability in order to inform the next SCCAP.

### Summary RAG assessment

**Table 4.8.** Summary RAG assessment - Business impacts from extreme weather

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>Other than for flooding, there are no plans set out in the SCCAP or elsewhere for business adaptation to climate change.</p> <p>A Climate Ready Business guide has been published by Adaptation Scotland.</p>	<p>Is there a plan?</p>  <p>Amber</p>
<p>Are actions taking place?</p>  <p>Green</p>		<p>Are actions taking place?</p>  <p>Green</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>Updated data on business continuity planning is not available</p> <p>The impact of climate hazards on business is not currently measured.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Grey</p>

### Why is it a priority for adaptation?

**Scottish businesses are vulnerable to a range of climate change risks such as flooding and extreme weather.** Impacts include both direct damage to premises, as well as indirect impacts on supply chains and service delivery from travel disruption. The potential for overheating in work environments could impact on productivity and employee wellbeing, and staff may be unable to get to work during spells of extreme weather or flooding.

**With projected increases in flooding and a risk of overheating in buildings during warmer summers, businesses must be prepared to manage the impacts of such events to minimise the effects on their operations.** Risks would likely be magnified for businesses in Scotland's rural communities, where there are limited transport and communication links, or where

businesses are dependent on natural resources which are vulnerable to climate change such as the fishing industry.

**There may be some opportunities for business under future climate projections, including changes in demand for goods and services, as well as a boost to tourism from warmer weather.** At the same time, there is an increased risk of erosion to a number of coastal tourist assets. This includes many of Scotland's golf courses, as well as more than 10,000 ancient and historical sites.

### *Progress of policies and actions*

**Regional flood risk management strategies continue to define local levels of flood risk and corresponding management strategies.** The development of Community Risk Registers within each local authority area provides the foundations for flood prevention and protection initiatives to be taken forward, which cover businesses as well as residential and public buildings.

**New guidance is available for business to increase resilience against climate change impacts.** In February 2018, Adaptation Scotland launched a new Climate Ready Business guide, which includes practical examples of steps that businesses can take to increase resilience and adapt to the impacts of climate change. The guide was developed in partnership with Scottish Enterprise, Visit Scotland and the 2020 Climate Group and includes case studies from large and small companies. The extent to which this guidance is being used by Scottish businesses is not yet clear.

**PREVIOUS RECOMMENDATION 20:** The Scottish Government should, before the next SCCAP, develop policies to encourage businesses in high risk areas to become more flood resilient and report on the actions being taken by businesses as a result.

**RESPONSE:** We have commissioned a 3 year study to assess the long term social impacts of the flood events in Aberdeenshire during the winter of 2015/16. The study also considers the impacts on businesses. Findings from the study will feed into work with a range of stakeholders to develop an action plan to promote flood resilient properties. Flood resilience measures can help people return to their homes quicker after a flood event and lessen the social and economic impacts of a flood event. The action plan will include specific actions to promote flood resilience in businesses. The action plan steering group includes representation from the insurance and construction industry and works closely with the Defra Roundtable set up to consider actions to promote resilient buildings in England.

**A range of research projects are underway to better understand climate risks for business and inform future policy.** A research project has been commissioned through ClimateXChange to develop a method to estimate the extent to which Scottish businesses are exposed to climate-related hazards, evaluate the potential impact this may have on the Scottish economy, and understand businesses' preparedness and their capacity to respond and recover.<sup>167</sup> The method includes a quantitative analysis of the potential impact of climate-related risks on each of key growth sectors and the design of primary research that will establish a baseline of vulnerability, highlighting sectoral differences. ClimateXChange anticipate that a baseline study using the method will be commissioned in financial year 2019/20. The resulting evidence base is

<sup>167</sup> An overview of the method is available at <https://www.climateexchange.org.uk/media/3179/assessing-business-risk-and-preparedness-method-overview.pdf>

intended to inform the development of the second SCCAP. Scottish Enterprise are also conducting research on climate impacts on businesses.

### *Climate change vulnerability assessment*

**Updated data is not available on the number of businesses with continuity plans in place in Scotland.** The impact of climate hazards on businesses is also not currently known. Research currently underway by ClimateXChange will hopefully provide baseline data on the impacts of climate change on Scottish businesses, however this will not be ready in time for the next SCCAP.

**Some data is available on the extent of flood risk facing Scottish business.** The 2018 NFRA identified that there are approximately 55,000 properties categorised as 'business and services' at risk from a 0.5% (1 in 200) probability event from any source. This increases to approximately 29,300 properties by the 2080s under a high emissions scenario.<sup>168</sup>

**A recent survey commissioned by WWF found that nearly nine out of ten big companies in Scotland accept climate change is a risk to their business.**<sup>169</sup> It found that 46% of larger businesses think that climate change definitely poses a risk to their business and a further 39% think it poses "somewhat" of a risk. Only 12% of large business do not regard climate change as a risk to their organisation. In contrast, smaller businesses are much more relaxed about climate-related risks, the survey found.

**NEW RECOMMENDATION 1:** Work with partners to measure the adequacy of actions being taken by Scottish businesses to prepare for extreme weather and adapt to climate change.







## **Business opportunities from climate change**

CCC rating	Rationale for rating
Positive progress	While there are no specific policies in the SCCAP which focus on business opportunities, specific research is underway to inform the next programme.

<sup>168</sup> The NFRA uses the high 2080s climate change scenarios from the UK Climate Projections 2009 (UKCP09), however no assumptions for population growth or the extent of adaptation measures are included.

<sup>169</sup> WWF (2018) *Web article*, <https://www.wwf.org.uk/updates/new-poll-majority-companies-scotland-say-climate-change-risk-business>. The survey of 300 Scottish businesses was conducted by Censuswide, with 150 businesses with over 250 employees and 150 smaller businesses providing responses.

## Summary RAG assessment

Table 4.9. Summary RAG assessment - Business opportunities from climate change		
First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>There are no specific policies in the SCCAP focussed on business opportunities. Some Scotland-specific research is underway to inform the next programme - Scoping and Sizing the Scottish Adaptation &amp; Resilience (Climate Change) Economy.</p>	<p>Is there a plan?</p>  <p>Red</p>
<p>Are actions taking place?</p>  <p>Amber</p>		<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in realising opportunities?</p>  <p>Amber</p>	<p>In the absence of data for Scotland, UK data was used in the first assessment – updated data is not available.</p>	<p>Is progress being made in realising opportunities?</p>  <p>Grey</p>

### Why is it a priority for adaptation?

**A changing climate in Scotland presents a number of opportunities for business.** Warmer weather could lead to increased tourist numbers and longer tourist seasons, providing an opportunity for new businesses to develop and for established businesses to become more profitable. There will be an increasing need for innovative products and services that will enable more resilient buildings and places. A warming climate may improve growing conditions in Scotland and increase the productivity for agriculture and forestry and there will be opportunities to develop new farming and forestry practices that support increased resilience. There will be opportunities to develop expertise and technology in a number of areas, for example in relation to water management and drainage in response to an increase in frequency and intensity of heavy rainfall events.

### Progress of policies and actions

**There are no specific policies in the SCCAP focussed on business opportunities but some Scotland-specific research is underway to inform the next programme. This was identified as a gap in the first assessment and is being addressed in consultation activities for the next iteration of the SCCAP:**



**PREVIOUS RECOMMENDATION 21:** The Scottish Government should include actions within the next SCCAP that will help businesses in Scotland understand and exploit the economic opportunities arising from climate change.

**RESPONSE:** In developing the next SCCAP, the Scottish Government is holding a series of workshops and Twitter sessions with stakeholders, including on business and the economy, to hear their views and priorities for the next SCCAP. Wider public consultation on the draft SCCAP will take place in early 2019.

In April 2018, ClimateXChange published a paper on Scoping and Sizing the Scottish Adaptation & Resilience (Climate Change) (A&RCC) Economy: An overview of methods.<sup>170</sup> This paper makes recommendations on how to progress the scoping and sizing of the ARCC economy in Scotland, by establishing a baseline assessment of the Scottish A&RCC Economy and developing a method to support periodic updates to the baseline dataset. This would enable year-on-year comparisons and start to develop a time series for the A&RCC Economy. A project to develop the baseline would be a positive action to include in the second SCCAP.

#### *Climate change vulnerability assessment*

**There is no data available to form an updated view on vulnerability.** The research indicated above would provide a useful baseline against which to measure progress under the next SCCAP.







### **Supply chain disruptions**

CCC rating	Rationale for rating
Mixed progress	While there is no overarching plan to address risks to Scottish businesses' supply chains from climate change, some sector specific strategies exist and actions are taking place. There is a lack of information however to assess the vulnerability of Scottish supply chains to climate impacts.

<sup>170</sup> Bonaventura, M. for ClimateXChange (2018) *Scoping and sizing the Scottish Adaptation & Resilience (Climate Change) (A&RCC) Economy: An overview of methods*, <https://www.climateexchange.org.uk/media/3095/scoping-and-sizing-the-scottish-adaptation-economy.pdf>

## Summary RAG assessment

**Table 4.10.** Summary RAG assessment – Supply chain disruptions

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is there a plan?</p>  <p>Amber</p>	<p>There is no overarching plan to address systemic risks to Scottish businesses' supply chains.</p> <p>Some sector specific strategies do exist :</p> <ul style="list-style-type: none"> <li>The Scotland Food &amp; Drink (SF&amp;D) Strategy Ambition 2030 includes activities by agriculture sector to consider climate change risks to supply chains.</li> <li>The Sustainable Procurement Duty has created greater scrutiny of the extent to which public sector organisations are building climate resilience into their procurement of goods and services.</li> </ul> <p>Adaptation Scotland's Climate Ready Business Guide supports business to improve resilience of supply chains to extreme weather events – but the uptake of guidance is not known.</p>	<p>Is there a plan?</p>  <p>Amber</p>
<p>Are actions taking place?</p>  <p>Amber</p>		<p>Are actions taking place?</p>  <p>Amber</p>
<p>Is progress being made in managing vulnerability?</p>  <p>Amber</p>	<p>There is a lack of information to assess the vulnerability of supply chains to climate impacts.</p> <p>Impacts data for Scotland is also not available. Internationally, 56% of business surveyed suffered a supply chain disruption in 2017 and adverse weather was the second most common cause of disruption.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Grey</p>

### Why is it a priority for adaptation?

**The productivity of the Scottish economy depends on secure supply chains, as well as secure resource supplies (energy, water, materials) and infrastructure.** In 2017, exports of goods from Scotland were up by 19% to nearly £29 billion, while they rose 13% for the UK as a whole. Scotland's biggest exports are whisky, salmon, beef and lamb, chemicals, petroleum products, electronics, and textiles. Imports to Scotland rose by 12% to more than £24 billion, and included manufactured goods, beverages and tobacco, machinery and vehicles, and fuels.

**Extreme weather events, such as flooding, storms and drought, are already common causes of supply chain disruptions and are projected to become more frequent.** In the Business Continuity Institute's (BCI) Supply Chain Resilience Report (2018), 56% of all respondents suffered a supply chain disruption in the past 12 months and for UK respondents, adverse weather was the second most cited reason for supply chain disruption.<sup>171</sup> Impacts of disruption can be both short term, such as a drop in productivity and unfulfilled orders leading

<sup>171</sup> Business Continuity Institute (2018) *Supply Chain Resilience Report 2018*, <https://www.thebci.org/resource/bci-supply-chain-resilience-report-2018.html>

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to a dip in share price, and persistent, such as damage to brand reputation, an increase in regulatory scrutiny, and losses of regular customers and market share. With 49% of goods exported to European countries in 2017, the importance of supply chain resilience is heightened in the context of political uncertainty regarding Brexit and the impact this will have on the trade economy in Scotland.

### *Progress of policies and actions*

#### **There is no overarching plan to address systemic risks to Scottish businesses' supply chains. Some sector level strategies are in place for supply chains more generally.**

There is currently no overall assessment of specific or systemic risks to Scottish businesses from vulnerable supply chains, and there is no plan to act on such risks should they be identified. The Market Driven Supply Chain Project<sup>172</sup> (MDSC) is funded by the Scottish Government and Scottish Enterprise and is designed to help unlock barriers preventing Scottish food and drink supply chains exploiting major market opportunities. MDSC is a contributor to the Scotland Food & Drink (SF&D) Strategy Ambition 2030, a new strategy for Scotland's farming, fishing, food and drink sectors, launched in March 2017. One of the activities identified in the strategy delivery programme to 2020 is to drive a collective farming response to climate change.

The introduction of the Sustainable Procurement Duty under the Procurement Reform (Scotland) Act 2014 has created greater scrutiny of the extent to which public sector organisations are building climate resilience into their procurement of goods and services. The duty imposes a requirement to consider the climate change risks that required supplies and services may be vulnerable to. The Scottish Government's Sustainable Procurement Guidance supports organisations to embed relevant and proportionate contract and framework requirements to reduce climate vulnerability of procurement arrangements.<sup>173</sup> Scottish Ministers are required to publish an annual procurement report to Parliament following the publication of public bodies' annual procurement reports, the first of which is due at the end of the 2017/18 financial year.

Adaptation Scotland have published additional tools and guidance but it is not clear if these are being used by businesses to take action. Adaptation Scotland's Climate Ready Business Guide, published in 2017, includes guidance for businesses in shoring up the resilience of supply chains to extreme weather events. It includes a set of questions businesses should ask themselves in assessing resilience of business logistics including supply chains and a number of actions businesses can take to improve resilience. The extent to which this guidance is being used to take action cannot currently be assessed.

### *Climate change vulnerability assessment*

**There is a lack of information to assess the vulnerability of Scottish supply chains to climate impacts but a recent international survey provides useful context.** It is difficult to determine the overall vulnerability of Scottish businesses to supply chain disruptions without greater information disclosure by companies and a more systematic assessment by the Government. In the Business Continuity Institute's (BCI) Supply Chain Resilience Report 2018, adverse weather was the second most common cause of supply chain disruption, reported by

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<sup>172</sup> Information on the project is available at <http://mdsc.scot/>

<sup>173</sup> The Scottish Government (2018) *Sustainable Procurement Guidance*, <https://www.gov.scot/publications/sustainable-procurement-guidance/>

41% of respondents. While reporting of supply chain disruptions has increased by 3% compared to the previous year, more than one in four (27%) do not report supply chain disruptions at all.<sup>174</sup>





**There are examples of sector-specific progress in assessing supply chain vulnerability in Scotland, such as a recent report by ClimateXChange which looked at climate change impacts on Scotland’s forestry supply chain with a focus on forest wood products.** The report concludes that each stage of Scotland’s forest supply chain is likely to be directly affected by climate change in the form of primary and secondary impacts. Examples include increased mortality and reduced growth at nursery and forest levels; costly and difficult operations at the establishment, management, harvesting, and transport stages; and disruption to infrastructure. The report does not quantify the impacts but recommends an additional risk identification and risk assessment process, to enable adaptation actions to be put in place for the sector.

### Water demand by industry

CCC rating	Rationale for rating
Positive progress	SCCAP actions for water efficiency are progressing and non-domestic water consumption has declined in recent years. Data are not available to assess trends in water abstraction by industry.



### Summary RAG assessment

**Table 4.11.** Summary RAG assessment - Water demand by industry

First assessment RAG score	What has changed since first assessment?	Updated RAG score
Is there a plan?  Amber	Scottish Building Regulations include provisions for water efficiency measures for domestic buildings, however this does not currently extend to non-domestic buildings.  Scottish Water’s investment programme 2015-2021 is driven by mandatory Ministerial Directions on water efficiency and management.  The ‘Scotland the Hydro Nation’ annual reports record the development of the Hydro Nation policy agenda and reports on progress.	Is there a plan?  Amber
Are actions taking place?  Green		Are actions taking place?  Green

<sup>174</sup> This is an international survey of 589 businesses in 76 countries.

**Table 4.11.** Summary RAG assessment - Water demand by industry

First assessment RAG score	What has changed since first assessment?	Updated RAG score
<p>Is progress being made in managing vulnerability?</p>  <p>Grey</p>	<p>Non-domestic water consumption is decreasing, however the role of efficiency improvements is not known. A working party has been established to consider the potential to extend water efficiency measures to non-domestic buildings. Progress is being made in specific industry sectors, such as food and drink manufacturing and whisky production.</p> <p>Data are not available to assess trends in water abstraction by industry.</p>	<p>Is progress being made in managing vulnerability?</p>  <p>Green</p>

*Why is it a priority for adaptation?*

**If demand for water is reduced in Scotland, it will reduce the vulnerability of businesses to lower available water supplies in the future.** Although Scotland is a relatively water rich country, there are not unlimited resources available for treatment and supply and water supply is likely to become increasingly stressed in the future under the combined effects of climate change and a growing population.

It is provisionally estimated that about 40% of the population of Scotland might be affected by a supply-demand deficit by the 2020s rising to over 70% by the 2080s, although the uncertainty associated with these estimates is large.<sup>175</sup> The nature of Scotland’s geography means that impacts will vary across the country. Whilst overall rainfall is not projected to change significantly, there is projected to be an overall reduction in rainfall in the summer and an overall increase in rainfall in the winter.

Water is used by industry for cooling and heating, washing products, dissolving chemicals, suppressing dust, and also as a direct input to products. Without sufficient water, production in many businesses would have to be reduced or stopped. Although industrial demand is a relatively small proportion of overall water demand in Scotland, climate change could still affect the access of industrial plants and other businesses to water, a particular concern being the need for increased cooling requirements for industrial machinery (including power stations), which requires greater water abstraction. The number of river sites with sustainable abstraction in the UK is projected to reduce by the order of 45% by the 2020s and 70% by the 2080s. There are currently no projections for Scotland specifically.

*Progress of policies and actions*

**Scottish Building Regulations include provisions for water efficiency measures for domestic buildings, however this does not currently extend to non-domestic buildings.**

The Scottish Government is considering the practicalities of extending the water efficiency measures to non-domestic buildings and has established a working party to consider this issue.

<sup>175</sup> CCC (2017) *UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Scotland*. Committee on Climate Change, London.



**The high level requirements for Scottish Water's 2015 - 2021 investment programme are set out in Ministerial Directions<sup>176</sup>** and includes obligations to reduce the impact of its discharges, abstractions and impoundments, maintain a sufficient water supply and increase the resilience of water supply systems.

**The 'Scotland the Hydro Nation' annual reports record the development of the Hydro Nation policy agenda and reports on progress.** In the first assessment of the SCCAP, the CCC identified an opportunity to align the Scotland the Hydro Nation' programme with SEPA's national water scarcity plan:

**PREVIOUS RECOMMENDATION 23:** The Scottish Government should, before the next SCCAP, set out how the 'Scotland the Hydro Nation' programme incorporates SEPA's national water scarcity plan.

**RESPONSE:** The Hydro Nation Forum which advises the Scottish Government on the content and direction of the Hydro Nation Strategy includes SEPA CEO Terry A'Hearn. The Forum's biannual meetings provide an opportunity for members to discuss relevant areas of policy and issues such as water scarcity. Hydro Nation officials work alongside colleagues with responsibility for Environmental Quality to discuss the operational aspects of the Water Safety Plan in relation to drinking water supply and wastewater treatment, and participated in regular extraordinary Water Scarcity planning and response meetings with SEPA colleagues throughout the unusually dry, warm spell in summer 2018. The issue will be discussed and reviewed by the Hydro Nation Forum at its December 2018 meeting where further consideration will be given to appropriate alignment between the Plan and the Hydro Nation Strategy.

**There is continued evidence of improvements in water efficiency by specific industry sectors, such as food and drink manufacturing and whisky production.** Members of the UK Food and Drink Federation (FDF) have set an industry-wide absolute target to reduce water use, outside of that embedded in products, by 20% by 2020 against a 2007 baseline. This target is set out in Defra's Food Industry Sustainability Strategy recommendations and was previously delivered through the Federation House Commitment (FHC). In 2016, FDF members submitting data reported that they had reduced their absolute water consumption in 2016 by 35.8% compared to the 2007 baseline. The amount of water consumed per tonne of product has been reduced by 36.6% over the same period. The 23 FDF member companies that reported data (93 sites) account for approximately 10% of water use within UK food and drink manufacturing sector and around 10% of the sites are in Scotland.

Whisky accounts for around 20% of all UK food and drink exports. In their 2018 Environmental Strategy report, the Scotch Whisky Association reported that net water use has fallen by 29% since 2002 and that the industry has already met their 2020 water efficiency target.<sup>177</sup>

### *Climate change vulnerability assessment*

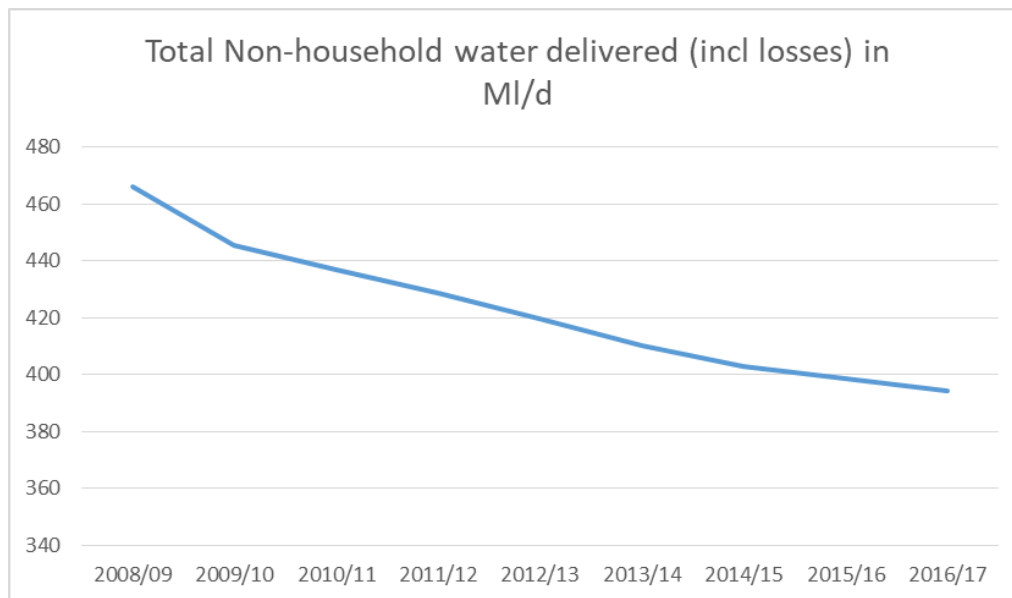
**Non-domestic water consumption has continued to decrease in Scotland but it is still not possible to assess whether the decrease is attributable to water efficiency measures.** There has been a sustained decrease in the annual average volume of non-domestic water delivered

<sup>176</sup> The Scottish Water (Objectives: 2015 to 2021) Directions 2014 are available at <http://www.gov.scot/Resource/0045/00459867.pdf>

<sup>177</sup> The Scotch Whisky Association (2018) *Environmental Strategy Report 2018* - <https://www.scotch-whisky.org.uk/news-publications/publications/documents/environmental-strategy-report-2018/>

per day between 2008/09 (466.1 MI/d) and 2016/17 (394.49 MI/d) (Figure 4.3).<sup>178</sup>

**Figure 4.3.** Trend in total non-household water delivered (2008/09-2016/17)



**Source:** ClimateXChange (2018), *Indicator BW9 Non-domestic water usage* - [https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic\\_2018.pdf](https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic_2018.pdf). Data derived from Scottish Water's Annual Returns (Water Industry Commission for Scotland, 2018).

This reason for the reduction in demand for water is not known, but regardless of the reason, reduced demand will also lead to lower vulnerability to water deficits in future. The financial motivation for businesses to reduce water usage in order to reduce their costs is a key difference between non-household and household water usage, as non-household customer usage is reflected directly in the charges they pay. Data are not available to determine whether the decline in use is due to improvements in water efficiency or a decrease in production.<sup>179</sup> There has been no notable change in the uptake of non-domestic water metering, with 96% of non-domestic water consumption in Scotland in 2016/17 already delivered to properties with a meter.

**Data is not available to assess trends in water abstraction by industry.** While SEPA monitor and report on water abstraction for their submissions under Water Information System for Europe (WISE) reporting, a breakdown of abstraction by industry in Scotland is not published by SEPA and was not able to be obtained for this report. This was highlighted as a gap in our first assessment:

<sup>178</sup> ClimateXChange (2018) *Indicator BW9 Non-domestic water usage* - [https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic\\_2018.pdf](https://www.climateexchange.org.uk/media/3510/bw9-water-usage-non-domestic_2018.pdf)

<sup>179</sup> A number of factors including changes in supply pipe losses and changes in occupancy status (e.g. the reclassification of properties from vacant to occupied status) influence the non-household water consumption figures.

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**PREVIOUS RECOMMENDATION 22:** The Scottish Environment Protection Agency should begin, by the end of 2017, to publish annual data on water abstraction by industry (separately from agriculture and energy generation) so vulnerabilities can be assessed and managed over time.

**RESPONSE:** SEPA's Water Resources Hydrology compile this data and produce the annual Water Quality report. This is put into the overall Water Information System for Europe (WISE) report, which is provided directly to the European Environment Agency. The submission normally takes place in the autumn, and relates to the previous calendar year (e.g. the 2015 report was submitted in August 2016). The 2017 data was not submitted, as it is to be provided along with the 2018 report.

SEPA have advised that they are establishing a process to publish data on water abstraction by industry in Scotland.

## Annex A: Recommendations from First Independent Assessment

**Table A1.** Full set of recommendations from first independent assessment, with responses

### **RECOMMENDATION 1: Scottish Government; By Next SCCAP in 2019**

In preparing the next SCCAP the Scottish Government should: address all of the urgent risks and opportunities for Scotland identified in the 2017 UK Climate Change Risk Assessment; identify a senior owner for each objective that can be held accountable for delivery; list the specific actions that will be taken to achieve each objective together with appropriate milestones and timescales; introduce an effective monitoring and evaluation regime, to allow the impact of actions and delivery of each objective to be fully assessed; and co-ordinate the actions being taken within each sector especially where they appear within different themes of the SCCAP.

**RESPONSE:** The Scottish Government is developing the next SCCAP for publication in 2019. A programme of external engagement is currently underway. The outcome based approach that is planned will address the urgent risks and opportunities identified in the UK CCRA. We are engaging with policy sectors throughout government and individual sectors will contribute and approve policies within their sector. We have appointed a Programme Board at senior level which will decide the governance arrangements for the new programme. When the development of the new programme is complete, we will be able to list specific actions however these are not confirmed as yet. A Monitoring and Evaluation regime is being developed to address all levels of the new programme from outcomes to actions. The engagement workshops currently underway include a monitoring and evaluation exercise to gather views and information from stakeholders.

### **RECOMMENDATION 2: Scottish Government/Scottish Natural Heritage; By End 2017**

The Scottish Government and Scottish Natural Heritage should by the end of 2017 develop the 2020 Route Map into a clear action plan setting out how the outcomes in the Scottish Biodiversity Strategy will be delivered in the context of climate change.

**RESPONSE:** The Scottish Biodiversity Strategy: 2020 Challenge for Scotland's Biodiversity recognises the need to help nature adapt to climate change, for example through reducing pressures on ecosystems, habitats and species, and making space for natural processes. Ecosystem restoration priorities include peatlands, coastal sand dunes, native woodlands and establishment of saltmarsh to improve resilience to climate change. The Route Map to 2020 sets out large-scale, cooperative actions that will improve ecosystem health so helping nature to adapt to climate change. The second annual report identified that 96% of actions are on track to 2020; with over 10,000ha of peatland under restoration, additional funding allocated for native woodland planting and continued restoration of 19 river SACs through riparian planting to reduce water temperature fluctuations. While the Strategy

progress report to Parliament showed many species and habitats improving it also identified the need to focus on particular groups such as seabirds. Future priorities for action will take account of biodiversity pressures including climate change.

**RECOMMENDATION 3: Scottish Natural Heritage; By Next SCCAP in 2019**

Scottish Natural Heritage should commit to developing a monitoring system before the next SCCAP which can measure (a) the impact of climate change on the condition of sites and species and (b) the effectiveness of conservation interventions, thereby enabling the tracking of progress towards favourable ecological condition.

**RESPONSE:** Site Condition Monitoring as we currently operate it will not be with us very much longer. In line with the Protected Areas 2020 project, specialists are currently working on realigning our protected areas related monitoring to better fit with an ecosystem approach and thereby better contribute to Scottish Biodiversity Strategy delivery. In particular, we are considering how we best go about detecting the large scale drivers of change – whether that be climate change or nitrogen deposition.

**RECOMMENDATION 4: Scottish Government / Scottish Natural Heritage; By End 2017**

The Scottish Government and Scottish Natural Heritage should by the end of 2017 establish a target in the Scotland National Peat Action Plan for the area of peatland that will be under restoration by 2030 and introduce and monitor a delivery programme for meeting this target.

**RESPONSE:** As per the Climate Change Plan, The Third Report on Proposals and Policies 2018-2032, published February 2018, which set out targets for the restoration and management of Scotland's peatlands of 250,000 hectares of degraded peatlands by 2030. The aim is to make significant progress on achieving restoration of degraded peatlands, from the 1990 baseline, to restore 50,000 hectares of degraded peatland to a healthy state by 2020 and 250,000 hectares by 2030. Restored areas will help mitigate flood risk and improve water quality, as well as helping to increase biodiversity in restored areas.

**RECOMMENDATION 5: Scottish Government / Scottish Environment Protection Agency; By Next SCCAP in 2019**

The Scottish Government and the Scottish Environment Protection Agency should, before the next SCCAP, assess whether the design and operation of the water abstraction regime is compatible with the risk of reduced water availability in coming decades, in a context of projected increases in demand.

**RESPONSE:** The River Basin Management Plans allow SEPA to review and manage the impacts of water abstraction. These are reviewed every 6 years with sector groups reviewing the measures during that period. The plans also have a section on managing the water environment and climate change. SEPA is looking at ways to include better low flow protection in licences which cover sites without physical limitations on the amount of water that can be taken in prolonged low flow periods. This includes links to the National Water Scarcity Plan and lessons learned from 2018. SEPA's National



Water Scarcity Plan sets out how they will manage water scarcity during prolonged dry periods and also says that they will continue to build in steps to make sure water users are better placed to cope with a changing climate. Part of this is to ensure they have resilience plans in place to cope with dry weather now and in the future. SEPA also link to the SCCAP in their plan. SEPA plan to update the Water Scarcity plan and abstraction controls with the output from UKCP18 due later this year. SEPA's Regulatory Evidence Strategy aims to review the information they receive from operators and they collect themselves to demonstrate compliance with licences but to also assess the impacts on the water environment. Having better monitoring of the things we are concerned about will allow us to adapt to climate change impacts in the future. SEPA work closely with Scottish Water to assess their future water needs and manage short term lack of supply through SEPA's fast track licensing procedures.

#### **RECOMMENDATION 6: Scottish Government, By End 2017**

The Scottish Government should assess by the end of 2017 the implications of increases in marine water temperatures and acidity (both actual and projected) for marine ecosystems, the MPA network, and the commercial fisheries and aquaculture sectors.

**RESPONSE:** Marine Science Scotland (MSS) contributes significantly to the UK Marine Climate Change Impact Partnership (MCCIP) climate change impact assessment process. MSS provides environmental and ecological monitoring data, assessments and research output to MCCIP products, and co-authors them. MCCIP report cards summarise the latest evidence relating to temperature, salinity and ocean acidification change and impacts. It also assesses current and future impacts on the aquaculture and fishing industries, and on the conservation of marine features and the MPA process. MCCIP reports were updated in 2017 and work is underway to update the full set for 2019. MSS research and monitoring programme aims to support the MCCIP process, and is addressing specific identified knowledge gaps. The report cards can be found at: <http://www.mccip.org.uk/impacts-report-cards/> and were extensively cited by the UK CCRA Evidence Report (2017). MSS additionally publishes climate change impact related evidence (research and monitoring) in peer-reviewed Journals.

#### **RECOMMENDATION 7: Scottish Government; By End 2017**

The Scottish Government should, by the end of 2017, set a long-term target for the area of intertidal habitat to be created through managed realignment in Scotland and introduce appropriate policy mechanisms to achieve it.

**RESPONSE:** Although evidence suggests that intertidal habitat loss in response to rising sea levels is occurring in some areas, we still have a very partial picture of changes in Scotland. Whilst the Dynamic Coast project has informed our understanding of coastal changes to the upper shore, knowledge of lower coastal changes is currently insufficient to inform specific policies or targets for habitat creation. SNH is funding research to improve the evidence base on Scottish intertidal habitat change. This work will support policy development to conserve our important intertidal habitats and the benefits they provide to society.

**RECOMMENDATION 8: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should take action to deliver the vision in its Soils Framework that “soils are safeguarded for existing and future generations”. An action plan should be published before the next SCCAP, which includes proposals for: establishing a scheme to monitor the health of agricultural soils and the uptake of soil conservation measures, and taking enforcement action where poor management practices are found.

**RESPONSE:** Currently no action has been taken forward in developing an action plan, however further consideration will be given to this area in the new SCCAP.

**RECOMMENDATION 9: Forestry Commission Scotland; By End 2017**

Forestry Commission Scotland should consider by the end of 2017 whether additional action is needed to reduce the spread of pests and pathogens, particularly where they threaten native Caledonian pinewoods, and whether further action to increase species diversity in the Public Forest Estate would be beneficial in order to build resilience to climate change.

**RESPONSE:** Through the Land Management Planning Process, Forest Enterprise Scotland regularly reviews all plans to make sure they are fit for a changing climate and for the threat of pests and diseases. Key planning principles include planning at a landscape scale to include connectivity and improve tree species diversity - refer to page 13 ref 5 of FES Restocking Strategy. Through the Resilience Programme, Forest Enterprise Scotland is developing a decision making framework to inform decisions about species choice, recognising the importance of maintaining productivity but also the need to prepare for a changing climate and threats of pests and diseases. Alternative species and mixture of species are being considered and used in Land Management Plans to help reduce the impact of catastrophic events on single trees species. To address windthrow risk, in large upland forests (where possible), Forest Enterprise Scotland aims to design coupes so that if one coupe suffers catastrophic wind damage the adjacent coupe can be independent and unaffected and can have a different intervention/fell date.

**RECOMMENDATION 10: Scottish Government; In time to inform next FRMSs in 2021**

The Scottish Government should assess the level of flood risk management interventions and investments that are likely to be needed to reduce risks in each part of Scotland to acceptable levels over the next 25 to 50 years, accounting for the impacts of climate change and sea level rise. This assessment should help ensure that the objectives set in the next Flood Risk Management Strategies, due in 2021, are compatible with reducing flood risk in the long term.

**RESPONSE:** SEPA's National Flood Risk Assessment and FRM Strategies allow our understanding of flood risk in Scotland to be updated over each 6-yearly cycle. The second NFRA for Scotland was published in December 2018. Embedded in it is an assessment of how risks might change due to climate change, which has allowed us to understand which areas might be more sensitive to climate change in future. Further, it embeds current information on flood disadvantage and coastal erosion. SEPA is seeking to develop the data and approaches which will allow us to track the impact of

flood risk management actions across and beyond planning cycles, including identifying short, medium and long term actions to address flood risk. There is a Scottish Government commitment to allocate a minimum of £42 million per annum to Local Authorities for prioritised actions identified and agreed jointly between them, SEPA and SG. Investment decisions are made on the basis of the NFRA and FRM Strategies.

**RECOMMENDATION 11: Scottish Environment Protection Agency; In time to inform next FRMSs in 2021**

The Scottish Environment Protection Agency should ensure the next Flood Risk Management Strategies monitor and report:

- 1) The impact of local flood risk management plans in reducing surface water flood risk, including in relation to managing urban creep.
- 2) The number and capacity of SuDS installed in new developments and of other drainage assets retrofitted with SuDS.
- 3) The number of planning applications for new developments in the floodplain that were granted, and within these, the number of applications for which SEPA advice was sought and the number of applications to which SEPA objected.
- 4) The number and location of new homes and other properties built in areas of flood risk.

**RESPONSE:** (1) CREW is undertaking a project to develop a reproducible method for quantifying urban creep which will include a case study area in Scotland (<https://www.crew.ac.uk/project/quantifying-urban-creep>). Data currently available will allow SEPA to track reductions in surface water flood risk by actions put in place to address the risk, but not to quantify it. SEPA is seeking to develop data and approaches which will allow us to track the impact of flood risk management actions.

(2) SEPA does not monitor uptake of SuDS in new developments. SuDS are implemented where they are a legal requirement (i.e. when discharging to rivers and lochs) and SEPA states that this should be the case in our planning responses.

(3) There hasn't been progress on this since CREW completed their report in 2015. We don't routinely get decision notices from local planning authorities so there is no quick and comprehensive means of tracking our involvement through the planning process. Unless we get the information we require, either in form of individual decision notices or as an aggregated data set, we won't be able to quantify the number of decisions where our advice has been ignored.

(4) Currently this could be tracked at a strategic level via the NFRA and updates to the property dataset every six years, if new development can be identified via the property dataset. However, this misses out small catchments due to the mapping. It could be linked to (3) above if data capture and resourcing is sorted out.

**RECOMMENDATION 12: Scottish Government/Scottish Water; By Next SCCAP in 2019**

The Scottish Government should review before the next SCCAP whether further action is required to deliver and sustain reductions in average water consumption per person in Scotland. As part of this review, Scottish Water should publish the outputs of their water efficiency trials, including an assessment of the impact of metering.

**RESPONSE:** While metering is not promoted in Scotland, there is a number of ongoing and planned measures being undertaken by Scottish Water to improve efficiency and reduce water consumption, including a water efficiency trial of 200 households. Water meters were installed to record the impact of various measures/combinations of measures upon water usage. These measures included advice on reducing water consumption, installation of water efficient devices and financial incentives. Following analysis of the data, a report will be produced in late 2018. There is also a Water Saving Pack Project, where between 2017 and 2021 Scottish Water is engaging with 2% of Scottish householders through distribution of 49,000 water saving packs, which include an advice brochure and, depending on suitability, water efficiency devices. The packs are delivered in partnership with the Energy Saving trust, who manage Home Energy Scotland, the customer facing brand of the Scottish Government's energy efficiency programmes. Their network of energy advisors provides both water efficiency and energy advice. Scottish Water hopes to scale up this programme in its next business plan. Since 2013, Scottish building regulations mandate water efficiency measures for new buildings and new work to existing buildings.

**RECOMMENDATION 13: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should work with all infrastructure sectors before the next SCCAP to develop consistent incident reporting, together with indicators of network resilience and performance, and the implementation of resilience measures, to allow improvements in resilience to extreme weather events to be measured over time.

**RESPONSE:** Regional Resilience Partnerships (RRPs) are currently undertaking their biennial Risk and Preparedness Assessment. This process gives partnerships (Cat 1 and 2 Responders) an understanding of the hazards they may be faced with, including extreme weather events such as low temperature and snow and storms and gales. This assessment is then used to inform their capability to deal with these events and identify the gaps that exist and the work needed to close those gaps. This next cycle will finish in March 2019 and a report for each region will be provided to Scottish Government Resilience Division. Following that RRP's will spend the next 18 months on work to close gaps before they move into another round of risk assessment.

**RECOMMENDATION 14: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should, before the next SCCAP, assess the current level of capability within the emergency response system to deal with extreme weather events and take further steps as necessary to prepare for climate change.

**RESPONSE:** Regional Resilience Partnerships (RRPs) are currently undertaking their biennial Risk and Preparedness Assessment. This process gives partnerships (Cat 1 and 2 Responders) an understanding of the hazards they may be faced with, including extreme weather events such as low temperature and snow and storms and gales. This assessment is then used to inform their capability to deal with these events and identify the gaps that exist and the work needed to close those gaps. This next cycle will finish in March 2019 and a report for each region will be provided to Scottish Government Resilience Division. Following that RRP will spend the next 18 months on work to close gaps before they move into another round of risk assessment.

**RECOMMENDATION 15: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should, before the next SCCAP, co-ordinate with local authorities to assess the impact on people, businesses and communities arising from flood events, including persistent health and wellbeing effects, and consider what further steps might be taken to help communities recover from extreme weather events more quickly.

**RESPONSE:** We have commissioned a 3 year study to assess the long term social impacts of the flood events in Aberdeenshire during the winter of 2015/16. Findings from the study will feed into work with a range of stakeholders to develop an action plan to promote flood resilient properties. Flood resilience measures can help people return to their homes quicker after a flood event and lessen the social and economic impacts of a flood event. The approach to prioritise FRM actions currently being developed by SEPA will include improved consideration of social vulnerability to flooding as well as health and wellbeing.

**RECOMMENDATION 16: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should, before the next SCCAP, review policies that address the current and long-term risks from both heat and extreme cold.

**RESPONSE:** In 2017, with funding from the National centre for Resilience, the Scottish Government commissioned Health Protection Scotland to conduct a study into health impacts of hot and cold temperatures.

**RECOMMENDATION 17: Health Protection Scotland; By Next SCCAP in 2019**

Health Protection Scotland should, before the next SCCAP, carry out new research into the current and future risks to the population from heat and UV radiation, and consider proportionate responses to the risk.

**RESPONSE:** In 2017, ClimateXChange, with support from Health Facilities Scotland and Health Protection Scotland, completed a scoping study to identify how to monitor overheating risk in buildings housing vulnerable people in Scotland.

**RECOMMENDATION 18: Health Protection Scotland; By Next SCCAP in 2019**

Health Protection Scotland should, before the next SCCAP, assess the changing risks to people from vector-borne diseases, making use of the second UK Climate Change Risk Assessment Evidence Report. This should consider priority areas for future monitoring and surveillance and whether current resources are aligned with the areas of greatest current and future risk.

**RESPONSE:** Health Protection Scotland routinely monitors new, emerging or re-emerging disease epidemiology and considers the role that climate change plays in developments. The report on the vector borne disease work will be completed by March 2019. It will include comments about gaps in surveillance but the main issues with inadequate surveillance are not related to identifying human illness. The gaps relate more to inadequate monitoring the insect vectors and pathogen carriage.

**RECOMMENDATION 19: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should, before the next SCCAP, review the take-up and impact of guidance and tools for organisations, businesses and communities provided by Adaptation Scotland.

**RESPONSE:** Sniffer submits 6-monthly reports on the activities and objectives of the Adaptation Scotland programme, covering input and output indicators, milestones and impact indicators, which are reviewed by a Programme Board comprising Scottish Government Decarbonisation officials and Directors of the Adaptation Scotland programme.

**RECOMMENDATION 20: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should, before the next SCCAP, develop policies to encourage businesses in high risk areas to become more flood resilient and report on the actions being taken by businesses as a result.

**RESPONSE:** We have commissioned a 3 year study to assess the long term social impacts of the flood events in Aberdeenshire during the winter of 2015/16. The study also considers the impacts on businesses. Findings from the study will feed into work with a range of stakeholders to develop an action plan to promote flood resilient properties. Flood resilience measures can help people return to their homes quicker after a flood event and lessen the social and economic impacts of a flood event. The action plan will include specific actions to promote flood resilience in businesses. The action plan steering group includes representation from the insurance and construction industry and works closely with the Defra Roundtable set up to consider actions to promote resilient buildings in England.



**RECOMMENDATION 21: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should include actions within the next SCCAP that will help businesses in Scotland understand and exploit the economic opportunities arising from climate change.

**RESPONSE:** In developing the next SCCAP, the Scottish Government is holding a series of workshops and Twitter sessions with stakeholders, including on business and the economy, to hear their views and priorities for the next SCCAP. Wider public consultation on the draft SCCAP will take place in early 2019.

**RECOMMENDATION 22: Scottish Environment Protection Agency; By End 2017**

The Scottish Environment Protection Agency should begin, by the end of 2017, to publish annual data on water abstraction by industry (separately from agriculture and energy generation) so vulnerabilities can be assessed and managed over time.

**RESPONSE:** SEPA's Water Resources Hydrology compile this data and produce the annual Water Quality report. This is put into the overall Water Information System for Europe (WISE) report, which is provided directly to the European Environment Agency. The submission normally takes place in the autumn, and relates to the previous calendar year (e.g. the 2015 report was submitted in August 2016). The 2017 data was not submitted, as it is to be provided along with the 2018 report.

**RECOMMENDATION 23: Scottish Government; By Next SCCAP in 2019**

The Scottish Government should, before the next SCCAP, set out how the 'Scotland the Hydro Nation' programme incorporates SEPA's national water scarcity plan.

**RESPONSE:** The Hydro Nation Forum which advises Scottish Government on the content and direction of the Hydro Nation Strategy includes SEPA CEO Terry A'Hearn. The Forum's biannual meetings provide an opportunity for members to discuss relevant areas of policy and issues such as water scarcity. Hydro Nation officials work alongside colleagues with responsibility for Environmental Quality to discuss the operational aspects of the Water Safety Plan in relation to drinking water supply and wastewater treatment, and participated in regular extraordinary Water Scarcity planning and response meetings with SEPA colleagues throughout the unusually dry, warm spell in summer 2018. The issue will be discussed and reviewed by the Hydro Nation Forum at its December 2018 meeting where further consideration will be given to appropriate alignment between the Plan and the Hydro Nation Strategy.

**Notes:** Progress in implementing these recommendations is assessed throughout the report.

## Annex B: Recommendations from Second Independent Assessment

**Table B1.** Additional recommendations from second assessment

**RECOMMENDATION 1: Scottish Government; By End 2020**

Work with partners to improve the measurement of vulnerability to climate change in Scotland, and the actions being taken, in:

a) Areas where appropriate metrics have been identified but vulnerability and actions are not being measured or analysed:

- Impact of new development on long-term flood risks and risk management costs, including the use of sustainable drainage systems to help manage surface water flood risks.

b) Areas where appropriate metrics have not yet been identified or measured :

- Overheating risks in buildings, including monitoring of internal temperatures in hospitals and care homes.
- Rates of soil erosion including the uptake of soil conservation measures by farmers.
- Securing the performance of infrastructure networks in severe weather.

Adequacy of actions being taken by Scottish businesses to prepare for extreme weather and adapt to climate change.

**RECOMMENDATION 2: Scottish Government; By Next SCCAP in 2019**

Include specific actions in the next SCCAP with regards to the resilience of digital infrastructure. Data on the exposure of data and telecommunication facilities and services to extreme weather impacts is limited and there are no actions in the current SCCAP related to this.

**RECOMMENDATION 3: Scottish Government and Health Protection Scotland; By Next SCCAP in 2019**

The next SCCAP should commit to more ambitious actions to address current and long-term risks from both heat and cold.

**RECOMMENDATION 4: Forestry Commission Scotland; By Next SCCAP in 2019**

Increase efforts to manage and reduce the spread of disease in order to increase resilience to climate change, including Dothistroma Needle Blight (DNB) and other pests and pathogens.

**Table B1.** Additional recommendations from second assessment

**RECOMMENDATION 5: Scottish Government and Scottish Environment Protection Agency; By Next SCCAP in 2019**

In preparing the next SCCAP, review monitoring and reporting arrangements for the uptake of Sustainable Urban Drainage Systems. There may be an opportunity to collect information through public sector organisations.

**RECOMMENDATION 6: Scottish Government; By End 2020**

Work with Local Authorities to identify the areas of coastline that are inhabited, at risk of erosion and/or at risk of flooding and ensure these are all covered by a Shoreline Management Plan.

**RECOMMENDATION 7: Scottish Government; By Next SCCAP in 2019**

Given that two programmes related to energy sector resilience in the current SCCAP were not taken up - Energy Sector Climate Change Impacts research programme and Scottish Government Energy Sector Flood Risk work stream – include actions are required in the next iteration of the SCCAP to ensure adaptation actions for energy sector resilience continue.

**RECOMMENDATION 8: Scottish Government; By Next SCCAP in 2019**

Include specific actions to understand and improve resilience of health and social care services are included in the next iteration of the SCCAP. Research such as that currently underway by ClimateXChange to provide data on the direct and indirect impacts of climate change on social care delivery and understand risks and dependencies is crucial. The next SCCAP should commit to action to take the findings of this research forward.

**RECOMMENDATION 9: Scottish Government; By Next SCCAP in 2019**

Consider specific actions that can be incorporated into the next SCCAP to link adaptation to National Health and Wellbeing Outcomes. In particular, Outcome 4: 'Health and social care services are centred on helping to maintain or improve the quality of life of people who use those services'.



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