

Integrating monitoring and evaluation in the Scottish Climate Change Adaptation Programme

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Developing climate change adaptation indicators

Monitoring and evaluation (M&E) is a central part of assessing the effectiveness of our efforts to tackle climate change. Scotland (and the wider UK) was one of the pioneering countries in developing an adaptation M&E framework and is one of a handful of countries that have a system that is fully operationalised. However, we are currently still largely unable to adequately answer basic questions regarding whether Scotland is adapting to the impacts of climate change, and whether resilience is increasing and opportunities are being realised.

As a result, as part of its recommendations in the 2016 assessment of progress on climate change adaptation in Scotland, the Adaptation Sub Committee of the UK Committee on Climate Change (ASC) said that the Scottish Government in preparing the second adaptation programme should:

introduce an effective monitoring regime to allow impact of actions and delivery of each objective to be properly assessed¹.

The UK's Climate Change Risk Assessment (CCRA) also identified that there is '*no routine collection of data and other evidence to assess whether policies are successful in achieving their objectives*'².

This is despite the wealth of data collected for various purposes that can be analysed to say something about the state of climate change impacts in Scotland. CXC had by mid-2016 published over 100 indicators measuring and monitoring climate change impacts and actions. The indicators were developed with the aim to support Scottish Government policy in three key areas:

- inform and analyse risks identified for Scotland in the CCRA;
- show progress towards the objectives set out in Scotland's Climate Change Adaptation Programme (SCCAP); and
- inform the independent assessment of the SCCAP carried out by the ASC.

¹ <https://www.theccc.org.uk/wp-content/uploads/2016/09/Scottish-Climate-Change-Adaptation-Programme-An-independent-assessment-CCC-September-2016.pdf>

² <https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/>

A key element of the indicators relevance is tracking developments and trends over time. To fulfil this aim they need to be updated as appropriate. ClimateXChange initiated a project to 'Update key adaptation indicators and report identifying new indicators which need to be developed to fill critical knowledge gaps'³. As part of this project, the existing CXC indicators have been assessed for their direct and indirect relevance to the second CCRA for Scotland (see Appendix 1), as well as the recommendations set out by the ASC in their assessment.

As work on the second SCCAP begins in earnest it is clear that the programme will take a different format – focussing on policy outcomes in line with the National Performance Framework. This means indicators will have to be chosen based on their suitability for tracking progress against the defined outcomes.

This paper outlines how monitoring and evaluation can be integrated into the programme design in a way that:

- tracks progress against outcomes;
- responds to the ASC recommendations in the independent assessment;
- monitors implementation of the programme; and
- makes best use of the existing indicator set.

It is based on the recommendations made in our paper "*Developing adaptation monitoring and evaluation in Scotland*"⁴. The approach:

- encourages M&E to be considered at all stages of policy development;
- links adaptation process to adaptation outcomes; and
- discourages listing measures and actions without considering their potential effectiveness.

Ownership by senior policy officials and wider adaptation effectiveness

In order for an adaptation programme to be successful, there needs to be political and organisational commitment to establish, implement and resource the associated M&E. This applies not just at national level, but at all levels of implementation.

Senior policy officials can champion, not only adaptation *per se*, but also the importance of adaptation M&E, and ensure that findings contribute to a transparent, evidence-based adaptation policy planning and implementation process⁵. It is therefore recommended that all adaptation objectives, outcomes and measures should have a 'senior owner' identified who is responsible for ensuring implementation and progress. This responsibility should also extend to coordinating the response to the recommendations resulting from the independent assessment of the adaptation programme. It is also critical to ensure that the M&E is able to identify any progress towards desired outcomes and ultimately tell us if Scotland is becoming more resilient to climate change. Therefore, it needs to be clear who is responsible for ensuring that we have an adequate evidence base to answer these questions.

Climate change adaptation measures should not be considered in isolation from each other nor from other policy areas. To help maximise adaptation effectiveness and coherency with the whole Scottish policy landscape, the use of senior

³ ClimateXChange Adaptation Science Fellow workplan 2017/18 agreed with Scottish Government

⁴http://www.climateexchange.org.uk/files/9114/9847/9481/Developing_adaptation_monitoring_and_evaluation_in_Scotland.pdf

⁵<http://www.oecd.org/env/cc/national-climate-change-adaptation-9789264229679-en.htm>

owners could also enable a broader assessment of adaptation effectiveness as well as highlighting the potential for cross-sectoral impacts.

It is important that those responsible for delivering the adaptation measures are also actively engaged in identifying the desired outcomes for the programme. This will help maximise the legitimacy of the final programme and participation in the subsequent M&E process.

Identify measurable objectives and outcomes

The ASC assessment highlighted the difficulty in assessing progress within the first SCCAP due to the lack of clear, measurable objectives and identification of associated milestones and targets. The terminology used within the SCCAP, against which evaluation occurs, is often very open-ended e.g. 'Increase awareness...', 'Improve understanding...'; 'Publish resources...'. Without clearly identifying what achievement against these terms means, it is therefore currently very difficult to monitor the development and implementation of adaptation policies beyond very broad and non-transparent categorisation.

Therefore, there is an urgent need to establish a more structured reporting process with a more detailed framework against which progress can be monitored. This will enable:

- external evaluation of progress; and
- internal evaluation of delivery, progress and timely changes to the programme in response.

Monitor progress towards adaptation outcomes

Metrics to measure progress should be considered *at the same time* that planned outcomes are identified. Metrics should be identified for monitoring both the primary level general aims and more specific secondary level goals (see Table 1). CXC's current suite of adaptation indicators (developed with an integral link to the first CCRA and SCCAP) provide an extensive evidence base from which to draw indicators to support the monitoring of the second SCCAP.

Some outcomes may lack available metrics, highlighting the current inability to adequately measure progress. This can be used as a tool for sectors and organisations to address these gaps as part of their adaptation measures. ClimateXChange has tested a workshop methodology with SNH for bringing together key stakeholders to identify existing data for outcome metrics. This focuses on filling current gaps in analysis and encourages cross sector cooperation.

To maintain a strong link between adaptation actions and adaptation outcomes, the programme should clearly set out the specific outcomes which the actions are intended to address. This will enable future assessment of coincidence between changes in outcome indicators with adaptation actions, thereby building evidence of adaptation impact. It will also be necessary to identify other elements of the programme framework which the actions are likely to *indirectly* influence, both to acknowledge their potential wider positive influence, as well as encouraging consideration of the potential for maladaptation. For example, increasing woodland habitat has the potential to address a number of adaptation areas like improving habitat

connectivity for biodiversity, natural flood management, and increasing slope stability, but this change in land cover may conflict with the projected expansion of prime agricultural land.

Outcome milestones

Milestones are important to assess interim progress and indicators will enable monitoring of that incremental progress. In some cases it may only be possible (and appropriate) to identify a desired direction of travel. This is particularly likely to be the case with some natural environment indicators such as those based on species abundance and/or distribution, where there may not be a scientific consensus on 'how much is enough'. Examples of existing indicators from CXC's suite of Adaptation Indicators based on the abundance and productivity of key species groups:

- Abundance and productivity of breeding sea birds (NB6a/NB17a)
- Abundance and frequency of specialist and generalist species: snow bed species (NB16a)

However, in many cases (even in the natural environment) it will be suitable to identify more specific targets and this should be encouraged. Examples from the natural environment could include identifying specific targets for improving the extent or condition of key habitats, which can be linked to specific management strategies. Examples of existing indicators from CXC's suite of Adaptation Indicators:

- Extent of key habitats: Deep peat (NB11)
- Condition of key habitats: Proportion of notified habitats in unfavourable condition (NB12)

Monitor the adaptation process

Process monitoring assesses whether the programme actions are taking place and that policies and interventions are on track. By demonstrating that an action has been taken or a stage of implementation reached, process indicators support accountability in the short term. In addition, given that climate changes unfold over a long timeframe, beyond usual programme cycles, process indicators can also monitor the implementation of actions which focus on achieving longer-term aims, with the assumption that successful implementation will contribute to desired outcomes in the long-run.

Process milestones and timetables

Monitoring the adaptation process will involve identifying both qualitative (e.g. setting up a training programme for a decision support tool) and quantitative (e.g. number of users of a decision support tool) milestones as appropriate to the measure.

Examples of existing quantitative indicators from CXC's suite of Adaptation Indicators:

- Diversity of tree species ordered for planting in Scotland (NF4)
- Number of uses & users of the Ecological Site Classification (ESC) decision support tool (NF6)
- Area of woodland with active, approved deer management plans (NF14)

Linking process monitoring to annual reporting

There should be an integral link between process monitoring and the requirements of annual reporting of the SCCAP. The use of a standardised monitoring format would aid that process and minimise duplication of effort. Utilising a standard system will also:

- enable standardised data to be collected across all sectors and consistency across policy areas;
- ensure (or at least encourage) the consideration of pertinent issues (risk of non-achievement, potential impact on other policy areas etc.) when measures, milestones etc. are being documented; and
- enable internal evaluation of critical adaptation issues (e.g. utility of measures, early detection of potential non-achievement, improve flexibility of programme etc.)

The standardised monitoring format should clearly identify the association between adaptation measures, milestones and the programme outcomes; utilise standard and clearly understood categories for assessing progress; and provide a means to provide explanatory detail regarding progress status and remedial action. Appendix 2 provides an example of a potential standardised monitoring form for the SCCAP.

Table 1 Summary of the role of integrated monitoring and evaluation

Adaptation programme framework	Monitoring	Evaluation
<p>Primary level</p> <p>Over-arching general aims providing the primary structure for the adaptation programme. These could be at the level of current National Outcomes in the Scottish Government's National Performance Framework⁶.</p> <p><i>e.g. A healthy diverse natural environment with the capacity to adapt</i></p>	<p>Senior owners to be accountable for the overall coherency and delivery of the adaptation programme</p> <p>Indicators to enable monitoring of <u>outcome progress</u></p> <p><i>e.g. Proportion of major timber species planted in areas likely to remain climatically suitable</i></p>	<p>Evaluate the adaptation programme in the context of contribution to wider government goals and performance framework</p> <p>Evaluate the ability of the adaptation programme to increase adaptive capacity and reduce Scotland's vulnerability to climate change</p>
<p>Secondary level</p> <p>Sets out specific, measurable targets for the adaptation objectives/ goals</p> <p><i>e.g. Maintain (or reduce) current distribution/ prevalence of key climate-related forestry pests and diseases</i></p>	<p>Indicators to enable monitoring of <u>outcome progress</u></p> <p><i>e.g. Proportion of forest area infected by DNB</i></p>	<p>Identify where critical data gaps are limiting ability to monitor adaptation outcomes effectively</p> <p>Evaluate outcome progress and the contribution of adaptation measures to that progress</p>
<p>Measures/ actions</p> <p>Policies and other measures which target or contribute to achievement of the outcomes. There needs to be consistency across measures and actions - in terms of level of detail and how they are framed in order to enable evaluation of progress within and between programme areas.</p> <p><i>e.g. Increase routine monitoring of disease presence and impact in the National Forest Estate (NFE)</i></p>	<p>Indicators to enable monitoring of the <u>adaptation process</u></p> <p>NB In the absence of outcome indicators or where changes to outcomes will only be detectable over a long timeframe, these may act as proxy indicators for adaptation progress.</p> <p><i>e.g. Proportion of NFE included in annual disease monitoring regime</i></p>	<p>Identify where critical data gaps are limiting ability to monitor adaptation process effectively</p> <p>Evaluate potential for measures to effectively and efficiently deliver the adaptation outcomes</p> <p>Highlight potential maladaptation</p>

⁶ <http://www.gov.scot/About/Performance/scotPerforms/outcome>

<p>Milestones & timetable</p> <p>Detail of the delivery milestones or targets which will indicate that a measure is ‘on-track’ or ‘achieved’, along with the planned timescale</p> <p>e.g.</p> <ul style="list-style-type: none"> • <i>Establish methodology/ protocol for routine disease monitoring (2018)</i> • <i>Implement protocol across 50% of the NFE (2019)</i> • <i>Implement protocol across 100% of the NFE (2020)</i> 	<p>Annual monitoring of programme delivery</p> <p>Standardised reporting format which:</p> <ul style="list-style-type: none"> • Improves the quality of annual reporting whilst minimising the burden • Enables early detection of risk of non-achievement and improves programme flexibility 	<p>The standardised monitoring format could also be used to:</p> <ul style="list-style-type: none"> • Facilitate comparison of progress across the programme • Identify linkages and multiple dependencies across the adaptation programme • Encourage consideration of wider adaptation issues and contribution to non-adaptation policy
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Appendix 1

Assessment of current CXC adaptation indicators for relevance to CCRA2 risks (includes only those with an urgency score of 'More action needed' or 'Research priority'). Detail regarding CXC indicators can be accessed at:

http://www.climatexchange.org.uk/files/4114/7738/6041/CXC_Adaptation_indicators_full_list.pdf

CCRA2 risk/ opportunity and urgency assessment	Relevance of current CXC indicators (in bold)	Significant current indicator gaps
<p>Ne1: Risks to species and habitats due to inability to respond to changing climatic conditions (3.2)</p> <p>More action needed (Reduce existing pressures, improve condition and size of habitats, restore degraded ecosystems, and deliver coherent ecological networks; factor cc into conservation planning and site management.)</p>	<p>This is a very general risk so the majority of biodiversity indicators have some relevance.</p> <p>Ability to track climate space: NB3, NB4 (specific species info)</p> <p>Example of species range restricted: NB31b</p> <p>General condition: NB24, NB33</p> <p>Indicators aimed at capturing management: NB7, NB19, NB22a, NB33</p> <p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Migratory birds, breeding seabirds and coastal wading birds- NB6a/NB17a, NB6b/ NB17b • Considering conservation on wider scale- NB7 • Habitat being 'bigger, better, joined'- NB10a, NB10b, NB11 • Improving site condition- NB12, NB19 • Snowbeds- NB16a (NB NB10a does not currently include extent of snowbeds) • Natural capital framework- NB14 • Butterflies- NB16b (NB butterflies good indicator species, though CCRA does not specifically refer to specialists v generalists as the indicator does) 	<p>Iconic species (ptarmigan, mountain hare); habitat connectivity; actual management changes; securing conservation areas based on future climatic need</p>
<p>Ne2: Opportunities from new species colonisations (3.2)</p> <p>More action needed (Coherent ecological network; factor climate change into conservation planning and site management)</p>	<p>'More action' overlap with Ne1 above.</p> <p>Ability to colonise via coherent habitat networks and extent of suitable habitat: NB3, NB10a, NB10b</p> <p>Butterflies: NB16a</p>	<p>Habitat connectivity; actual management changes; securing conservation areas based on future climatic need</p>

<p>Ne3: Risks and opportunities from changes in agricultural and forestry productivity and land suitability (3.3)</p> <p>Research priority (Integrated land-use planning based upon changing land suitability; impacts of changing land suitability; resilient crop varieties, tree species and agricultural systems)</p>	<p>Broad risk, so majority of agriculture and forestry indicators are relevant.</p> <p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Land suitability- NA2 (indicator utilised in CCRA2 doc), NA28, NA29 (indicator utilised in CCRA2 doc) • Land use planning- NA1 • Resilience/ suitability of crops & tree species- NA3a/b, NA6, NF1 • Research priority re impacts- NA5 (birds) • Resilient agri-systems- NA8, NA9, NF3, NF4, NF5, NF6 	<p>Tree growth and yield; crop/tree selection based on climatic resilience</p>
<p>Ne4: Risks to soils from increased seasonal aridity and wetness (3.3)</p> <p>More action needed (Reduce existing pressures on soils, increase uptake of soil conservation measures and restore degraded soils)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Soil erosion risk, and management: NA10, NA12Wetness: NA28 (NB this relates more to agri-suitability than soil risks per se) • Aridity: NA29 (NB this relates more to agri-suitability than soil risks per se) • Soil carbon: NA11 • Sediment loading of water: NA14 	<p>Expansion of high-risk crops (maize) and increased cropping on marginal land, particularly slopes.; Long-term monitoring of soil health</p>
<p>Ne5: Risks to natural carbon stores and carbon sequestration (3.3)</p> <p>More action needed (Restore degraded carbon stores; research to account for cc impacts on carbon stores in the UK GHG projections)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Extent of deep peat: NB11 • Condition of deep peat: NB13 • Loss of carbon: NB18, NA11, NA12 • Restoration: NB22a 	<p>More info needed on agri-soils; blue carbon; woodland area (info available elsewhere) and tree growth rates</p>
<p>Ne6: Risks to agriculture and wildlife from water scarcity; and flooding (3.4)</p> <p>More action needed (Reduce pollution, over-abstraction and improve the ecological condition of water bodies; Ensure decisions on use of water allow for necessary environmental flows and take account of climate change.</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Low flows- NB27 • Drought risk to agri- NA29 • Action to improve water condition- NB33 • Irrigation- NA13 • Diffuse pollution- NA14 • Flood risk to agri- NA17 <p>NB24 relates to water quality, but strong connection between quantity and quality</p>	<p>NFM; water storage infrastructure</p>
<p>Ne7: Risks to freshwater species from higher water temperatures (3.4)</p>	<p>General water condition: NB24</p> <p>Temperature monitoring stations: NB32 (NB improved data now available based on SRTMN)</p>	<p>Water temperature changes; invasive fish species; riparian planting</p>

<p>Research priority (Scale of risk and effectiveness of adaptation measures)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> Temp. impacts on species: NB31b 	
<p>Ne8: Risks of land management practices exacerbating flood risk (3.4)</p> <p>More action needed (Deliver wider uptake of NFM in high-risk catchments especially where there are likely to be carbon storage, water quality and biodiversity benefits; catchment-scale planning for flood risk management; review potential for adverse flood risk outcomes from land management subsidies.)</p>	<p>NA17 identifies flood risk to agri land, but this risk relates more to impact from agri on flood risk.</p> <p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> Soil erosion- NA10, NA12 	<p>No indicators specifically address management; soil compaction; NFM</p>
<p>Ne12: Risks to habitats and heritage in the coastal zone from sea-level rise; and loss of natural flood protection (3.5)</p> <p>More action needed (Managed realignment of coastlines and compensatory habitat)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> Migratory and breeding seabirds, coastal wading birds- NB6a/NB17a, NB6b/NB17b Coastal habitats: NB10b (extent) Heritage: BB6 	<p>Specific habitat information (machair); impact of hard sea defences on habitats; shift in coastal species; sea level (and consequent habitat loss); coastal erosion risk (available from NCCA) and Shoreline Management Plans; NFM</p>
<p>Ne13: Risks to, and opportunities for, marine species, fisheries and marine heritage from ocean acidification and higher water temperatures (3.6)</p> <p>Research priority (Magnitude of risk to marine ecosystems and heritage.)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> Sea temperature- NM1 Opportunities for species- NM21 Aquaculture- NM46 Algal blooms- NM7 	<p>Acidification (and impact on cold water corals); primary productivity (plankton distribution/abundance); shift in distribution of main catch species; migration/ spawning timings; growth rates of farmed species; Good Environmental Status of marine waters; CC responsive quotas</p>
<p>In1: Risks of cascading failures from interdependent infrastructure networks (4.4 to 4.9)</p> <p>More action needed (Enhance arrangements for information sharing in order to improve understanding of critical risks arising from interdependencies)</p>	<p>General flood risks to infrastructure see other risks below</p>	<p>Interdependency; ICT</p>

<p>In2: Risks to infrastructure services from river, surface water and groundwater flooding (4.4 to 4.9)</p> <p>More action needed (Manage increasing risk to existing assets and networks and ensure increased risk is accounted for in design and location of new infrastructure)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Power- BE1/2/3, BE4/14, BE5, BE6, BE7, BE8 • Transport- BT2, BT4, BT6, BT8, BT9, BT12, BT16, BT17 • Wastewater- BW4, BW5 • Flood management measures- BE7, BE8, BT6, BT16 (NB effectiveness not really covered) 	<p>Flood protection measures (extent and capability); CC taken into account in planning and design</p>
<p>In3: Risks to infrastructure services from coastal flooding and erosion (4.4 to 4.9)</p> <p>Research priority (Risk to existing networks, including flood and coastal erosion risk management infrastructure which protects other systems, from sea level rise and increased rate of erosion)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Power- BE1/2/3, BE4/14, BE5, BE6, BE7, BE8 • Transport- BT2, BT4, BT6, BT8, BT9, BT12, BT16, BT17 • Wastewater- BW4, BW5 • Flood management measures- BE7, BE8, BT6, BT16 (NB effectiveness not really covered) 	<p>Flood protection measures (extent and capability); CC taken into account in planning and design; ports; coastal erosion; CBA of Shoreline Management Plans</p>
<p>In4: Risks of sewer flooding due to heavy rainfall (4.5)</p> <p>More action needed (SUDS, upgrade sewers where appropriate, and tackle drivers of increasing surface runoff e.g. impermeable surfacing in urban areas)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Impermeable surfaces- BB13 	<p>CSOs, SUDs (extent, effectiveness, maintenance); porous paving material usage; enforcement of permitted development rights</p>
<p>In5: Risks to bridges and pipelines from high river flows and bank erosion (4.5, 4.7, 4.8)</p> <p>Research priority (Implications of projected changes in river flows on future risk of scour/erosion)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Bridge scour- BT26 	<p>High river flows; repair and resilience measures</p>
<p>In6: Risks to transport networks from slope and embankment failure (4.7)</p> <p>More action needed (Locate and remediate slopes, embankments and cuttings at risk of failure)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Landslide events- BT22/23 	<p>Landslide risk</p>
<p>In11: Risks to energy, transport and ICT infrastructure from high winds and lightning (4.6, 4.7, 4.8)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Electricity supply disruption- BE15 	<p>Risks to & impacts on transport; risks to and impacts on ICT; vegetation management</p>

<p>Research priority (Implications of increased vegetation growth rates on future risks of damage from falling trees in storms)</p>		
<p>In12: Risks to offshore infrastructure from storms and high waves (4.7, 4.8)</p> <p>Research priority (Assess climate risks to existing and planned offshore renewable energy infrastructure)</p>		<p>Wind and wave stress; scour and erosion; installation of resiliently designed structures</p>
<p>PB1: Risks to health and wellbeing from high temperatures (5.2.2, 5.3.2, 5.5.3)</p> <p>Research priority (Current and future risk for homes, hospitals, care homes, schools, offices and prisons)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Deaths due to extreme temperature: CRS8 (NB current focus on decrease in deaths related to low temperatures) • Hospital admissions: CRS9 (NB includes all due to extreme weather) 	<p>Impact of building regulations on overheating risks; overheating risk for vulnerable groups (hospital population, care homes)</p>
<p>PB4: Potential benefits to health and wellbeing from reduced cold (5.3.3, 5.5.4)</p> <p>More action needed (Despite warming climate, further measures need to be taken in the next 5 years to tackle large numbers of cold homes and reduce cold effects on health, due to aging population.</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Deaths due to extreme temperature: CRS8 (NB discrepancy between CXC indicator figures and CCRA2?) • Hospital admissions: CRS9 (NB includes all due to extreme weather) • Fuel poverty- CRS61 	<p>Thermal standards of dwellings</p>
<p>PB5: Risks to people, communities and buildings from flooding (5.2.5, 5.3.4, 5.5.1)</p> <p>Research priority (Future spending plans and how these relate to the level of risk)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Flood risk residential and community services: BB1/3, CRS12 • Hospital admissions: CRS9 includes flooding • Risk to services: CRS12 • Flooding incidents: CRS20 (covers attendance by SFRS only) • Managing surface water: BB13 (impermeable surfaces) • Flood prevention: BB11 (Planning and flood risk advice); CRS34 (flood warning registrations) 	<p>Flooding incident frequency and extent; adequate data on flood related injuries; impact on mental health; impact on services; actual damages; flood protection extent and condition; green and blue infrastructure; property level protection</p>
<p>PB6: Risks to the viability of coastal communities from sea level rise (5.2.6, 5.2.7)</p>	<p>BB1/3 includes coastal flooding risk</p>	<p>Storm surge risk to vulnerable communities; evidence of long term planning</p>

<p>Research priority (Impacts from sea level rise on coastal communities, thresholds for viability, and what steps should be taken to engage and support affected communities)</p>		
<p>PB7: Risks to building fabric from moisture, wind and driving rain (5.3.4, 5.3.6, 5.3.7)</p> <p>Research priority (Future level of risk and further steps which might be appropriate)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Building condition: BB16, BB17/18, CRS58 	<p>Actual risk level of different building types and location; adaptation actions</p>
<p>PB8: Risks to culturally valued structures and the wider historic environment (5.3.8)</p> <p>Research priority (Scale of current and future risks, including historic urban green spaces and gardens as well as structures)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Flood risk: BB6 	<p>Risks to historic (non-listed) housing stock; non-flooding risks to historic environment; measures to protect property</p>
<p>PB9: Risks to health and social care delivery from extreme weather (5.4)</p> <p>Research priority (Relationship between level of risk and level of action within the health and social care sector)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Health: CRS9 (hospital admissions but not directly related to impact on delivery of care) • Impact on community services from flooding: CRS12 <p>General disruption to transport network- multiple indicators</p>	<p>Non-flooding CC risks and impacts; over-heating risks in hospitals and care homes ; disruption to staff transport to work; evidence of contingency planning</p>
<p>PB10: Risks to health from changes in air quality (5.2.2, 5.3.5, 5.5.5)</p> <p>Research priority (Influence of cc on ground level ozone and other outdoor air pollutants; how climate and other factors affect indoor air quality)</p>	<p>No current CXC indicators</p>	<p>Scotland specific data on risks to health; non-temp climate change impacts on air pollution levels; no. of people living with chronic respiratory conditions</p>
<p>PB11: Risks to health from vector-borne pathogens (5.5.2)</p> <p>Research priority (Monitoring and surveillance of vector species and related infectious disease; assess the extent to which current efforts are focussed on those infections that pose the greatest long-term risks)</p>	<p>No current CXC indicators</p>	<p>Scotland specific data on vector-borne pathogens; vector range and prevalence data</p>

<p>Bu1: Risks to business sites from flooding (6.2.2, 6.2.3)</p> <p>Research priority (Uptake of flood protection measures by businesses and how spending plans on defences and other measures protect individual businesses)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Non-residential property at flood risk: BB1/3 • Wider planning to limit flooding: BB11, BB13 • Flood alerts/ warnings: CRS34 	<p>Property level protection; business level plans in place; SUDs</p>
<p>Bu2: Risks to business from loss of coastal locations and infrastructure (6.2.2, 6.2.3)</p> <p>Research priority (Costs and benefits of adaptation options)</p>	<p>BB1/3 includes coastal flooding</p>	<p>Sea level rise and storm surge risk; private management plans in place</p>
<p>Bu5: Risks to business from reduced employee productivity, due to infrastructure disruption and higher temperatures in working environments (6.4.2, 6.4.3, 6.4.4, 6.4.5)</p> <p>Research priority (Disruption to ICT, power and transport infrastructure which prevents workers accessing premises or working remotely; impacts of higher temperatures on employee safety and productivity)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Power disruption- BE4/14 (flooding only) • Transport disruption- BT9, BT17 	<p>Non-flooding risks and impacts to power and transport; ICT risks and impacts; secondary impacts (school closures, child care costs etc); heat stress; business level contingency planning in place</p>
<p>It1: Risks from weather-related shocks to international food production and trade (Section 7.2)</p> <p>More action needed (Co-ordinated national approach to ensure the resilience of the UK food system)</p>	<p>No current CXC indicators</p> <p>Resilience of Scotland’s agricultural output partially addressed by diversity: NA6</p>	<p>Food security- food price volatility, reliance on imports; Scotland specific data</p>
<p>It2: Imported food safety risks (7.2)</p> <p>Research priority (Food safety at source and in complex international supply chains)</p>	<p>No current CXC indicators</p>	<p>Contamination due to flooding; increased pesticide use; foodborne pathogens; maintenance of food stocks; Scotland specific data</p>
<p>It3: Risks and opportunities from long-term, climate-related changes in global food production (7.2)</p>	<p>CCRA2 specifically refers to:</p> <ul style="list-style-type: none"> • Potential opportunities for Scottish agriculture: increase in prime land (NA2, NA1); crop yields NA3a/b 	<p>Reliance on global food production</p>

<p>Research priority (Trends in global agricultural production and consumption)</p>	<ul style="list-style-type: none"> Risks from intensification: NA8, NA9 	
<p>It4: Risks to the UK from climate-related international human displacements (7.3)</p> <p>More action needed (Pro-active strategy to work in partnership with other countries to provide rapid legal and basic assistance to migrants and build resilience in exposed regions)</p>	<p>No current CXC indicators</p> <p>UK responsibility</p>	<p>UK data sources</p>
<p>It5: Risks to the UK from international violent conflict (7.4)</p> <p>Research priority (Appropriate balance between long-term development aid and responsive interventions)</p>	<p>No current CXC indicators</p> <p>UK responsibility</p>	<p>UK data sources</p>
<p>It6: Risks to international law and governance (7.4)</p> <p>Research priority (Potential for breakdown in foreign national and international governance, and inter-state rivalry, caused by shortages in resources sensitive to cc)</p>	<p>No current CXC indicators</p> <p>UK responsibility</p>	<p>UK data sources</p>

Appendix 2

Example of a standardised monitoring form for the SCCAP

Scottish Adaptation Programme Annual Monitoring Form					
Adaptation programme outcome/s	Measure	Milestones	Progress category	Detail/ evidence of stated progress category	Proposed actions for policies and proposals at risk of non-achievement

Table terminology and explanation:

Progress category

Categories are defined as follows:

- **Achieved:** measure is in place *and* fully implemented by national/lead stakeholders with action now occurring at regional and local levels as appropriate.
- **On-track:** the measure has been implemented and progress is as planned, with full implementation or outcomes expected to be delivered on time
- **At risk of non-achievement:** implementation, completion or progress of the measure is at risk of not being achieved as planned
- **Superseded/not relevant:** the measure has been superseded or now deemed not relevant

Detail/ evidence of stated progress category

- This would encourage the provision of:
- Explanation (and evidence) of the stated level of progress for the measure.
 - Evidence might be general information about what has been achieved and/or information supported by publications. If possible including links to any published information.
 - It should be established in advance what evidence will be required to identify achievement and/or that a measure is on-track.
- Where a measure has been superseded, a brief explanation of why and identifying any measures which replace it.

Proposed actions for policies and proposals at risk of non-achievement

This would encourage setting out the actions planned to be implemented to address measures at risk of non-achievement e.g. remedial actions to get a measure back 'on track' or 'achieved'.