CLIMATE READY SCOTLAND: SCOTTISH CLIMATE CHANGE ADAPTATION PROGRAMME

Third annual progress report 2017

Report laid in The Scottish Parliament
in accordance with Section 54 of the
Climate Change (Scotland) Act 2009 (SG/2017/72)

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Contents

Separately Available

Detailed Tables
http://www.gov.scot/Topics/Environment/climatechange/adaptation/reporting/SCCAP-Progress-Report-2017

SCOTTISH CLIMATE CHANGE ADAPTATION PROGRAMME (SCCAP)

THIRD ANNUAL REPORT 2017

INTRODUCTION

Executive Summary

"Scotland's unique geography creates both resilience and vulnerabilities to the impacts of extreme weather and climate change. Scotland's iconic industries including timber and whisky, and its fisheries, rely on the abundance of climate-sensitive natural resources. The projected changes in weather patterns combined with sea level rise will test the nation's transport, communication, fuel and energy networks and challenge the delivery of health and social care services. There will also be opportunities for Scottish businesses investing in the products, services and new technologies that will be needed to adapt urban areas and grow rural economies in Scotland". These are some of the opening messages from the first independent assessment of the Scottish Climate Change Adaptation Programme, a report commissioned by the Scottish Government from the Adaptation Sub-Committee, laid before the Scottish Parliament in September 2016.

This year's Scottish Government Annual Report covers 12 months which have seen a huge body of work published on which Scotland can build its next Adaptation Programme due in 2019.

In addition to the independent assessment, in July 2016 the Adaptation Sub-Committee (ASC) of the Committee on Climate Change published the UK Climate Change Risk Assessment Evidence Report and Synthesis Report and a National Summary for Scotland. In January 2017 the UK Government published the UK Climate Change Risk Assessment 2017 including a contribution from Scotland.

In last year's Annual Report we set out key recent developments in climate change adaptation in Scotland, including new climate adaptation indicators, new public bodies reporting duties, a new National Centre for Resilience, Scotland's Flood Risk Management Plan and our Mapping Flood Disadvantage report.

As Scotland prepares to host the 3rd European Climate Change Adaptation (ECCA) Conference in Glasgow in June 2017, this Annual Report follows the detailed and comprehensive independent assessment last September, by setting out current highlights on progress of the Adaptation Programme, including Scotland's National Coastal Change Assessment, Climate Ready Clyde, Edinburgh Adapts, Historic Environment Scotland's climate change risk assessment for its 335 Properties in Care, and the appointment by ClimateXChange of two Adaptation Research Fellowships which will help address the ongoing research priorities highlighted by the Adaptation Sub Committee, as well as our preliminary responses to key recommendations of the ASC.

Scotland's International Leadership on Climate Action

The Paris Agreement highlighted the links between climate change mitigation and adaptation. Scotland is a world-leader in tackling climate change, with ambitious statutory emissions targets, strong progress to date, and a commitment to maintaining this position by bringing forward new legislation. Thanks to the efforts of everyone in Scotland, Patricia Espinosa, the head of the UN climate body, speaking from last year's UN climate conference, praised Scotland's great achievement in exceeding the level of our 2020 emissions target (a 42% reduction) six years early, with a 45.8% reduction as at 2014. The 2016 annual report from the Compact of States and Regions showed Scotland leading a group of six major states and regions who have already met or exceeded their 2020 emissions targets several years ahead of schedule.

The First Minister met Governor Jerry Brown of California in April, where they agreed to work together to support the Under2 Coalition of progressive and ambitious states, regions and cities, which now covers over 1 billion people and over a third of the global economy, prepare for a major summit in 2018, aimed at persuading national governments to increase their efforts to tackle climate change. Scotland's Climate Justice Fund is delivering £3 million per year to help developing countries and the poorest communities in Africa. The Scottish Government agrees with the United Nations and its partners that the momentum on cutting global emissions is unstoppable, with real progress at national, regional, state, city and local level.

Scotland's emissions cuts have been underpinned by a rapid decarbonisation of our electricity sector. Provisional figures for 2016 showed us generating 53.8% of gross electricity demand from renewables, representing a more than threefold increase in renewable capacity over a decade or so. We also delivered our 500 MegaWatts target for community and locally owned renewables five years early with 595 MegaWatts operating by June last year. We have already set new targets for community renewables of 1 GigaWatt by 2020 and 2 GigaWatts by 2030. Scotland's energy consumption was cut over the past decade by 15.2%, passing our 12% target six years early. Since the 1970s, Scotland has grown to become an international centre of expertise in subsea engineering. Statoil's Hywind Pilot Park, the world's first offshore floating wind park, will begin construction off the Scottish coast in 2017, creating a great deal of international interest in the ability to place wind turbines in deeper water offshore.

Scotland's draft new Climate Change Plan sets out how we propose to drive emissions down further, by 66% in 2032. The Climate Change Bill, and the Plan, with its proposals on forestry and peatlands, together with our Energy Strategy, and its aim of resilience, will deliver a low-carbon transition for Scotland which promotes social inclusion and sustainable growth and makes links between mitigation and adaptation actions.

Scotland's Changing Climate and the Need for Adaptation

Scotland has shown strong commitment in tackling climate change and protecting our environment. We want to avoid the worst impacts of climate change falling on the poor and vulnerable at home and abroad.

The Paris Agreement will reduce but not remove the risk of dangerous levels of warming. Commitments to date imply considerably more than 2°C of warming by 2100, with a central estimate of 2.7°C, and up to 6°C remaining possible.

Scotland's climate has already changed over the past 50 years and we expect that further change is inevitable, so adapting and being resilient to climate change is a very important part of our climate response.

Lord Krebs, then Chairman of the Adaptation Sub-Committee (ASC) of the Committee on Climate Change, echoed this on the 11th July, 2016, when he stated: "*The impacts of climate change are becoming ever clearer, both in the United Kingdom and around the world. We must take action now to prepare for the further, inevitable changes we can expect. Delaying or failing to take appropriate steps will increase the costs and risks for all UK nations arising from the changing climate*."

The first independent assessment of Scotland's Climate Change Adaptation Programme (SCCAP) published in September 2016, carried out by the Committee on Climate Change, provided further insight stating that "*Scotland needs to prepare for the impacts of climate change. The climate in Scotland has already warmed and become wetter and further changes are inevitable in the coming decades due to greenhouse gases from human activity already released to the atmosphere. …Average temperatures in Scotland have increased in line with global trends, with average annual temperatures around 0.7° C higher than they were a century ago. Annual rainfall over Scotland has increased since the 1970s, to a level 13% above the average for the early decades of the 20th century. All seasons contribute 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 100mm higher than during the 1920s*."

All stakeholders including Government, the public sector, businesses, communities and members of the public have a role to play in managing the risks posed by the different possible climate change scenarios, adapting to climate change and improving levels of resilience. In so doing, there will also be a host of opportunities with different climate conditions, in innovating and developing the products and services that are needed both domestically and internationally.

Scotland's Climate Change Adaptation Programme (SCCAP)

Scotland's first statutory Adaptation Programme was published in May 2014. This set out objectives, policies and proposals under three themes: (i) natural environment (ii) buildings and infrastructure (iii) society.

Under Section 54 of the Climate Change (Scotland) Act 2009, Scottish Ministers are required to provide an annual report on progress towards achieving the objectives and implementing the proposals and policies set out in the Programme.

The first annual progress report was published in May 2015: (http://www.gov.scot/Resource/0047/00477541.pdf), and the second annual progress report was published in May 2016: http://www.gov.scot/Publications/2016/05/7046/0.

UK Climate Change Risk Assessment

The UK Government is required under the 2008 Climate Change Act to publish a UK wide Climate Change Risk Assessment (CCRA) every five years, assessing the 'risks for the UK from the current and predicted impacts of climate change'.

The ASC was asked to prepare an independent Evidence Report for CCRA2. This comprised a synthesis report for the UK as a whole, technical chapters and national summaries, including one for Scotland. The Evidence Report was published in July 2016 and used the concept of urgency to summarise the findings of the analysis, variously identifying 'more action needed', 'research priority', 'sustain current action' and 'watching brief' categories.

It highlighted:-

- The need for more action to address flood risks;
- The potential for water scarcity;
- Heat related impacts on health and wellbeing;
- Risks to the natural environment;
- Risks of food price volatility; and
- New and emerging pest and disease risks, especially for Scotland's forestry.

Notably many of the actions identified as priorities for other parts of the UK have been shown to be less critical for Scotland at this stage.

The CCRA was published in 2012 and the second CCRA2 was published in January 2017.

CCRA2 will feed into the development of the next UK National Adaptation Programme as well as the national adaptation programmes of the devolved administrations.

The ASC Independent Assessment and Recommendations

The first statutory assessment of the SCCAP by the ASC in September 2016, took into account the SCCAP second annual progress report and the CCRA2 Evidence Report.

It confirmed that steps were being taken to prepare Scotland for climate change, the SCCAP was a positive start with almost all of its 148 policies and proposals reported as being on track and it acknowledged that it provided a solid foundation for further progress.

However, the assessment highlighted a number of evidence gaps that meant it was difficult to determine whether key vulnerabilities are being suitably addressed and there was insufficient evidence to judge progress.' Additionally, there is a need for more adaptation action: specific, effective steps to directly confront and tackle the risks highlighted. Also, more could be done to make sure Scotland is ready to realise the opportunities that milder winters and warmer summers will bring.

Reference: ASC Recommendation 1 :

The ASC recommended that the Scottish Government in preparing the second SCCAP should:

- address all urgent risks and opportunities for Scotland;
- 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 impact of actions and delivery of each objective to be properly assessed; and
- present the actions being taken within each sector together and coordinate their delivery.

The ASC recommended that the Scottish Government work with partners and build on the suite of ClimateXChange Indicators to develop datasets where progress is most important and develop outcome based indicators where this is possible.

Opportunities in the Near Future

There will be a key opportunity to share emerging international and national good practice on adaptation at the 3rd European Climate Change Conference to be held in Glasgow in June 2017.

Next year, the UK Climate Projections UKCP18 (updating UKCP09) will also be available which will allow us to further consider the direction we need to take in the next SCCAP in 2019 to make sure Scotland can meet the challenges and opportunities that climate change presents.

THE SCCAP: WHAT PROGRESS IS BEING MADE?

Part 1: Highlights in Policy and Process

The following section sets out some of the highlights emerging this year in delivering the objectives and implementing the proposals and policies set out in the 2014 SCCAP. These are set out under each of the three main SCCAP themes. More detailed reporting on every policy / proposal of the SCCAP is contained within the detailed tables which are available online.

Natural Environment – Highlights in Policy and Process

Our understanding of the impact of climate change on the natural environment is improving:

The **National Coastal Change Assessment** due to be published will identify areas of past and anticipated future coastal erosion. The results (www.dynamiccoast.com) provide the context for current and anticipated changes associated with climate change. The data and maps collected during the project will support the flood risk management planning process, as well as land use planning and the management of infrastructure and other material and heritage assets.

The **MarClim** survey fieldwork has been completed and the data have been analysed and the final report published. Sites from the previous MarClim survey (10 years ago) were revisited and new sites established where the previous survey has not sampled. MarClim provides long term data on changes in the distributions of species of rocky shores and allows us to detect effects from climate change.

A range of projects are improving the capacity of the natural environment to adapt to climate change and to sustain the range of benefits that nature provides:

The **Green Infrastructure Strategic Intervention** is working with partners to deliver a programme of urban green infrastructure projects for funding as part of Scotland's programme for European and Structural Investment Funds 2014-2020. https://www.greeninfrastructurescotland.org.uk/ Projects are required to consider how they can contribute to climate change objectives, including flood alleviation.

SNH completed a set of **8 case studies on managing National Nature Reserves which demonstrate adaptation principles** for helping nature adapt to climate change. http://www.snh.gov.uk/climate-change/taking-action/adapting-to-change/helping-nature-adapt/turning-principles-into-practice/ (see also Case Studies below)

The first annual report on progress with **Scotland's Biodiversity Route Map to 2020** was published in 2016. 11 of the 12 Priority Projects are on track to be completed by 2020. Notable achievements include restoration management of over 10,000ha of peatland, the target of 80% of natural features on protected sites to be in favourable or recovering condition was met, and extensive habitat improvements were delivered across Central Scotland.

The **Peatland** Action project actively promoted restoration of both designated and un-designated peatland habitats working to promote mitigation and adaptation to climate change. Since 2013, Peatland Action has started the restoration process on more than 10,000 hectares of degraded peatlands. The project continues in 17/18 with £8m of new funding.

The Statutory Group on Non-Native Species, chaired by SNH, is developing **contingency plans for responding to the arrival of new invaders**. Notable responses during the past year include: the successful interception of quagga mussels near Grangemouth; the eradication of floating pennywort from a site near Elgin; and preventing the spread carpet seasquirt in Loch Creran Special Area for Conservation.

The SNH-led **Pearls in Peril LIFE+ project** has undertaken much work to improve the condition and resilience to climate change of Special Conservation Areas for freshwater pearl mussels. The project comes to an end in 2017.

The SNH-led LIFE+ Project: **EcoCo LIFE** is implementing £2.3m of habitat management and awareness-raising habitat networks projects across the Central Scotland Green Network area to improve ecological coherence, natural capital and derived socio-economic benefits

A range of recent developments are improving our capacity in **promoting tree health**, including better biosecurity co-ordination (e.g. through the GB and Scottish Tree Health Advisory Groups). The new Centre of Expertise on Plant Health is expected to be commissioned in 2017, and will work with the new Scottish Strategy on Plant Health.

A **west of Scotland case study** is underway in support of **ClimeFish,** a Horizon 2020 EU Project, which aims to identify, assess and propose management solutions to tackle the main impacts of climate change on fish production in Europe, with an overarching goal of stakeholders have a model to ensure a sustainable future for European aquatic production.

Farming for a Better Climate, the Scottish Government flagship scheme for climate change in agriculture, has published a series of case studies on the work it has done regarding climate change adaptation. (further details : case study 13)

Buildings and Infrastructure – Highlights in Policy and Process

The **University of St Andrews** has completed **a climate impact assessment workshop** with staff and senior managers from the Estates department. The assessment has helped to identify how the University's historic and modern buildings may be impacted by climate change and to identify actions that can increase resilience. (more detail: case study 3 below)

Historic Environment Scotland (HES) have worked in close partnership with the British Geological Survey (BGS) and the Scottish Environment Protection Agency (SEPA) to conduct a **Climate Change Risk Assessment for the 335 Properties in Care (PICs) on the Estate**. This assessment will improve decision-making for prioritising the on-going conservation and maintenance programmes, thus ensuring the long term survival of **HES monuments and buildings**. (more detail: study 4 below)

The Engine Shed, due to open in summer 2017, is Scotland's dedicated building conservation centre, based in Stirling. Run by Historic Environment Scotland, it serves as a central hub for building and conservation professionals and the general public. It will support Scotland in adapting the built historic environment to the impacts of climate, including the promotion of the use of traditional skills and materials in historic building maintenance and repair.

Society – Highlights in Policy and Process

Adaptation Scotland and PAS developed climate ready places lesson plans and resources for primary and secondary schools, to include in **Charrette*plus*®** spatial planning with community planning model, thereby factoring in **adaptation** in helping local communities plan and deliver the future of their place. (Further detail: case study 5).

Flood Risk Management Strategies were published in December 2015 The Scottish Government continue to fund Scottish Flood Forum which works directly with communities to raise awareness of flood risk and help protect families and homes.

Part 2: Case Studies

Case Study 1 : Climate Ready Clyde Partnership – Regional Approach to Adaptation

Background and Latest Developments

The Climate Ready Clyde Partnership is a collaborative partnership initiative aimed at developing a regional structure for adapting to climate change, to accelerate work on adaptation within the Glasgow City Region. 10 partners from the City Region, comprising 6 local Councils, NHS Greater Glasgow and Clyde, SPT, University of Glasgow and University of Strathclyde have formally agreed to pool their resources, alongside Scottish Government, to fund a regional secretariat, delivered by Sniffer. The secretariat will assess the risks and opportunities presented by climate change, and work with partners to develop a strategy and action plan for the City Region.

The initiative was initially brought about by Sniffer who involved core partners across the region in developing and endorsing the Vision for a Climate Ready Clyde in 2013, as part of the 'Adaptation Scotland' programme. A steering group was established, which developed a business case for a strategic, City-Region approach. Following this, the Scottish Government provided £100,000 seed funding to get Climate Ready Clyde up and running by appointing a project manager who worked with partners to develop a viable proposition for co-funding.

In total, the Scottish Government funding has directly leveraged £72,500 investment, but has also enabled the City Region to be a demonstrator for research, with £4.5m of NERC-funded research being undertaken on climate adaptation as a result.

The board to govern the next phase of Climate Ready Clyde was formed in April 2017, and the initiative will be formally launched at the European Climate Change Adaptation Conference in June 2017.

Target Objectives

The establishment of the Climate Ready Clyde initiative is aligned with the Scottish Government's Strategic Principles for adapting to climate change as set out in the SCCAP.

More broadly, the idea of the initiative is to be transformative and show that collaboration helps to improve resilience and adaptation to a changing climate brings many other positive benefits - boosting local economies, reducing inequalities, improving public realm, protecting natural resources and attracting investment.

It is hoped now that the Partnership's work will make a significant contribution towards securing the long term climate resilience of a third of Scotland's population and a city region that generates £40Bn GVA per year - a third of Scotland's economic wealth.

Through its shared understanding and collaborative focus, the initiative will support Councils, public sector agencies, business and community organisations to identify

where action is needed on climate adaptation measures, and how to finance and deliver them.

Over 40 different organisations, businesses and community groups are expected to take part in the *Climate Ready Clyde* project, either as part of the partnership board or through wider stakeholder engagement mechanisms.

Alongside, it will develop the evidence and business case for action on adaptation across all sectors; and act as a hub for expert advice, co-ordination, capacity building and support on adaptation. The initiative will also work with other organisations to ensure that adaptation, (and the economic, social and environmental benefits it brings) are firmly articulated in the region's development plans and programmes.

The approach taken to the initiative is already beginning to provide national / international climate leadership, being featured in international publications, and featured at both the European Conference on Climate Change Adaptation, and the European Commission's 'Open European Day'. Going forward, the area-based approach will link into resilience initiatives in neighbouring parts of Scotland, and will be able to be extended across other regions of Scotland.

Working in this way provides a cost-effective way for partners to respond to the public body duty for adaptation under S44 of CC(S) Act 2009; it will help to enhance reputations as responsible bodies minimizing risk and will help deliver efficiency & financial savings.

Case Study 2 : Edinburgh Adapts - Helping Edinburgh Meet the Challenges of a Changing Climate

2016 was a momentous year for adaptation planning in Edinburgh. Supported by the Adaptation Scotland programme, the Edinburgh Sustainable Development Partnership (ESDP) published the Edinburgh Adapts vision and action plan in December 2016.

The Action Plan runs from 2016-2020 and contains over 100 committed adaptation actions contributed by 50 partner organisations. The Vision looks even further; setting out the project partners' adaptation aims for two key landmark dates, 2025 and 2050.

As well as ensuring overall governance of adaptation in the city, the plan aims to protect and enhance Edinburgh's wildlife and green spaces, providing nature-based solutions to climate-related problems. Planning and development play a key role in ensuring the city adapts, including the use of green infrastructure to offset predicted changes in weather and rainfall and naturalising flood prevention measures when feasible. Actions involving working with communities and raising awareness of the impacts of climate change on local areas are also integral to the plan.

Edinburgh Adapts is an important example of the value of partnership working to address shared adaptation challenges. The process of developing the vision, action

plan and governance arrangements has strengthened links between partners and provided a strong foundation for the future.

Implementation is already well underway with new projects on coastal change and community engagement recently receiving funding and excellent progress with raising awareness of adaptation challenges facing the city's UNESCO World Heritage site including action to support communities to improve maintenance of tenement buildings.

Edinburgh Adapts is a live process driven by an active steering group with representatives from the Royal Botanic Garden Edinburgh, City of Edinburgh Council, Historic Environment Scotland, Scottish Wildlife Trust, Heriot Watt University, Edinburgh World Heritage, University of Edinburgh, Edinburgh College, Napier University and Adaptation Scotland.

Download the Edinburgh Adapts vision, action plan and detailed case study here: http://adaptationscotland.org.uk/get-involved/our-projects/edinburgh-adapts

Case Study 3: University of St Andrews – Climate Impact Assessment

The University of St Andrews has completed a climate impact assessment workshop with staff and senior managers from the Estates department.
The assessment has helped to identify how the University's historic and modern buildings may be impacted by climate change and, identify actions that can increase resilience.

Key findings from the workshop included:

- Current climate threats

The Estates department identified a number of climate threats based on severe weather events that had occurred in recent years. This included high wind speeds which caused damage to the cladding of roofs, heavy rainfall resulting in surface water flooding, a storm surge that ran alongside the Estates' building and coastal erosion to cliffs that house University buildings.

- Future climate threats

Staff noted that an increase in heavy rainfall could cause: blocked or over-topping drains as they reach full capacity; flooding of ground floors, and the deterioration of traditional stone buildings, internally and externally, as they become saturated with water. In addition, they noted that increased temperatures could cause staff discomfort on warmer days.

- Strengths

Building maintenance is currently being managed using condition surveys, Computer Aided Facilities Management software and site knowledge. Staff referred to having a

crisis management plan that details what to do in the case of a flood event. They also noted the use of backup generators in the event of power failure.

- Weaknesses

Staff are investigating prevention of the deterioration of traditional stone buildings in a changing climate and felt more guidance was needed to better understand this element. In addition, more clarity was needed over the responsibility for the drains in town which affect University buildings.

- Opportunities

Identifying increased heavy rainfall as a climate threat is useful for the department to be able to make improvements to, for example, the material of ground floor doors and the width of gutters, as and when funding allows. Design teams for new projects now report on how they have considered adaptation to climate change in their processes.

- What more could be done?

Staff felt that there were preventative measures for increased heavy rainfall. This included filling and storing sandbags before a flood event occurs, preventing grease from entering and blocking drains, and clearing gutters more often. Other actions included implementing a data recording system for weather event information, embedding climate change in business continuity plans, and opening a dialogue on climate change through the introduction of a newsletter.

Completing the climate impact assessment increased awareness of the impacts of severe weather events and climate change impacts affecting the department. It laid the foundations for further work to develop an adaptation action plan and run other climate impact assessment workshops with all services and departments across the University.

Read the full case study on the Adaptation Scotland website:
http://www.adaptationscotland.org.uk/how-adapt/case-studies/assessing-current-and-future-climate-threats-and-opportuniti

Case Study 4: Historic Environment Scotland - Screening for Natural Hazards to Inform a Climate Change Risk Assessment

Historic Environment Scotland (HES) have worked in close partnership with the British Geological Survey (BGS) and the Scottish Environment Protection Agency (SEPA) to conduct a Climate Change Risk Assessment for the 335 Properties in Care (PICs) on the Estate. This assessment will improve decision-making for prioritising the on-going conservation and maintenance programmes, thus ensuring the long term survival of HES monuments and buildings.

Many of the properties HES care for are situated in landscapes that are vulnerable to climate-related natural hazards. Although a number of the properties are well

adapted to everyday weather events, changes in the climate are pushing the properties into unchartered territory, with many now facing challenges they were never designed to deal with. This is why this assessment was so crucially important.

The assessment was completed by using a GIS-based approach to combine asset management information with natural hazard datasets obtained from BGS and SEPA. A spatial analysis was completed by overlaying hazard layers with site specific spatial information, focusing on the area of ownership or guardianship for each site. This generated a hazard profile for each property, which was combined with information about property type, allowing an appropriate risk score to be assigned.

The analysis provided a site-specific report on natural hazards that will be made available for use by conservation architects and works managers. This will allow HES to match up the modelled data with real-life observations, site management practices, and additional information on climate impacts.

The GIS-based screening of climate related natural hazards has allowed Historic Environment Scotland to identify those sites most likely to be threatened by flooding, coastal erosion, and ground instability. The organisation is now looking at site-specific studies to further understand climate change risk.

Read the full case study on the Adaptation Scotland website:
http://www.adaptationscotland.org.uk/how-adapt/case-studies/screening-natural-hazards-inform-climate-change-risk-assessm

Case Study 5 : Climate Ready Places, including Adaptation within Charrette Projects

What's a Charrette? - The Scottish Government describes a charrette as "an interactive design process, in which the public and stakeholders work directly with a specialised design team to generate a community vision, masterplan and action plan". The charrette process takes place over a number of weeks and months. They have become an integral part of Scottish placemaking activity in the last decade, thanks to continued support from the Scottish Government.

Charrette*plus*® Is a charrette model developed by PAS and is delivered using a team of professional staff, volunteers and associates. It focuses specifically on aligning spatial planning with community planning. By linking community empowerment, democratic citizenship and capacity-building, the Charrette*plus* model supports local communities (including businesses, residents, institutions and Community Planning partners) to plan and deliver the future of their place.

PAS and Adaptation Scotland initially worked together to raise awareness of climate adaptation with planning professionals and to develop new information resources. Following this, the two organisations worked together to explore ways to include climate change adaptation as part of the Charrette*plus* projects delivered by PAS.

How was adaptation included in the PAS Charrette*plus* model? - Adaptation Scotland and PAS developed climate ready places lesson plans and resources for primary and secondary schools. PAS volunteers used these plans to run sessions in Schools across the Garnock Valley in North Ayrshire and collected feedback from young people to be included in the Charrette*plus* project.

PAS added a climate ready element to the Place Standard tool and provided volunteers with a briefing on climate impacts as part of preparations for the Charrette*plus* workshops. This enabled volunteers to help community members complete the climate ready elements of the place standard tool.

What were the lessons learned? - Supplementing the Place Standard tool with a climate ready places element was an effective way of helping people to think about how climate change might impact their community now and in the future. Young people engaged well with the climate ready places lessons and were able to feed in their views to the wider Charrette*plus* project.

Through the project PAS identified several opportunities to develop additional resources to engage young people in imagining climate ready places and have since worked with Adaptation Scotland to update the lesson plans and resources and publish them for teachers and partner organisations to use.

Advice for others engaging with communities? - PAS used Adaptation Scotland's existing Climate Ready Places graphics as the basis for briefing volunteers about climate change impacts and developing new climate ready place cards for the lesson plans. This climate ready places graphics are available online and provide an effective and accessible introduction to climate change impacts and could be used to help raise awareness among many different groups.

The lesson plans developed through this project are suitable to be used as part of general awareness raising and engagement on adaptation – they could be used for general educational purposes or to help young people feed in views to any type of adaptation related strategy, planning or action process.

The Place Standard tool provides an excellent framework for helping people to think about climate change impacts as part of wider aspects of place such as buildings, spaces, and transport links as well as the social aspects, for example whether people feel they have a say in decision making and influence over their surroundings.

Next steps? - Adaptation Scotland and PAS are building upon the work of their first two collaborative projects with a new project to support the creation of a city-wide adaptation strategy in Aberdeen, specifically involving young people in the process of shaping their environment.

Case Study 6 – SNH - Protecting Scotland's Pinewood from Disease

http://www.snh.gov.uk/docs/A1746713.pdf

SNH recognises that Scotland's Caledonian pinewoods will be affected by climate change and some woods are already changing.

However, the future nature of climate change impacts is still not known.

There could be some positive changes: as a result of an increase in CO2 in the atmosphere, biomass may increase giving a higher forest yield and economic value; and a new climate space (the area of land climatically suitable for a particular species or habitat) may become available for species previously at the edge of their range in Scotland.

Equally, there could be negative effects: it is possible that droughts and floods will cause stress to forest ecosystems. This may make trees more susceptible to pests and disease, and international trade or the changing climate itself may result in Scotland harbouring some new viruses, fungi or insects. Climate spaces may shift for certain tree species, or phenology – the timing of seasonal events – may change, causing species' life cycles to no longer match up, resulting in a lack of food, shelter, or other provisions at certain key times in the year (Broadmeadow & Ray, 2005).

Accordingly, it is very difficult to develop a single management approach for Caledonian pinewoods that can deliver the multiple management objectives in the face of threats which are inherently uncertain, especially given the long time-scales involved in managing woodlands for climate change.

SNH's Climate Change Action Plan states the need to "deal with uncertainty" and to plan carefully. Accordingly we welcome trials and research on a range of different management approaches. We consider it likely that different combinations of these approaches can be implemented in different pinewoods to offer the best possible national insurance against the consequences of climate change.

The identification of this 'managing-under-uncertainty' approach is only the first step, and a lot of work needs to be done to create a management approach for individual sites. The first step to implementing site management plans is to clarify the objectives and assumptions of risk, and to be clear about what trade-offs are acceptable in each situation. These will not be the same across Scotland.

Being aware of the changes that are likely to occur allows us to apply SNH's eighth adaptation principle: to plan for habitat change. No single solution will be suitable across all of Scotland, and given the uncertainties, we may need to use different approaches across Scotland to provide resilience to the possible risks.

A combination of actions, based on the needs of and uncertain threats to different forests, should offer some 'insurance' or a hedge against widespread loss or decline of Caledonian pinewoods.

Case Study 7 – SNH – Restoring Forest to Bog at RSPB Forsinard Flows

http://www.snh.gov.uk/docs/A1790788.pdf

The Peatlands Partnership's Flows to the Future Project demonstrates SNH's second climate change adaptation principle: the importance of making space for - and restoring - natural processes, allowing ecosystems to increase resilience against climate change pressures.

The Flow Country is a vast area of blanket bog - Europe's largest - found in Sutherland and Caithness. These peatlands are of national and international significance not only for the rich and varied wildlife they support but also as one of the largest stores of carbon in Britain. There is almost three times the carbon stored in the peatlands of the Flow Country than in all the forests of the UK. (Approximately 400 million tonnes of carbon is locked up in peat in the Flow Country; in comparison, all the forests and woodlands in the UK contain around 150 million tonnes.)

Blanket bog ecosystems are at risk from climate change as they are vulnerable to changes in rainfall and temperature. Bogs can also become damaged and degraded through inappropriate land management practices such as the planting of large areas of conifers that occurred here in the past. Healthy, actively growing bogs are more resilient to climate change and the SNH adaptation principle focuses on restoring the natural functions of degraded bogs.

One of the key members of the Peatlands Partnership is the RSPB and on their Forsinard Flows National Nature Reserve, they have pioneered and undertaken peatland restoration on a vast scale delivering what is probably one of the largest peatland restoration projects in the UK.

Since 2014, much of this restoration work has been undertaken through the Partnership's Heritage Lottery funded "Flows to the Future" project.

This has the ambitious aim to restore a further seven square miles of blanket bog habitat – removing forestry blocks, crushing brash and blocking furrows in areas where forestry has already been felled, and drain blocking. In addition to this, the project will also promote and develop our knowledge about the role of peat and carbon storage, and involve and connect people all over the world with this precious habitat, and in the process deliver real economic benefits to one of the least densely populated areas in Scotland.

Case Study 8 – Adapting Edinburgh's World Heritage Site

Edinburgh's World Heritage status confirms its reputation as one of the most beautiful and historically significant cities in the world. The World Heritage Site, with the medieval Old Town and Georgian New Town, provides an unforgettable experience for visitors and a much loved home for over 20,000 residents. Along with the rest of the city, the World Heritage Site is vulnerable to the impacts of climate change, with changes such as increased rainfall and severe weather events increasing the risk of damage to the historic built environment.

Edinburgh World Heritage aims to ensure that the city's World Heritage status is a dynamic force for good that benefits everyone. This includes taking early action to increase resilience and supporting communities to adapt to the impacts of climate change.

During 2016 EWH completed a building condition survey for over 1000 properties across the World Heritage Site. The survey results are being used to inform a climate risk assessment, and will be used to measure progress with sustaining and improving the condition of the World Heritage Site in the years ahead.

Alongside establishing a strong evidence base, EWH has placed community engagement at the heart of its response to ensuring that the World Heritage Site is resilient and adapts to the impacts of climate change. Work has focused on raising awareness and supporting residents to improve the maintenance of their homes.

National press and politicians were engaged as part of National Maintenance Week, leading to print and broadcast news features on the need to improve maintenance, with many references to the need to adapt to the impacts of climate change. Events and training sessions are providing residents with opportunities to find out about funding support and gain skills to help maintain their homes. Pioneering work is also under way to address barriers to maintenance by investigating the feasibility of setting up M.O.T. schemes that would support residents to carry out maintenance work through creating maintenance co-operatives.

EWH has found that awareness raising and community engagement are very powerful driving forces for change. EWH will continue to develop work to support wider adaptation efforts including working with city partners to implement the Edinburgh Adapts Vision and Action Plan.

Case Study 9 - Glasgow City Council Surface Water Management Projects

Research undertaken for the development of the Clyde and Loch Lomond (CaLL) Flood Risk Management Strategy (December 2015) predicted that Annual Average Damages from flooding across the District are approximately £67 million annually. Damages from surface water flooding equate to £20 million of this total, and are largely concentrated in Glasgow, with 13,000 residential and non-residential properties at risk. With climate change, the frequency and severity of rainfall events that can lead to surface water flooding is likely to increase. In response to this, Glasgow City Council (GCC) and the Metropolitan Glasgow Strategic Drainage Partnership (MGSDP – www.mgsdp.org) are leading the delivery of Surface Water Management Plans (SWMPs) across the city. The areas covered by the first tranche of SWMPs identified by GCC in the CaLL Local Flood Risk Management Plan are:

- Cardowan & Cockenzie St
- Garrowhill
- Croftfoot, King's Park and Overwood Dr
- Drumchapel
- Hillington / Cardonald
- Darnley Mains
- Eastern Springburn
- High Knightswood
- Fullarton Avenue

Reducing the risks and impacts of flooding, and removing drainage constraints to regeneration and development, have been identified as key enabling factors for increasing economic growth in Glasgow. This first tranche of SWMPs will be enabled through Glasgow City Region City Deal (www.glasgowcityregion.co.uk) funding in recognition of the direct link between the impacts of flooding and economic prosperity, backed by Business Cases. By reducing the risks and impacts of flooding in these areas, the SWMPs will contribute to increased, sustainable economic growth, improved resilience, and will open previously constrained sites to regeneration and development.

Rather than deliver 'traditional' approaches to flood management – such as large, below ground pipes, storage tanks and pumping stations – the SWMPs will endeavour to deliver interventions that align with the MGSDP Vision of:

- Enhancing our urban biodiversity and landscape
- Reconnecting our waterways
- Designing for the severity of the rain
- Keeping surface water on the surface
- Creating integrated blue green networks
- Integrating urban master planning and design
- Providing sustainable and affordable drainage solutions
- And, being climate-change ready

In so doing, the SWMPs will help to transform how the city region thinks about and manages rainfall, will reduce the risks and impacts of flooding and improve water quality. Following detailed design, each SWMP will require Full Business Case

approval by the Glasgow City Region City Deal Cabinet to allow construction to begin.

The consequences of flooding, as with many other climate impacts, do not observe traditional boundaries of governance and ownership. To overcome this challenge, during the ongoing design of the SWMPs, Glasgow City Council is engaging a wide range of stakeholders, including: Scottish Water, SNH, SEPA, Scottish Canals, Clyde Gateway, Forestry Commission Scotland, neighbouring Local Authorities, private landowners, businesses, and residents. Working in partnership allows the Council to identify opportunities for integrated investment, such as with Scottish Water, and ensures the interventions, when delivered, make the best use of the available public purse.

Case Study 10 – Scottish Water – Renewable Energy

Scottish Water now facilitates the generation of more renewable power than it consumes for the first time since it launched efforts to reduce its energy bill and increase renewable generation five years ago. Annual savings amounting to some £7 million are being saved on an electricity bill of over £40 million.

Scottish Water is one of the biggest users of electricity in Scotland and requires 445 Gigawatt hours (GWh) per year across 4500 sites such as water and waste water treatment works.

Renewable power is being generated through a combination of Scottish Water's own investment in renewable energy and hosting private investment on its estate. By 2018 it is expected to produce double the amount it consumes.

SW is delivering lower carbon solutions and delivering projects that help Scotland to adapt to climate change. Examples include:

- The Shieldhall Tunnel, which is part of the £250 million of upgrades to Glasgow's wastewater system, will improve the water quality in the River Clyde, resolve many long-standing flooding problems in the Giffnock area and provide capacity for economic growth as well as the impact of climate change.
- Ayrshire resilience Scheme – to bring greater resilience in water supply to Ayrshire/
- Heat from wastewater - Borders College is now heated from heat recovered from sewage.
- Water efficiency trials – to understand how much water is used by households and therefore to understand better how to implement water efficiency measures.
- Sustainable Land Management – working with SEPA and farmers to reduce levels of pollutants in drinking water. This reduces the costs of treatment.

Case Study 11 - Adapting the Forth Road Bridge - Amey Plc

Amey : what it does: 2017 marks the opening of the new Queensferry Crossing with the Forth Road Bridge then being dedicated for public transport, cycle and walking use. The Forth Road Bridge and Queensferry crossing will then both be operated and maintained by Amey which is a large and diverse company, managing infrastructure and public services across the UK.

How climate change is already affecting how Amey operates: Although the bridges are designed to withstand most weather conditions, Bridge Control staff constantly monitor weather conditions in case drivers need to be advised to slow down, wind susceptible vehicles need to be advised against using the bridge or, in extreme cases, the bridges have to be closed to all traffic. High wind speeds already affect the Forth Road Bridge posing significant challenges to the operations staff and the thousands of drivers that travel between Fife and Edinburgh every day.

Changes Amey has made to reduce the impact of climate change :The Forth Road Bridge operations at Amey are taking a strong and proactive response to increasing awareness and managing climate risks.

They have put in place a number of systems to increase their capacity to adapt to more severe weather conditions. These include signs to inform drivers of high wind speeds, changes to practices and guidance, new materials and innovative designs to the bridge itself. Amey's procedures over the years have moved from an approach where the roads must always remain open towards an approach that accepts, and communicates to the public, that travel will not always be possible during severe weather events.

This is in line with the approach that Transport Scotland is moving towards. The construction of the new Queensferry Crossing has also provided an opportunity to incorporate changes that will allow the bridge to be more resilient to severe weather conditions and a changing climate.

These changes include using the latest and most durable materials, cables that can be replaced with more ease than on the existing FRB as it can be done as part of normal maintenance works without closing the bridge, a dehumidification system which reduces moisture and prevents corrosion, and thicker road surfacing which has a longer surface life and can be machine laid, making it easier to replace.

The biggest change incorporated into the new bridge will be wind shielding which will make the crossing less susceptible to closure during high winds. Experience of other estuarial crossings, such as the Second Severn Crossing, shows that wind barriers provide a high degree of reliability against closure.

Amey plans for the future : Amey will continue to prepare for and alleviate the impacts of climate change through its various contracts while helping staff carry out their duties more efficiently and safely.

Case Study 12 - The National Coastal Change Assessment (Dynamic Coast)

Scotland's National Coastal Change Assessment (NCCA) which is due to be published gives agencies and local authorities a reliable overview of the risk posed by erosion along our coastline. This allows us in future to take a proactive, evidence based and plan led approach to coastal erosion.

The NCCA has compared over three thousand maps and quantified the changes that have occurred over the last 120 years along all 21,000 km of Scotland's dynamic coastline. As a result both the public sector and the public now have access to the historical and recent changes, via dynamiccoast.com. Indicative vulnerability assessments have also been developed to identify assets that may be at increased risk from erosion if present erosion rates continue and no change in management occurs.

Of the soft and erodible coast (rock coasts are excluded), 870 km has been subject to significant change since the 1970s, with 11% accreting, 12% eroding and 77% remaining stable. Compared with the historical period (1890 to 1970), the proportion of shorelines accreting has fallen almost everywhere with the proportion of eroding coast having increased, particularly on the east coast.

However, increasing stability may signal a transition from accretion to erosion and, if so, then it may highlight a window of opportunity to improve our adaptation management of the coast in advance of any future erosion increases that may result from climate change.

The NCCA enables a step change in the implementation of policies aiming to deliver sustainable and adaptation management of our coastline.

It supports multiple objectives of the SCCAP and helps deliver Scottish Planning Policy, Flood Risk Management Strategies, the Coast Protection Act as well as National and Regional Marine Plans.

Case Study 13 : Farming for a Better Climate

The Scottish Government flagship scheme for climate change in agriculture. This scheme promotes and informs on the impacts of climate change and how to both adapt to the changing climate and what can be done to reduce current emissions levels.

SG have published a series of case studies on the work it has done regarding climate change adaptation.

The Balruddery Farm case study is one example where adapting to climate change is already becoming part of routine farm business. By taking steps, such as securing water supplies for irrigation or reducing soil erosion risks, the farm is reducing the risk that predicted climate change impacts could have on the business.

http://www.sruc.ac.uk/downloads/120651/adapting_to_a_changing_climate

Case Study 14: ClimeFish West of Scotland case study

ClimeFish[1] is a Horizon 2020 EU project which aims to identify, assess, and propose management solutions to tackle the main impacts of climate change on fish production in Europe, with the overarching goal of delivering a Decision Support Framework designed to help stakeholders and policy makers securing a sustainable future for the European aquatic production.

This will be achieved through several consecutives steps: (i) identify the most important climate change impacts based an available literature and data, (ii) perform the required analyses to fill in our knowledge gaps on these impacts, (iii) perform biological forecasting to assess the extent to which these impacts will affect the future fish production at short-, medium-, and long-term under the various IPCC climate scenarios, (iv) develop early-warning systems to identify strategies that mitigate the risks and maximise potential opportunities resulting from climate change, (v) develop a Decision Support Framework through a cross-disciplinary approach involving researchers, managers and stakeholders.

Throughout these steps, interactions between articulated work packages[2] will ensure that any drawback and arising challenges will be dealt with.

The end-product delivered will be available through the European Committee for Standardisation to ensure that the ClimeFish Decision Support Framework can be used beyond the lifetime of the project.

ClimeFish includes an exhaustive geographical coverage of the European aquatic production, with a broad variety of case studies[3] spanning both fisheries and aquaculture sectors, and marine and freshwater environments.

One of the marine fisheries case studies considered is the shelf area off the west coast of Scotland, with a focus on demersal fish species. Although future warming in this area is expected to be relatively limited, this case study corresponds to both the southern distribution limit of cold-water species (e.g. cod) and the northern distribution limit of warm-water species (e.g. hake), hence the potential for significant changes in species abundance and composition which could affect the ecosystem and the fisheries that rely on it.

Current progress on the west of Scotland case study includes a foodweb ecosystem model which incorporates the effect of temperature on species' productivity, analyses on the changes in distribution of commercial fish species and associated drivers performed during the ICES FISHDISH[4] workshop which was co-chaired by the west of Scotland case study leader, and a contribution to drafting the advice resulting from the FISHDISH workshop in which the west of Scotland case study leader was also involved.

Further analyses on spatial indices of both commercial and non-commercial species as well as changes in growth patterns are currently ongoing.

The research undertaken in the west of Scotland case study is relevant for the Scottish Climate Change Adaptation Programme, and it is hoped that ClimeFish can contribute towards developing a Climate Change Adaptation Strategy for Scottish fisheries.

Marine Scotland has already been involved in ClimeFish activities as a policy stakeholder for the west of Scotland case study.

This interaction proved fruitful beyond expectations and it became evident that a future pro-active collaboration between ClimeFish and Marine Scotland could benefit both parties in tackling Climate Change impacts in Scottish fisheries.

[1] http://climefish.eu/

[2] http://climefish.eu/climate-change/

[3] http://climefish.eu/about-us/case-studies/

[4] http://www.ices.dk/news-and-events/news-archive/news/Pages/Substantial-changes-in-fish-distribution-identified-by-ICES.aspx

Case Study 15: ClimateXChange Adaptation Fellowships

The adaptation research undertaken by ClimateXChange supports the evidence needs of Scottish Government's various policy teams.

In this respect, two post-doctoral research fellowships have been funded as the foundation of CXC's research capacity in particular to support the development of the second SCCAP.

One fellowship is on adaptation science, with particular responsibilities for data collection and analysis, gap analysis, supporting the extension of the CXC indicators, interpreting the indicators for policy users and working closely with SEPA and the MET office.

The second fellowship is on adaptation policy and will involve interpreting and presenting CCRA risks for the adaptation policy community, researching questions on policy design and delivery and exploring methods to demonstrate / quantify the benefits of adaptation.

Part 3 : Work Underway on ASC Recommendations

This section includes information setting out work that has been carried out to date in response to the Adaptation Sub Committee (ASC) recommendations contained within last year's independent assessment.

Natural Environment – Work Underway on ASC Recommendations

The ASC Independent Assessment made several recommendations (Recommendations 2-9) relating to the SCCAP natural environment chapter.

This included the following:-

A clear action plan for delivering Scottish Biodiversity Strategy (ASC Rec 2)

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. Progress will be reported to the Scottish Parliament in 2017. Future priorities for action will take account of biodiversity pressures including climate change.

A monitoring system for sites and species (ASC Rec 3)

Evidence on observed and possible future effects of climate change on species in the terrestrial environment is summarised in the Biodiversity Climate Change Impacts Report Card (LWEC 2015) to which SNH contributed. The future effects of climate change on species are considered likely to be significant, with winners as well as losers.

To date, there are only a few examples so far of evidence of biodiversity 'losses' in Scotland attributed to climate change. The *Evidence Report for the UK Climate Change Risk Assessment* (Summary for Scotland, July 2016) highlighted research gaps around improving understanding of how species will respond to climate change, the uncertainties involved, and the best options for conservation taking into account such uncertainty.

Some research is being undertaken on the possible effects on particular iconic species (for example on capercaillie by RSPB, SNH and GWCT, and montane vegetation by RBGE, SNH and Bergen University). SNH, with help from the Climate Change Centre for Expertise (ClimateXChange), is bringing together sources of general information on impacts of climate change for its advisers on species conservation and management.

The Scottish Government is funding research into how to improve ecosystem resilience in the face of environmental change through the Strategic Research Programme. SNH and others support gathering long-term data to provide evidence

on the effects of climate change in ecosystems including species populations. The Environmental Change Network provides key underpinning data on long-term changes.

The development of the ecosystem health indicators (EHI) comprise a suite of 13 metrics that characterise the condition, natural function and resilience of ecosystems. They are a ground-breaking part of the wider suite of biodiversity indicators, with strong links to Scotland's Natural Capital Asset Index. They are being developed through partnership, overseen by the EHI subgroup of the Scotland's Biodiversity Strategy Science Support Group. One of the indicators will track an aspect of the impact of climate change on ecosystems, specifically tree disease.

SNH has already published some of its EHI components, such as condition results for protected areas. These, along with the other EHI components, will be processed through the SEWeb Spotfire application for viewing at a landscape scale, defined by the 10 river sub-basin management areas. All of the original 13 indicators are on schedule to be published on SEWeb by September 2017, with a further five by March 2018.

A target and delivery plan for peatland restoration (ASC Rec 4)

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

The Scottish Government recognises the importance of peatland restoration and the numerous and various benefits it brings, for example supporting increased biodiversity; this helps to maintain and improve the status of SSSIs, improving water quality, and mitigating the risk of flooding. In recognition of this in the 2017/18 Budget the Scottish Government identified £8m, to be managed thorough Scottish National Heritage, to support the Peatland Action initiative. SNH have been working with partners to develop an appropriate implementation plan.

The Climate Change Plan committed to supporting 10,000 hectares of restoration rising to 20,000 hectares pa in future years, which will be supported by a monitoring strategy which will ensure that restoration delivery is monitored, recorded and reported.

Generic risks of climate change to peatlands are widely recognised, for example summer drought lowering water tables and thus potentially affecting species composition as well as increasing the likelihood of damaging wildfires. However, fine-tuning climate change projections to different peatland types across their full range, from the Borders to Shetland, Aberdeenshire to St Kilda and from coast to mountain top, is extremely difficult with too few studies to provide clear, confident yet simple messages. Action being supported through the Peatland Action fund will make peatlands more resilient to the risks from climate change.

An assessment of the design and operation of water abstraction; (ASC Rec 5)

Since 2002 SW has delivered more than £1 billion of investment in environmental quality measures. In the 2015-21 investment period there will be £500 million of investment to further protect and enhance the environment. Scottish Water continues to bear down on the number of pollution incidents from its assets and has seen a dramatic improvement in this area over recent years. There is no update currently specifically on the design and operation of water abstraction.

An assessment of the implications of increases in marine water temperatures and acidity [reduction in pH] (ASC Rec 6)

SNH commissioned the first analysis of the issue of increasing water temperature resulting in the publication of a report in 2001 'The impact of climate change on subtidal and intertidal benthic species in Scotland'. Since then SNH has commissioned two MarClim surveys that have documented the changes in the distribution of a range of intertidal (indicator) species as a result of temperature changes. This has led to the development of a Community Temperature Index as a potential means of measuring changes in intertidal community composition as a result of climate change which is now being developed further as a Marine Strategy Framework Directive indicator.

In accordance with Article 8 of the MSFD, work is proceeding with the rest of the UK administrations to undertake an assessment of the progress towards Good Environmental Status by 2018. This includes an assessment of the permanent alteration of hydrographical conditions (e.g. changes in wave action, currents, salinity, temperature) to the seabed and water column.

SNH has also been involved with the Marine Climate Change Impacts partnership (MCCIP) since its inception. Various report cards have been produced over the years gathering the most up to date information available on the impacts of climate change on the marine environment and its biodiversity.

The wider implications of ocean warming have been reviewed in a major IUCN report entitled 'Explaining Ocean Warming: causes, scale, effects and consequences' edited by Laffoley and Baxter.

In relation to impacts from a reduction in pH, SNH has also been heavily involved in developing the research effort around the implications of ocean acidification through the Ocean Acidification international Reference User Group.

A target for managed realignment of intertidal habitat; (ASC Rec 7)

The *National Coastal Change Assessment* due to be published has analysed Scotland's 21,000 km of shoreline, identified the potentially erodible or soft 4,000km and assessed historic and recent change. Of the soft coast 89% has been stable or accretional and 11% has been eroding recently.

Past erosion has been projected forward to identify assets at risk between now, 2050 and 2100. The findings support The Climate Change Adaptation Programme, Flood

Risk Management Act, Terrestrial and Maine Planning, Land Use Strategy & Scottish Biodiversity Strategy and have implications across the public sector.

The National Coastal Change Assessment undertakes the first part of Shoreline Management Plans, namely the identification of change and vulnerable assets. The second part: the policy response remains the responsibility of the Coastal Protection Authority / Local Authority.

Phase 2 of the NCCA intends to explore novel policy opportunities via National Flood Risk Assessment which provide a supplementary or alternative approach to SMPs, which also exemplify the importance of Natural Flood Risk Management techniques, given the very significant role 'natural' coastal defences have been shown to play.

The data and maps collected during the project will support the flood risk management planning process. As a result Phase 2 of the NCCA will highlight areas where adaptation is needed across all 4,000km of Scotland's mobile shoreline.

An action plan to deliver the SG Soils Framework; (ASC Rec 8)

The agriculture chapter of the Climate Change Plan consists of five overarching policy outcome aims and agricultural soils is an area that we address through some of these.

Work is proposed in areas such as soil pH, soil carbon content, the use of legumes in rotation, promotion and dissemination of information on such things as the use of cover crops, how to minimise and alleviate soil compaction, the importance of soil health and condition and the use of zero or minimum tillage where practical.

By showing farmers, crofters and land managers the benefits that can be gained in both the economic and environmental terms we can achieve progress in these areas.

Action to reduce forestry pests and pathogens and an assessment of whether greater species diversity is required in the Public Forest Estate. (ASC –Rec 9)

The Forestry Commission's *Science and innovation strategy for forestry in Great Britain* includes a work area on forest resilience specifically to biotic threats. The Strategy sets out programmes and areas of work to enable and encourage wider collaboration with the research community. Forestry Commission Scotland (FCS) has also provided additional support for specific areas of tree health research in Scotland, including a partnership with the Scottish Forestry Trust to establish the *Tree Health Scotland Bursary Scheme*.

In addition, Scottish Government Rural and Environment Science and Analytical Services Division (RESAS) is in the process of commissioning a Centre of Expertise in Plant Health to develop a plant health virtual centre, to coordinate access to expertise from across Scotland and to stimulate innovative thinking in support of plant health policy. The appointment of a Chief Plant Health Officer for Scotland in February 2017 was a further milestone in securing effective collaborative effort across the research community.

FCS has significantly increased the resources devoted to tackling tree health, including a 6-person dedicated team supported by a network of tree health

champions in Forestry Commission Scotland and on the National Forest Estate. In collaboration with Forest Research, surveillance capacity has been greatly enhanced through bespoke contracts for the provision of bi-annual aerial surveys and 'ground-truthing' of sites.

In addition, the reporting of potential tree health issues has been facilitated through a new on-line TreeAlert tool, with diagnostic facilities being available through Forest Research and SASA.

In relation to an assessment of whether greater species diversity is required on the National Forest Estate: (i) Forest Research and Forest Enterprise Scotland have been exploring the effects of climate change on a range of alternative forest management options from 2010 to 2080 - this is part of a wider programme that examine a range of ecosystem services (for example carbon stock in forests) and how these are effected through different management regimes, species choice and forest policy. (ii) Forest Enterprise Scotland has started monitoring the Shannon Index of species diversity as part of its corporate reporting framework.

Overarching:

The Land Use Strategy (LUS)

The LUS continues to have a clear role in providing a high-level national policy agenda for the use of Scotland's land. This is expressed through the three Objectives and the Principles for Sustainable Land Use. The LUS encourages a strategic, integrated and informed approach to land use with the aim of delivering multiple benefits from our land resources. The new LUS Reporting Framework will be published shortly and will chart progress with the delivery of the LUS throughout its five year life.

Farming

The establishment of the new national Farm Advisory Service (under the Scottish Rural Development Programme 2014 – 2020) (launched September 2016), provides advice on a range of topics including climate change adaptation.

The Knowledge Transfer and Innovation Fund can offer financial support for projects.

Future Farming Scotland is run by the Soil Association Scotland and is funded through SRDP Knowledge Transfer and Innovation Fund. It promotes productive and profitable farming and land use, using low-input and sustainable approaches to build financial and environmental resilience in a changing climate. The programme's objectives are to: (i) Build a strong knowledge and skills base for productive, profitable and sustainable agriculture and land use amongst Scotland's rural communities and (ii) Increase the economic and environmental performance of Scottish agriculture.

Buildings and Infrastructure –– Work Underway on ASC Recommendations

The ASC Independent Assessment made several recommendations (Recommendations 10-13) relating to the SCCAP Buildings and Infrastructure chapter.

This included the following:-

Assessment of required flood and coastal erosion risk interventions and assessments (over the next 25-50yrs); (ASC Rec 10)

Flood Risk Strategies - Scottish Government, Scottish Local Authorities and partners are committed to reducing flood risk across Scotland, with an action plan in the first 6 year cycle providing protection to 10,000 properties and proposals for 42 flood protection schemes or engineering works planned.

The Scottish Flood Forum - £140,000 is given annually to help publicise flood risk, preparation to reduce it and support those who may be affected. In Winter 2015-16 there was significant flooding in communities across Scotland as a consequence of exceptional rainfall and the Scottish Government made available financial support to those affected.

SEPA recognises the need to ensure real, effective flood risk management considering future states and is seeking to better understand FRM delivery across cycles, considering future climate states.

Monitoring of local flood risk management strategies, SUDS schemes and building in flood risk areas (ASCRec 11)

Scottish Planning Policy sets out national planning policy on climate change adaptation, including policy on building in flood risk areas. It provides direction for planning authorities in drawing up development plans and assessing individual planning applications. We have an ongoing review of the planning system in Scotland and any future review of Scottish Planning policy will consider the outcome of that as well as the finalised Climate Change Plan.

Sharing good practice – The Tweed Forum is funded to share the research findings and experiences of implementing natural flood management. The Tweed Forum offers field trips and site visits to local authorities flood managers, agency staff, academics, school pupils and students from the Eddleston Water project which is now part of a wider EU Interreg research project to share evidence for building with nature to manage flood risk and coastal erosion across the North Sea region.

Recommendation 11, part three recommended that the Scottish Environment protection agency should ensure that the next flood risk management strategies monitor and report the number of planning applications for new development in the flood plain 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. This was discussed in the context of the recent Adaptation Sub-Committee report and SEPA's evidence on the budget (15 November):

ClimateXChange recently published the report '*Assessing the consideration of flood risk by Scottish local planning authorities'*. The report suggests the number of occasions an application was approved despite SEPA advice on flood risk is small, and is a very small proportion of the total number of planning applications that SEPA comment on and often relate to individual properties; not large scale developments.

The Scottish Government's Chief Planner submitted a report to the Scottish Parliament's Convenors Group on the subject of building in the flood plains on 21 December 2016.

In this we made clear that Ministers are notified of planning applications where the authority is minded to grant an application with an unresolved objection by a statutory consultee such as SEPA. In the last four years, 38 such notifications have been received. Of these, only 2 were determined by Ministers, the remainder were returned to the planning authority for approval.

Scottish Government are not complacent about the issue of flooding and can look to the review of Scottish Planning Policy as an opportunity to explore whether there is any further need to revise policy, including monitoring.

SEPA is assessing the feasibility of future flood risk management strategies monitoring and reporting on CCRA2 recommendation 11, based on the current and future availability of data and views of Scottish Government and wider stakeholders.

<u>Sustaining reductions in average water consumption per person</u> (ASC 12)

Scottish building regulations have since 2013 required water efficiency measures for new dwellings and new work to existing dwellings. In 2017 the intention is to form a working party to consider the practicalities of extending the water efficiency measures in building regulations and the supporting guidance to new non-domestic buildings and new work within such existing buildings.

<u>Monitoring to improve resilience to extreme weather events.</u> (ASC 13)

The National Centre for Resilience, now in its second year of operation, will help build our understanding of the effects of natural hazards (whether as a result of climate change or other causes) and how to mitigate against them.

The Centre has initially focused on the development of practical tools for the resilience community to utilise during such events.

With the recruitment of two researchers, who commence post in April 2017, the research element of the Centre will now be in a position to engage directly with the resilience community to identify appropriate areas for research.

Society – Work Underway on ASC Recommendations

The ASC Independent Assessment made several recommendations (14- 23) relating to the SCCAP society chapter.

Emergency response system to deal with extreme weather events (ASC Rec 14)

The issue of prediction of flooding events and the coverage of MET Office High-Density Radar is actively being considered.

The impact on people, businesses and communities from flood events, and developing resilience (ASC Recs 15 and 20)

Societal impacts: Scotland has a strong focus on climate justice because climate change impacts most severely on poor people and vulnerable communities. The report *Mapping Flood Disadvantage in Scotland 2015* assesses social vulnerability for the key risk of flooding to help people working in flood risk management, resilience, emergency services, public health, social care, housing, and the environment.

Scottish Enterprise Sustainability Specialists work directly with companies including 'future proof' business practices, including opportunities to address adaptation working closely with Adaptation Scotland.

In support of the Scottish Green Growth strategy, SE work with companies to address the significant business opportunities from adaptation in sectors like enabling technologies, tourism and construction, albeit companies tend to be focused on the more immediate opportunities and threats to their business.

Current and long term risks from heat and extreme cold; risks from pathogens/air pollution & UV radiation; (Rec 16 -18)

Using funding from the National Centre for Resilience, SG has commissioned Health Protection Scotland to conduct a study into the link (or absence thereof) between hot and cold ambient temperature and mortality and morbidity. This will enable SG to design evidence based interventions in response to extreme weather events related to climate change. SG are also working with HPS to scope proportionate research into the climate change related risks to public health from vector borne disease.

Uptake of adaptation Scotland guidance and tools. (ASC Rec 19)

Adaptation Scotland published an impact report in September 2016. This provides a summary of uptake and impact of Adaptation Scotland projects, training, guidance, tools and resources. A second impact report will be published in March 2018.

Part 4: Next Steps

European Climate Change Adaptation Conference 2017

In June, Glasgow will host the 3rd European Climate Change Adaptation (ECCA) Conference, attracting around 1000 delegates from all over the world. Climate resilience is at the core of decisions shaping investment in Glasgow and transforming communities and it is this pioneering work that has helped win Glasgow the conference. The bid was supported by 46 organisations across Scotland and the UK. It will mark the first time that the conference has been held in the UK since its inauguration, with previous host cities including Hamburg and Copenhagen.

Climate Projections 2018

The UKCP18 Project is responsible for completing a major upgrade of the UK Climate Projections (UKCP09) using the latest observations, climate models and information from the most recent Inter Governmental Panel on Climate Change (IPCC) assessment. Scotland is well represented on the UKCP18 User Group for Government Departments and Other Government Organisations and the non-Government User Group for UKCP18. The Scottish Government and its partners will continue to work with the project team to ensure the projections are best designed to meet Scotland's user needs.

Required Reporting for Public Bodies

Each year named public bodies are now required to report annually on compliance with their climate change duties, including adaptation. 2015-16 reports have been published by Local Authorities, Further and Higher Education, National Health Service and others (including transport partnerships, police and emergency services, National Parks, Scottish Water, SEPA and a range of other non-departmental public bodies). The reporting form captures information on the key emission sources and other governance, adaptation and sustainable procurement issues, including basic transport and business travel data.

Adaptation Scotland Programme

The Adaptation Scotland programme will continue to play a key role in supporting wider engagement to support delivery of Scottish Ministers' climate change adaptation objectives as set out in the SCCAP. The Adaptation Scotland Programme will continue to mainstream climate adaptation, delivering an embedded approach across public, private and community sectors and all Scottish Government portfolios, with the aim of achieving measured reductions in adaptation risks. Work on the next SCCAP due in 2019 will begin in advance of the fourth and final annual progress report on the 2014 SCCAP.

ANNEX: ADAPTATION PROGRAMME: BACKGROUND INFORMATION

Adaptation Annual Progress Report

Section 54 of the Climate Change Act (Scotland) 2009 requires Scottish Ministers to provide an annual report on progress towards achieving the objectives and implementing the proposals and policies set out in the Programme.

Scottish Climate Change Adaptation Programme (SCCAP)

Scotland's first statutory climate change adaptation programme (2014) sets out the Scottish Government's on-going commitment to ensuring Scottish Government policy, as far as possible, helps Scotland adapt to the effects of climate change. It contains a comprehensive package of measures that:

- helps Scotland adapt to the effects of climate change;
- creates a more resilient country for us to live and work in; and
- helps to protect Scotland's much loved natural environment.

At the heart of the Programme are Scottish Ministers' objectives, proposals and policies for addressing the key impacts identified for Scotland in the UK Climate Change Risk Assessment 2012.

The objectives set the long-term framework for adaptation in Scotland and the proposals and policies provide the focus for the lifetime of this Programme in order to progress towards these long-term objectives.

We are working to achieve our national adaptation objectives not only through integrating adaptation within Scottish Government policies, but through encouraging and facilitating partnership working across organisations, businesses, the public sector and individuals across Scotland.

And we are building partnerships to improve our understanding of the impacts of climate change. Where we need to continue to build the evidence base, our policies need to be flexible to respond to new information as it becomes available.

Adaptation Scotland

Adaptation Scotland continues to support organisations, business and communities to adapt to the impacts of climate change through connecting science and practice and building strong partnerships for planning and action.

Examples of progress between June 2016 – May 2017 include:

- Successful Adaptation Learning Exchange for Community Engagement and Adaptation Learning Exchange for Organisations events, training and task groups leading to increased progress with adaptation planning and action.

- New accelerator programme for Climate Ready Clyde, supporting the move towards a Glasgow City Region adaptation strategy.

- Effective guidance and training enabling successful introduction of the adaptation components of the Public Bodies Climate Change Duties Mandatory Reporting process.

- Bringing partners together to develop Edinburgh's first adaptation vision and action plan involving over 50 organisations and leading to 100 committed actions and new adaptation governance arrangements for the city.

- Bringing partners together in Aberdeen to develop a new adaptation strategy for the city and test new ways of engaging the public including projects using the creative arts and new engagement resources for children and young people.

- Advice on user needs provided to help shape the next set of UK Climate projections (UKCP18). This will help make sure that the projections are as useful and accessible as possible for Scottish stakeholders.

- Close partnership working with ClimateXChange including reviewing adaptation indicators, contributing to a new climate trends report card and helping identify future research priorities.

- Co-chairing the local advisory group leading preparations for the European Climate Change Adaptation Conference to be held in Glasgow in June 2017.

- Awareness raising and enquiries service supported by a new website and updated adaptation tools and resources.

This publication is available at **www.gov.scot**

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