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CCRA Workshop for Scotland Workshop Record

Glasgow, 23rd September 2010

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UK 2012 | Climate Change Risk Assessment

Statement of use

This is a working document recording the results of the workshop for the benefit of the project team and the participants.

Dissemination status

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CCRA WORKSHOP FOR SCOTLAND WORKSHOP RECORD GLASGOW 23 SEPTEMBER 2010

This workshop record covers the discussions, conclusions and actions from the CCRA Workshop for Scotland which brought together national stakeholders to discuss which climate change impacts are important for Scotland and which risks they would like to see reflected in the CCRA.

The record is presented in two parts. The first part provides a summary of the workshop activities and results. The second part, accompanied by appendices, provides a full record of the proceedings of the workshop.

SUMMARY

Context

The Climate Change Risk Assessment (CCRA) project team is currently undertaking a UK-wide sector-based assessment. The team is also working on assessments for Scotland, Wales and Northern Ireland. In March 2010 the CCRA team started the process by meeting with stakeholders in Northern Ireland, Scotland and Wales. These meetings highlighted work undertaken to date, key issues related to the practicalities of engaging stakeholders and some of the headline impacts and challenges posed by climate change.

In September workshops were held in each Devolved Administration (DA) to give stakeholders a more focussed opportunity to discuss which impacts are important for their country and hence which risks they would like to see reflected in the CCRA. The workshop for Scotland was held in Glasgow on 23rd September. This two-part report contains a summary and a full record of the proceedings of the workshop.

The views expressed during this workshop will be used to inform the CCRA assessment for Scotland, alongside other evidence sources. This summary includes a description of how the outcomes of this workshop are feeding into the CCRA.

Objectives and programme

The purpose of the CCRA workshop for Scotland was to help determine a list of high priority climate change impacts for Scotland. The specific aims of the day were to:

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- Ensure participants understood what the CCRA involves and bring them up to speed with progress so far.
- Compile a list of high priority climate change impacts for Scotland, including related consequences and the data sets that could be credibly used in the analysis of these impacts.
- Brief participants on how their input will be used and identify next steps for the project team and participants.

CCRA: Work in progress

Ian Townend (HR Wallingford) gave an update on the CCRA. He explained the purpose of CCRA and what is hoped people will use it for when it is complete. Ian described the work carried out so far, including:

- a. The reports that the CCRA will produce;
- b. The stages of the CCRA;
- c. The characterisation and selection of the UK-wide sector-based impacts;
- d. Examples of work in progress in some sectors;
- e. How Scotland's priorities will be reflected
- f. The ways that stakeholders have been involved and how they will be able to engage in the next stages.

Following the presentation, Clare Twigger-Ross invited questions and comments from participants. Some of the issues discussed were:

- The relationship between Tier 1 impacts and the Tier 2 list, with the point made by the team that it was fine to “bring back” a Tier 1 impact into the Tier 2 list for Scotland, if it was thought to be important for Scotland.
- A point was raised about how datasets that are not necessarily fit for purpose might be handled within the risk assessment and it was agreed that where possible response functions would be created but recognised that would not be the case for all the sectors.
- With respect to “metrics” it was confirmed that the UK wide risk metrics were pretty much determined but that there was flexibility to introduce different metrics for Scotland if appropriate and if time permitted. Further it was confirmed that at present there is no weighting of the risks e.g according to population.
- Finally, the importance of understanding cross-sector impacts was highlighted and it was noted that this process would be feeding into Scotland's statutory adaptation programme/action plan.

Headline messages: Which climate change impacts are most important for Scotland?

The purpose of this session was to provide an opportunity for participants to discuss which climate change impacts are most important for Scotland without the constraints of the UK-wide list of impacts. By identifying 'headline messages', the intention was to focus on key areas for Scotland.

Working in mixed-sector groups, participants discussed what they would tell a minister about the important impacts (both positive and negative) that climate change will have on Scotland. Each table wrote down up to 8 important impacts on post-its notes, which were subsequently clustered into themes.

The themes that emerged from the clustering were:

- Water Quantity and Quality
- Flooding and response
- Inequality
- Health and diseases
- Extreme events and weather
- Biodiversity
- Rural and Urban
- Economy and employment
- Contingency planning
- Governance and security
- Infrastructure – transport, other
- Culture and tourism
- Energy
- Aquaculture
- Agriculture and Rural
- Land Use
- Built environment and planning

Participants' comments on the themes comprised the following:

- There was a short discussion around the fact there seemed to be a greater emphasis on rainfall / flooding / water than on heat / warmer weather, which it was wondered was a reflection of the Scottish psyche, but it was also commented that in short-term this probably reflects the likely impacts: rainfall is likely to be the most important change in Scotland.
- It was remarked that there was little on Scotland in context of rest of the world or the rest of the UK.

- It was noted that sea level rise seemed to have been missed out, but it was still felt to be important.¹
- In addition it was suggested that heritage / historic aspects had not been highlighted. Impacts on remote and isolated communities were felt to be very difficult to manage and may be quite different to other areas of the UK.
- A number of issues around uncertainties and how they could be managed were raised. Uncertainty about the climate, especially wind speed projections which are important for Scotland. Also, the assumption that Scotland would become “nicer” in terms of weather due to increased temperatures was challenged with a suggestion that it may end up just being “grey” and foggy. Uncertainty around the predicted changes, and the response of policy makers and budget decisions was a further issue discussed, and how they could be “future proofed” in the light of possible future risks / conditions.

Tier 2 impacts: Important climate change impacts for Scotland

Linking back to the earlier presentation, Helen Udale-Clarke (HR Wallingford) described the Tier 2 list of impacts and its purpose and went on to explain how that Sector Contacts had been able to provide some feedback in advance of the workshop.

Participants were then asked to work in groups with others from the same sector, to review the Tier 2 impacts for the sector, identifying impacts that are particularly important for Scotland and providing supporting evidence for this view. Groups were also asked to add any significant impacts for Scotland that were felt to be missing from the Tier 2 list.

The important and additional impacts for Scotland identified are given in the tables below. Where a group identified an impact as less important for Scotland these are listed separately. Details of what was discussed are available in the full workshop record (pages 1 onwards in this document).

1. Agriculture

Impacts important to Scotland

Impact number	
6 +14	Pests and Diseases (crops) Exotic diseases become resident and occur

¹ Recent research has indicated that sea level rise is already occurring in Scotland and having impacts in a number of coastal areas see: Rennie, A.F. and Hansom, J.D. (in press) Sea level trend reversed: land uplift outpaced by sea level rise on Scotland’s coast. *Geomorphology*

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	with increased frequency (crops and livestock)
3	Flooding (livestock) and waterlogging. Seasonal pattern changes alter demands on livestock management
7	Drought effects (soil moisture availability) More demand for irrigation during drier summers
18	GHG emissions

Additional impacts important to Scotland

Vulnerability of remote communities
Heat stress when transporting livestock
Run off/erosion and leaching

Impacts less important to Scotland

8	Stress factors (crops)
5	Salt water intrusion
16	Stress factors (livestock)

2. Biodiversity

Impacts important to Scotland

Impact number	
1	Increased SMD and drying
4 + 5	Increased risk of pests and diseases (including alien invasives)
18	Asynchrony between a species breeding cycle & its food supply
7	Species unable to track changing climate space
17	Generalist species favoured over specialist species

Additional impacts important to Scotland

Altitudinal aspects of species tracking changing climate space e.g. species requiring cold habitats gradually migrating up mountains rather than northwards until the habitat is lost
Ecosystem functioning: loss of services through loss of keystone species
Impacts on protected area networks

Impacts less important to Scotland

8	Major drought events
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3. Built Environment

Impacts important to Scotland

6	Cultural heritage in flood risk areas
8	Pest infestations
5	Demand for heating and demand for cooling as well

General comments from the group: They felt that most of the impacts that are currently included in the Tier 2 list would be downgraded for Scotland, as they were 'London-centric' and mostly related to heat. There was also a

strong feeling that a large number of impacts were excluded, many of those were present in Tier 1. In particular, a primary concern was wind, and rain, specifically the impact of driving rain on buildings. The problem of impacts being excluded from the Tier 2 list was perceived by the group as being due to the lack of a metric, which it was felt missed crucial risks to the sector.²

Additional impacts important to Scotland

Extreme weather events
Blue space

4. Business, Industry and Services

Impacts important to Scotland

2	Coastal erosion and flooding of natural and tourist assets
5	Flooding (fluvial and pluvial) affects/leads to loss/ temporary failure of assets and delays with increased CAPEX/OPEX
6	Operational disruption and reliability of ICT requiring additional cooling (from high temperatures and heat wave).
9	Disruption from flooding of assets, transport links and supply chain.
10	Changing holiday trend leads to new markets.
11	Impact on operations from lack of available water resources either through shortage and competing demands of others (including conflict with other users?).
12	Extreme weather and changes to rainfall patterns impacts storage, supply and disposal of volatile and hazardous chemicals.

Additional impacts important to Scotland

Education and skills, adaptation of skills
Agricultural and forestry impacts in general. Make stronger link.
Changing consumption will lead to changing markets
New markets for products
Bumble bee disease
SMEs
Global markets – import or export

5. Energy

Impacts important to Scotland

1 + 4	(1) Flooding of electricity and gas infrastructure: capacity loss (4) Flooding of power stations: capacity loss
2 + 5	(2) Demand for cooling (5) Transmission efficiency

With regards to Impacts 6 – 10 the expertise to evaluate these impacts was not present at the workshop, and the group did not understand Impact 3.

² This concern was address in the summing up included in Session 7: Next steps (see section 6 of the full record).

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Additional impacts important to Scotland

Renewables – risk or opportunity?

6. Flooding

Impacts important to Scotland

4a and 4b	Damage to critical infrastructure
1a, 2a, 1b and 2b	River and Tidal flooding
5	Flood insurance collapse

Additional impacts important to Scotland

Coastal erosion, flooding tidal and river
Planning
Geomorphological issues
Snow melt

7. Forestry

Impacts important to Scotland

4	Biodiversity loss (and ecosystem service)
5	Water logging (in conjunction with wind throw)
1	Pests and diseases

Additional impacts important to Scotland

Increasing productivity of forests (m ³ /ha)

8. Health

Impacts important to Scotland

9	Extreme event (flooding and storms) injuries <u>and other health impacts including mental health impacts</u> (and wider service delivery impacts associated with healthcare estate/transport disruption/failures)
12	Water quality and water borne disease
11	Demand for emergency medicine <u>and emergency services</u>

Additional impacts important to Scotland

Vitamin D deficiency
Mould spores

Impacts less important to Scotland

7	Sunlight/UV exposure
16	Medicine efficacy
13	Winter air pollution

General comments from the group: The key point with respect to Impact 9 was that the group felt that the text in the Tier 2 list did not adequately reflect the real impacts that are more related to gastrointestinal diseases during the

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event and mental health post-event as well as the inability of staff to deal with these issues. Emergency medicine was felt to be less of an issue in Scotland, particularly within remote rural communities where teleconferencing is being used to support local GPs. Vitamin D deficiency was considered debatable as the risk depends on levels of cloud cover so it would possibly rank with UV exposure.

9. Marine and Fisheries

Impacts important to Scotland

7	Alien/Invasive species (marine)
9	Sea ice and icebergs
5	Coastal squeeze

Additional impacts important to Scotland

Increase in water temperature (Number 11 on Biodiversity list)	
Increase on species migration (Number 10 on biodiversity list)	
Sea water temperature change and stratification	
Changing weather patterns	
Nutrient input	

10. Transport

Impacts important to Scotland

1	Flood disruption and delay (transport)
3	Energy demands (transport)
6	Cold weather working/travelling
From the additional impacts list (pre-workshop)	
1 +	Erosion and landslides links to 2/3 wind/storm damage/disruption
2/3	
2/3	Wind/storm damage/disruption
4	Insurance cover
5	Leaf fall
6	Disruption to road repairs

Additional impacts important to Scotland

Encouragement of cycling/walking as a policy	
Resilience	
Numbers of people coming to Scotland	
Investment decisions/policies	

Impacts less important to Scotland

2	Subsidence (transport)
4/5	(4) Thermal Loading on Hard Surfaces (5) Heat Stress on Rail Infrastructure

11. Water

The water group responded to the questions asked at the workshop using an alternative format. The following is an interpretation by the project team of the information received:

Existing risk metrics important to Scotland

WA2	Change in Q95 (flow-duration curve and flow regime is also important)
WA3	Change in deployable output
WA4	Water demand (public supply and other abstractions)
WA5	Supply-demand balance
WA8	Change from sustainable to unsustainable abstraction
WA10	Change in CSO spill frequency

Additional impacts/risk metrics important to Scotland

Changes in groundwater recharge
Number of WFD derogations
Increased sedimentation in sewers due to low flows
Increased drought frequency and severity (relates to impact 3 – Major drought)
Increased sewer flooding (relates to impact 2 – sewer flooding and CSO spills)
Changes in raw water quality (relates to biodiversity impact)
Reductions in sewage treatment works performance due to low flows
Increased impact of discharges on receiving watercourses (at low flows) mostly relating to pollution sensitivity
Reduced impact of discharges on receiving watercourses (at high flows) more focussed on excess volume
Diffuse pollution management issues
Drying out of peat soils
Impacts on catchment runoff of altered planting patterns, crop life cycle (link to Forestry and agriculture sectors)
Failure of governance to respond to changes

Existing risk metrics less important to Scotland

WA1	Relative aridity
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12. General impacts

Impacts important to Scotland

1	Customer demands for retail, manufacturing and engineering in a changing climate (opportunities)
2	Emergency response to climate events including planning and implementation
3	Changes in UK trading patterns with overseas primary product/raw materials suppliers due to permanent crop production/ecosystem changes
4	Outdoor leisure, sport and tourism: opportunities and risks
5	Emergency response to increase in grassland and forest fires
6	Key workers unable to get to work due to extreme events or infrastructure failure
7	Immigration to EU countries (including UK) and northwards migration within EU space

Additional impacts important to Scotland

Scottish resilience
Political decision making, strategic leadership, lifestyle adaptation

Impacts less important to Scotland

8	Need for international emergency aid
9	More frequent air pollution episodes over the UK

Consequences of some of the important climate change impacts for Scotland

In the morning session the participants were asked to identify up three key impacts for Scotland in their sector which they wanted to work on in more detail in the afternoon. There was a short plenary session where all the key impacts were shown on the screen and there was a short discussion around that list.

- The issue of distinctions between sectors was raised with specific reference to marine and biodiversity. It was highlighted that many of the impacts in biodiversity appear to be relevant to the marine sector. It was explained that for practical reasons impacts had been assigned to sectors and agreed that it was in some cases essentially arbitrary, and if it was relevant for their sector then it was fine to examine it further.
- It was emphasised that participants should not assume that another sector would be covering an impact and that it was fine to have an overlap between sectors in the workshop.

After the plenary the participants went back into their small sector groups and worked through each important impact, filling in Worksheet 3 which focused on consequences and data. Full details of this exercise are in the full workshop record. The impacts focused on are listed below:

Agriculture

- Impacts 6 and 14: Indigenous and exotic diseases become more prevalent
- Impact 3: Seasonal weather patterns change and alter demands on livestock and crop management
- Workshop additional impact: Vulnerability of remote communities

Biodiversity

- Impact 10: Asynchrony between e.g. species breeding cycle and food supply
- Impact 4 + 5 Pest, diseases and invasive species
- Workshop additional impact: Ecosystem functioning: loss of services through loss of services through loss of keystone species.

Built environment

- Impact 6: Cultural heritage in flood risk areas
- Workshop additional impact: Extreme weather events (Intense rainfall, driving rain, high winds)

Business, industry, services

- Impact 5: Flooding (fluvial and pluvial) affects/leads to loss/ temporary failure of assets and delays with increased CAPEX/OPEX
- Workshop additional Impact: Global markets – changing consumer preferences and ability to get product to international markets

Energy

- Workshop additional impact: Renewables - risk or opportunity?

Flooding

- Impacts 1a, 2a, 1b and 2b: Flooding (all types)

Forestry

- Impact 4 Biodiversity loss
- Impact 5 Wind throw (associated with water logging)
- Impact 1 Pests and diseases impact negatively on forests

Health

The Health Sector group did not get to this task and spend more time on reviewing the Tier 2 impacts instead.

Marine and fisheries

- Extreme weather events
- Impact 3: Ocean acidification
- Biodiversity Impact 11: Increase water temperature and stratification of water bodies

Transport

- Impact 1: Flood disruption/delay
- Workshop additional Impact: Heat on passengers/staff
- Impact 2 on Additional Impacts: Wind/storm damage/disruption

Water

- Water quantity – long-term impacts
- Changes to extremes
- Water quality

Cross sectoral/general

- Impact 4: Leisure, sports, outdoor and tourism opportunities
- Impact 2: Emergency response and recovery including planning and implementation

- Workshop additional impact: Scottish resilience and political decision-making: Are we prepared?³

Reflections on climate change impacts that are particularly important for Scotland

Clare Twigger-Ross asked participants to have another look at the important themes they had identified in the first exercise in the morning and to consider whether:

- All of the headline messages had been covered by the work during the day
- They would want to change any of the headline messages.

The main points put forward were:

- Broadly covered all the headline topics
- Ecosystem services should be recognised as cross-sectoral
- Did not cover societal tolerance, i.e. expectations and acceptability of risks
- Not much discussion of the reputational risk to Scotland/public sector in terms of risks associated with not responding appropriately
- Need to consider a measure of the proportion of GDP allocated to adaptation response

Next Steps

The next steps for the assessment of climate impacts for Scotland were outlined. These are:

- **Workshop record**
 - The CCRA team will circulate a draft within three weeks
 - Participants should send back corrections or changes
- **Online feedback** (<http://ccra.defra.gov.uk/>)
 - Stakeholders can use this facility to post details of additional evidence
 - The online feedback will remain open until 11th October 2010
- **Continuation of data collection**
 - A data spreadsheet is available which shows the information gaps that are currently identified. Stakeholders are invited to provide information to fill these gaps. It was requested at the meeting that this be emailed to all participants.⁴

³ This is interpreted as relating to Scotland being able to progress towards and maintain sustainable growth.

⁴ Post workshop note: The data spreadsheet was issued on 5th October 2010 and participants were given until 15th October 2010 to provide information regarding suitable data sets.

- **Sector analysis**
 - Draft sector analysis reports will be available in November 2010
 - Details will be provided as soon as possible of future sector stakeholder engagement.⁵
- **Tier 2 impacts for Scotland**
 - A draft list will be circulated for comment (date to be confirmed), with approximately two weeks for review.⁶
- **Scotland's chapter of the DA and English Area Report**
 - A draft will be circulated for comment in early 2011 (date to be confirmed), with approximately three weeks for stakeholder review.

⁵ Post workshop note: This is likely to take the form of an online feedback opportunity once the draft sector reports become available during November 2010.

⁶ Post workshop note: The list is likely to be circulated in late October 2010. The primary purpose of this list is to identify what is important for Scotland. However, the list will also indicate which impacts we plan on adding to the detailed analysis.

FULL WORKSHOP RECORD

The CCRA Workshop for Scotland workshop was held in Glasgow on 23rd September 2010. The aims of the workshop were to:

- Ensure participants understood what the CCRA involves and bring them up to speed with progress so far.
- Compile a list of high priority climate change impacts for Scotland, including related consequences and the data sets that could be credibly used in the analysis of these impacts.
- Brief participants on how their input will be used and identify next steps for the project team and participants.

The views expressed during the workshop will be taken into account in developing the CCRA, alongside other evidence sources.

Please note: Contextual information about the day is outlined within a grey box. Where additional points have been added to the record these are either outlined as footnotes or within the appendices.

1. Sessions 1& 2: Welcome and Update on the UK Climate Change Risk Assessment

James Simpson (Scottish Government) welcomed participants and handed over to Clare Twigger-Ross (CEP) who was the facilitator for the day. Clare Twigger-Ross took participants through the aims and agenda, the working agreements, health and safety arrangements. Following this Ian Townend (HR Wallingford) gave an update on the progress of the CCRA project⁷. This was followed by a Q&A session.

1.1 Plenary - Q&A on update presentation

Question	Answer
Is there any weighting of risks, e.g. by population	Team: The basis for scoring the Tier 1 lists is set out in the method. Tier 2 is being developed by first defining response functions and then projecting the changes in each risk metric forward using climate scenarios. The results are then modified to take account of forecast socio-economic changes. As such there is no weighting but a scaling based on defined assumptions as to how things may change. We are investigating whether we

⁷ The presentation slides can be found in Appendix 1.

Question	Answer
	simplify the presentation of the resultant outputs into some consistent basis across all sectors and all risks (eg a high/medium/low categorisation).
From Tier 1 to Tier 2, clearly a lot of sifting out – opportunity to put Tier 1 impacts back in? .	Team: Yes – the process is iterative and the Tier 1 list is not “lost”. And today is an opportunity to identify any risks relevant to Scotland
Many datasets will be quite “messy” – not necessarily fit for purpose. How will this be handled? .	Team: Where possible data will be taken in the form it is and used to create response functions. However in some sectors it is recognised this won’t be possible (e.g. business, biodiversity) – in these cases, other means of illustration will be used – such as case studies. Response functions will be written up in detail in the reporting.
Recognise the process is “imperfect” – but, are the metrics sacrosanct? Example SOSI (security of supply index) which may be relevant. .	Team: Metrics at UK level are pretty much determined due to timescales – but there is flexibility to introduce new metrics as part of the Scotland / other DA work.
Not convinced that Tier 2 list bottoms out cross-sectoral and secondary impacts. In Scotland there are sector committees inputting to the CC adaptation framework – same timelines? .	Scottish Govt: Statutory adaptation programme / action plan in Scotland will follow UKCCRA. Today’s process is non-statutory, but will feed into the later statutory process / programme. Team: In terms of cross-sector impacts / actions. There are many examples of impacts which could be included in a number of sectors. Our “Systematic mapping” process is intended to help identify and understand these cross-sector impacts.

2. Session 3: Headline Messages for Scotland

The purpose of the session was to provide an opportunity for participants to discuss which climate change impacts are particularly important for Scotland without the constraints of the UK-wide list of impacts. Working in mixed-sector groups, participants discussed what they would tell a minister if s/he asked them what important impacts climate change will have on Scotland and then they wrote up to 8 impacts on post-its. The groups came together and Clare Twigger-Ross ran a session to cluster the impacts. Participants then discussed the themes that emerged.

2.1 Clustering of important impacts

The impacts were clustered as follows:

Water Quantity and Quality

- i) Water scarcity: what tools do we have to deal with?
- ii) Increased vulnerability to drought (water supply, agriculture, industry)
- iii) Public water supply
- iv) Water management supply/demand. Cross-sectoral. Volume, frequency, location of rainfall. Variability/uncertainty. Pollution impacts

Flooding and response

- i) Flooding
- ii) Opportunity to use land for flood storage

Inequality

- i) Flooding: increased number of people at risk from multiple sources of flooding (social vulnerability)

Health and diseases

- i) Rise in vector borne disease – especially Lyme’s disease. Increase outdoor activity could see rise in incidence. Warmer winters could mean more ticks.
- ii) Public health
- iii) Pest and disease. New varieties which we are not able to deal with
- iv) Greater opportunities for outside activities, positive physical and mental health consequences

Extreme events and weather

- i) Extreme weather events – variability and increase – all sectors.
- ii) Severe weather/flooding issues, extreme winters becoming the norm.
- iii) Extreme events – rainfall – increased frequency wind/ice/sea level/heatwaves
- iv) Extreme weather events

Biodiversity

- i) Biodiversity requires early action because it is being impacted now
- ii) Biodiversity: increased pollution risk; edge of range; eutrophication (low BOD conditions); resilience/environmental stress; direct/indirect change
- iii) Biodiversity positive and negative
- iv) Biodiversity impacts – ecosystems services – so much unknown
- v) Loss of coastal habitats unique to Scotland e.g. Machair Old Course dune systems. Coastal land squeeze, sea levels and erosion
- vi) Ecosystem resilience
- vii) Biodiversity: protected areas compromised by climate change. Do we Realign Directives? Or what?
- viii) Species loss and out of synch reproductive cycles

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- ix) Ecosystems: very complex systems need to be understood so we can foresee multiple/complex impacts. Impacts on ecosystem services
- x) Non native species – potential impact on all sectors

Rural and Urban

- i) Central belt/Highlands and Islands (rural vs urban): different impacts across Scotland.

Economy and employment

- i) Tools: Economic opportunity to produce “ideas”/innovate that others (outside Scotland) want to buy
- ii) Skills deficit to cope with flooding/building/campus issues resulting from weather changes – need better trained workforce
- iii) Capacity to cope (economics and organisational capacity) negative and positive

Contingency planning

- i) Extreme weather - contingency and emergency planning needed and ability to deal with aftermath – links to skills
- ii) Communications: ensure we understand the risks and who (if anyone) is taking responsibility

Governance and security

- i) International issues: Scotland will be impacted e.g. migration
- ii) Affordability: tweak what we already do, not necessary always to characterise adaptation action as requiring “new money” (but some times we will need new money!)
- iii) EC Directives - lots of targets set to changing climate – targets are set based on historical climate data and may no longer be valid. All sectors.
- iv) Scottish Govt. desire to be world leader on climate change
- v) Impacts will be worse if there is political inflexibility in decision making.
- vi) International dimension – opportunities for Scotland

Infrastructure – transport, other

- i) Impact on infrastructure railways/roads/power lines etc. Need to make infrastructure more resilient
- ii) Critical national infrastructure: how robust to climate change?
Transport/Communications/Water/Remote communities
- iii) Interruptions to utilities services
- iv) Persistent heavy rainfall resulting in landslides affecting transport networks
- v) Increased risk of flooding to electricity infrastructure
- vi) Infrastructure resilience and supply chains
- vii) Transport network – getting products to markets; accessibility of population to services

Culture and tourism

- i) Economic opportunities: tourism, longer growing season, lower energy costs
- ii) Loss of cultural heritage
- iii) Tourism: -ve and +ve. Warmer temperatures and accessibility via air travel but more midges and ticks and threats to coastal golf courses.
- iv) Warmer weather could increase tourism
- v) Social behaviour: expectation/use/riots. Contentment? Willingness to pay? Settlement patterns. Consumer patterns trade.

Energy

- i) Increase in ambient temperature will reduce capacity of electricity infrastructure
- ii) Renewable energy opportunities
- iii) Energy security: constant baseline for households/business
- iv) Renewables: hydro, wind, tidal/waves – change to conditions, location impacts. Energy use patterns.
- v) But uncertain environmental impacts of “wet” renewables. Long-term monitoring required – adaptive management.

Aquaculture

- i) Aquaculture – farming of fish need robust caging and culture change to eat different species of fish.

Agriculture and Rural

- i) Lengthened growing season may translate to higher yields (arable and grassland)
- ii) More intense rainfall may impact on potential for soil erosion leading decreased productivity and off-site impacts.
- iii) Agriculture and aquaculture: food supply/security. Capability/opportunities, response of landholders.
- iv) Appropriate responses to waterlogging – not draining organic soils but maintaining productivity of wetter mineral soils.
- v) Changes in farming crop cycles and crop growing capacity due to temperature and precipitation etc. Farm can adapt due to short crop cycles. Forestry can't – 60 years for a tree!

Land Use

- i) Land use: work for and promote multiple uses of land. Single use for land not sustainable. (land lost to housing migrant species, population etc.).
- ii) Agriculture: more land area has potential for wider range of crops but may not be possible in practical terms (e.g. trafficability)

Built environment and planning

- i) Increase demand for summer cooling

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- ii) Built environment: cavity fill insulation for mitigation of climate change may not be right for adaptation to climate change (wind driven rain, flooding).
- iii) Built environment: risk of overheating of buildings overplayed for Scotland (needs to be monitored though)
- iv) Landscaping – effective land-use planning e.g. housing, drainage, flooding.

2.2 Plenary – discussion about the task

Seems to be a greater emphasis on rainfall / flooding / water than on heat / warmer weather – perhaps a link to the Scottish psyche!?
Actually in short-term this probably reflects the likely impacts – rainfall is likely to be the predominant / most important change.
Remark that there is little on Scotland in context of rest of world / UK – e.g. need to ramp up food production / obligations in relation to bio-fuels / potential migration population increase if southern areas of EU become less favourable to live in (due to heat). Also issue of sea level rise seems to have been missed. In addition heritage / historic aspects are not highlighted.
Impacts on remote and isolated communities may be very difficult to manage / deal with, and may be quite different from other areas of the UK.
Sea level rise does matter and is still an issue for Scotland – however as Scotland is still rising following last ice age, this is perhaps less of an issue than in other areas of UK.
Uncertainty of climate is also a key issue – e.g. projections around wind-speed are uncertain – and these uncertainties may be very important for Scotland. Comments that it could be “nice” in Scotland if warmer – but actually it may end up just being “grey” and foggy! Basically not certain, and need to deal with / recognise these uncertainties.
Uncertainty around the predicted changes, and the response of policy makers / budget decisions – need discipline to define impacts very carefully and understand consequences in order to enable / inform decisions.
Investment decisions are being made in light of current risks. Trying to future proof them in the light of possible future risks / conditions. Good that “risk assessment” is being used in this process, as this is a process / terminology that business will understand and already use.
Issue around impacts – e.g. around mortality and morbidity projections – there is uncertainty around the change in the variable (temp) rather than the consequence (mortality). UKCIP – uncertainties are explicitly reflected in the way that variables are presented in scenarios (probabilistic).

3. Session 4: Tier 2 list of impacts

Helen Udale-Clarke introduced the next session and explained how the Tier 2 list of impacts had been developed⁸. The purpose of this session was to identify the most important impacts for Scotland by reviewing the impacts already identified, to identify impacts that are particularly important that are missing from the list and to provide supporting evidence. Participants worked in sector-based groups to complete two Worksheets. The cross- or non-sectoral impacts on the list were allocated to a “General” group.

At the end of the session, each sector group was asked to choose up to 3 impacts that they would like to focus on after lunch.

3.1 Impacts on the existing list that are particularly important for Scotland and why they are important

Table 2: Impacts that are particularly important for Scotland

Impact N°	Impact Name	Comments
AGRICULTURE		
	General comments	All the impacts highlighted below for Agriculture have impacts on the food and drink industry (e.g. whisky industry)
6 +14	Pests and Diseases (crops) Exotic diseases become resident and occur with increased frequency (crops and livestock)	Scottish agriculture is 40 – 50% livestock. E.g. Netherlands blue tongue outbreak led to 30% loss of production. Reputation of Scottish product is critical to market. Seed potatoes critical to economy because disease free. Need skills base to recognise and deal with such problems. Direct impact on exports.
3	Flooding (livestock) and waterlogging. Seasonal pattern changes alter demands on livestock management	Management of animal waste Feed for extended periods of stock housing Longer growing season(positive); wetter winters leads to more water logging and can't put livestock into the fields (negative).[This is distinct from flooding]. Waste storage fills up sooner because animals are being housed for longer and overflows - can lead to pollution. Heavy rainfall can exacerbate the problem.
7	Drought effects (soil moisture availability) More demand for irrigation during drier	Probably mainly effects the East coast crop growing areas.

⁸ The presentation slides for this session can be found in Appendix 1

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Impact N°	Impact Name	Comments
	summers	
8	Stress factors (crops)	May be an increased opportunity (reduced stress) or it becomes possible to grow crops at higher latitudes
5	Salt water intrusion	Not Important for Scotland
16	Stress factors (livestock)	Agreed less important for Scotland
18	GHG emissions	High proportion of peat soils. Land use changes could have influence. Not sure why this is here but depends on other attributes. Political issues – re: 80% target.
BIODIVERSITY		
1	Increased SMD and drying	Probably less important in Scotland but locally important for some key habitats (e.g. peat bogs)
4 + 5	Increased risk of pests and diseases (including alien invasives)	
18	Asynchrony between a species breeding cycle & its food supply	Should be elevated (e.g. golden plover) because impacts are identifiable now.
7	Species unable to track changing climate space	Important for Scotland in terms of altitude
17	Generalist species favoured over specialist species	Important for Scotland elevate to blue – plenty of species specific data to use in analysis
6	Major drought events	Less important for Scotland
BUILT ENVIRONMENT		
General comments		Most of the impacts highlighted in blue would be downgraded for Scotland – the list is London-centric, similar problem to Scotland is English Regions and Wales
		There is a strong feeling that a large number of impacts are excluded, many of those were present in Tier 1. In particular, relating to wind, rain, frost (in the current blue list the impacts are mostly heat related). The problem is that it appears that lack of a metric for an impact leads to its exclusion. This misses crucial risks to the sector.
		There is water in cities as well as green space.
6	Cultural heritage in flood risk areas	Data is available . Historic Scotland
8	Pest infestations	Aggressive beetles in southern UK with the changing climate northward migration could be a problem. Use data from England.
5	Demand for heating	Needs demand for cooling as well – metric= cooling degree days

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Impact N°	Impact Name	Comments
BUSINESS, INDUSTRY, SERVICES		
2	Coastal erosion and flooding of natural and tourist assets	Whisky distilleries, golf-links courses, historic sites
5	Flooding (fluvial and pluvial) affects/leads to loss/ temporary failure of assets and delays with increased CAPEX/OPEX	Grangemouth and other parts, Scottish whisky stock storage.
6	Operational disruption and reliability of ICT requiring additional cooling (from high temperatures and heat wave).	Opportunity for Scotland re: data centres moving here.
9	Disruption from flooding of assets, transport links and supply chain.	Further to go to market, fewer arterial routes, global risks, transport to and from islands e.g. scotch whisky
10	Changing holiday trend leads to new markets.	Good opportunities for Scotland, staycations, longer seasons. Also threat to skiing in Scotland.
11	Impact on operations from lack of available water resources either through shortage and competing demands of others (including conflict with other users?).	e.g. Scottish whisky – public water supplies might be prioritised which would therefore affect operations in terms of whisky.
12	Extreme weather and changes to rainfall patterns impacts storage, supply and disposal of volatile and hazardous chemicals.	This is a growing industry in Scotland and therefore important.
ENERGY		
1 + 4	(1) Flooding of electricity and gas infrastructure: capacity loss (4) Flooding of power stations: capacity loss	Already currently an issue in Scotland for sub-stations.

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Impact N°	Impact Name	Comments
2 + 5	(2) Demand for cooling (5) Transmission efficiency	Increased consumption during Summer – can't take equipment out for maintenance., reduction in capacity
6 - 10	THE EXPERTISE TO EVALUATE THESE IMPACTS WAS NOT PRESENT AT THE WORKSHOP	
3	The group did not understand this impact.	
FLOODING		
4a and 4b	Damage to critical infrastructure	Question of metrics Need hospitals to be the metric Critical community aspects. Data is available
1a, 2a, 1b and 2b	River and Tidal flooding	Very important for Scotland, cross cuts to Transport, urban vs rural. Very big impacts on the economy. In terms of metrics FL4 agricultural productivity loss or land grade change cross-cuts to agriculture and for FL8 Road class and rail by frequency for independent flood areas there are few alternative transport options in Scotland.
5	Flood insurance collapse	Metric not comparable with Scotland as there is no 1:75 data, Scotland uses a 1:200 year indicative flood map.
FORESTRY		
4	Biodiversity loss (and ecosystem service)	Positive opportunities for forestry. Many other risk metrics to offer which are most important to Scotland (native pine woods)
5	Water logging	Needs to be considered in conjunction with wind throw
1	Pests and diseases	Metrics can be different for Scotland also some pest/disease species have fairly long-time series data (spruce bark beetle)
HEALTH		
9	Extreme event (flooding and storms) injuries <u>and other health impacts including mental health impacts</u> (and wider service delivery impacts associated with healthcare estate/transport disruption/failures)	More important than fatalities (which can't always be mitigated against also needs to cover gastroenteritis etc. skin complaints.[Risk 3 lower and Risk 9 higher]. It is the failure of infrastructure which is more likely to cause fatalities.
12	Water quality and water borne disease	Greater consequences in Scotland: have higher instances of e-coli in Scotland and if more rainfall the increase in animal effluent runoff will exacerbate the problem and more people in the remote communities are served by private water sources rather than the mains in Scotland.

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Impact N°	Impact Name	Comments
7	Sunlight/UV exposure	This was felt to be lower for Scotland. Much higher uncertainty surrounding this and whether it would actually be a risk for cloudier future.
16	Medicine efficacy	Could drop off as this only really kicks in at 25C so much less of a problem in Scotland.
13	Winter air pollution	Less of a risk as temperature inversions fall. However, summer air pollution could be far higher if it is sunnier. Air quality monitoring data is held over a period of years which could feed into this. Further work therefore may not be necessary but it is essential that this is acted on.
11	Demand for emergency medicine <u>and emergency services</u>	Of far greater impact in rural and remote communities which could be more cut off by extreme weather events. But on the other hand a huge flood in central Glasgow would impact more people and they are less likely to have built in adaptive/resilience measures such as back-up energy generation
MARINE & FISHERIES		
7	Alien/Invasive species (marine)	Consequences of increase of invasive species would be of more significance to the Scottish economy. Case studies on invasive sea squirt – Scottish Mariners. Case study – B??s water and fouling – Marine Scotland Science
9	Sea ice and icebergs	Unsure whether risk metric is most appropriate. Opening of shipping routes: Also economic opportunities for Northern Isles in particular – opportunity for transport/business; potential damage risk to marine biodiversity. Does not need to be “promoted” under marine list but should perhaps be looked at under TRANSPORT.
5	Coastal squeeze	Question raised about whether this is a Scottish as well as UK level – general consensus that it is – it should include coastal erosion.
TRANSPORT		
1	Flood disruption and delay (transport)	The group generally thought the ranking was correct. Question about ferries – the cost of disruption and repair work
2	Subsidence (transport)	Less important in Scotland due to geology. <u>Definitions need to be clearer</u>
3	Energy demands (transport)	DECC data on emissions. Metric about cars is one dimensional - would be good to think about other modes of transport. Capacity issues? (energy). Too narrow a focus as an impact. Imports. What does the term “energy demands” refer to?
4/5	(4) Thermal Loading on Hard Surfaces (5) Heat Stress on Rail Infrastructure	Reduced priority due to lower temperatures BUT what about the potential impact of water/flooding/wind instead? If temperature increases – Scotland can learn from others – question about the cost of

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Impact N°	Impact Name	Comments
		retrofitting? Need longer term infrastructure planning.
6	Cold weather working/travelling	Definition – what is meant by this? Advance planning – impacts on workers in other sectors + transport sector (increased heat)
From the additional impacts list		
1 + 2/3	Erosion and landslides links to 2/3 wind/storm damage/disruption	Network closures = long diversions. <u>Should be given more importance.</u> – transport network is more thinly spread.
2/3	Wind/storm damage/disruption	Disruption may occur more often. Cut off parts of network. <u>More importance needs to be given to these.</u> Connections to England (rail/road).
4	Insurance cover	Links to abover – so would also increase the priority of this impact.
5	Leaf fall	Biodiversity links? Temperature increases to attract animals – cause problems.
6	Disruption to road repairs	Statistics weather/delays available. Economic costs of these? Tourism? Links to health/accidents – costs involved related to weather.
WATER		
The water group responded to the questions asked at the workshop using an alternative format. The following is an interpretation by the project team of the information received (risk metrics are listed rather than impacts):		
WA2	Change in Q95 (flow-duration curve and flow regime is also important)	
WA3	Change in deployable output	
WA4	Water demand (public supply and other abstractions)	
WA5	Supply-demand balance	
WA8	Change from sustainable to unsustainable abstraction	
WA10	Change in CSO spill frequency	
CROSS- AND NON-SECTORAL		
1	Customer demands for retail, manufacturing and engineering in a changing climate (opportunities)	Drop “retail” from this. Impact not key for Scotland. Engineering opportunities – renewables, buildings protection/maintenance, water capacity. 1a Engineering and manufacturing tie in with North Sea infrastructure skills and technical capacity. 1b Built environment and infrastructure – separate issues and potential e.g. SUDS, air control, water

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Impact N°	Impact Name	Comments
		management, fabric maintenance and design – business opportunities Very important for Scotland 1a and 1b
2	Emergency response to climate events including planning and implementation	Metrics should include magnitude of events, not just the number. Aftermath clear up and long term planning – need more. Move ‘Beyond coping’, to rely less on an emergency response. Need joined up response/planning Add “recovery” to the impact
3	Changes in UK trading patterns with overseas primary product/raw materials suppliers due to permanent crop production/ecosystem changes	Timber, cereals – availability and prices elsewhere will drive land use decisions in Scotland also. Need to distinguish between what we produce at home and what we import. Need more fully to map out the change in UK trading patterns and look at a broader range of impacts. Change UK to Scotland in wording of impact. Contributions to a Scottish GDP – need to understand what the key elements of this are and look at those.
4	Outdoor leisure, sport and tourism: opportunities and risks	Important yes. Tourism high contribution to economy. More tourists will lead to more risks also. Potential loss of GDP as a result of impacts on tourism.
5	Emergency response to increase in grassland and forest fires	Merge this with Impact 2 - e.g. insert this into the metrics for Impact 2.
6	Key workers unable to get to work due to extreme events or infrastructure failure	Yes important - mobility and transport of goods and delivery of services. Movement of people. Key workers doctors, fire-fighters etc. Huge impact. Will need “professional evidence” – may not be data.
7	Immigration to EU countries (including UK) and northwards migration within EU space	Massive and not understood. Call it climate change refugees not immigration. Whether displaced or chosen to move! E.g economic advantage of moving, business opportunities.
8	Need for international emergency aid	Important to consider impact of climate change on other parts of the world. This may direct ££ away from emergency aid.
9	More frequent air pollution episodes over the UK	Not important? Some

3.2 Impacts additional to the existing list that are particularly important for Scotland

Table 3: Additional important impacts for Scotland

Impact Name	Why it is important for Scotland?
AGRICULTURE	
Vulnerability of remote communities	Only source of income and therefore may lead to abandonment (refer to “loss of particular landscapes” under additional impact on list for agriculture)
Heat stress when transporting livestock	May be minor because distances not huge but require changes to existing practices
Run off/erosion and leaching	(one of the additional impacts already listed) often combined as a result of heavy downpours. Need to think of pathogens as well as fertilisers.
BIODIVERSITY	
Altitudinal aspects of species ??? tracking changing climate space	Scotland has more mountains! Therefore more biodiversity issues relating to changes in altitude.
Ecosystem functioning: loss of services through loss of keystone species	Data set from National Ecosystem Assessment project (NEA)
Impacts on protected area networks	Risks of infraction of EU directives (political/reputational risk).
BUILT ENVIRONMENT	
Extreme weather events	Driving rain, high winds, concentrated rainfall. At present the list is <u>very</u> heat focussed!!!. Scotland needs a rain focus as well. The projections show this. Not included at all but critical in Scotland. Evidence: data for climate ?? will get.
Blue space	In addition to green spaces
BUSINESS, INDUSTRY, SERVICES	
Education and skills, adaptation of skills	Migration issue, renewables etc - opportunity
Agricultural and forestry impacts in general. Make stronger link.	Food and drink industry extremely important to Scotland
Changing consumption will lead to changing markets	e.g. textiles, woollens etc. not just for the Scottish markets but also global markets will reduce.
New markets for products	e.g. waste water
Bumble bee disease	Soft fruit industry important to Scotland
SMES	
Global markets – import or export	Scottish business sector is export focussed. Climate Change will impact changing consumer preferences and ability to get products to international markets.
ENERGY	
Renewables – risk or opportunity?	Large proportion of energy production in Scotland is from renewables which are dependent on the weather

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Impact Name	Why it is important for Scotland?
	e.g. wind/growing crops. It could make Scotland more resilient but also there is the issue of extreme weather events.
Possibly something on North Sea oil and gas but the expertise was not available at the workshop	
FLOODING	
Coastal erosion, flooding (tidal and river)	Cultural heritage – archaeology, current heritage needs due consideration. EU floods directive includes it. Historic Scotland has data
Planning	Links to Impact 5, planning needs to be included planning blight – no development in uninsurable areas.
Geomorphological issues	Ties in with Impact 2a but is not addressed. Changes to stream - flow predictors – rainfall. Metrics: channel type tied to CNI, population, habitat, business, cultural heritage.
Snow melt	Potential additional input to (extreme) fluvial flood events; estimation accuracy - uncertainty. Impact on seasonal flow patterns and on to water supply, habitat/ecosystems, flooding (social, econ, cultural heritage)
FORESTRY	
Increasing productivity of forests (m ³ /ha)	Consequence of increasing CO2 concentration?
HEALTH	
General comment	Key linkage needs to be made between health care delivery and services e.g. built environment and integrity of buildings, primary care and accessibility for health care staff to respond (or limited due to extreme weather). Extreme weather links to built environment, transport and emergency responders
General comment:	Health care estates – what health care need to be provided? More, less, different times of the year particularly with respect to extremes.
General comment:	How big an impact could telehealth have on access for rural communities? e.g. video conferencing in GP surgeries actually under way at present. But obviously this is dependent on climate change proofed IT and still having access after flooding. Estates need to build in capacity for future surgeries.
General comment:	What can actually be put in place to adapt HC estates? If a hospital is in a floodplain do you stay or build new? New is within gift of local authority as part of planning.
Vitamin D deficiency	This is an uncertain impact given cloudiness, but possibly a positive impact if there are fewer cloudy days.
Mould spores	Mild wetter winters will increase these – impacts on asthma [but don't have evidence here] - cross sector

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Impact Name	Why it is important for Scotland?
	link to built environment about how to replenish old damp housing and build more resilient/drier houses.
DATA:	Food borne diseases: Health Protection Scotland has very good monitoring of this. HPS weekly data and annual reports available on the website. Health care Scotland, Health facilities Scotland: energy monitoring for all hospitals is held, extending to collate a range of environmental monitoring (CO2, water consumption, heat, energy) and reporting tool – annual report published from data.
MARINE & FISHERIES	
Increase in water temperature (Number 11 on Biodiversity list)	Marine impacts should be considered under biodiversity sector as it is a driver for a number of the impacts under the marine sector.
Increase on species migration (Number 10 on biodiversity list)	Changing mackerel – economic impact on Scotland. Seabird Sand eels
Sea water temperature change and stratification Changing weather patterns Nutrient input	These are the direct impact on marine which we should focus on understanding first.
TRANSPORT	
General comment: look at uses of the network	
Encouragement of cycling/walking as a policy	How this impacts on climate change cycling/walking not covered in impacts at present. Mobility rather than transport network.
Resilience	How infrastructure responds? How transport network can respond?
Numbers of people coming to Scotland	Stress on systems/infrastructure if more visitors
Investment decisions/policies	Where are funds directed
WATER	
Changes in groundwater recharge	
Number of WFD derogations	
Increased sedimentation in sewers due to low flows	
Increased drought frequency and severity (relates to impact 3 – Major drought)	
Increased sewer flooding (relates to impact 2 – sewer flooding and CSO spills)	
Changes in raw water quality	

Impact Name	Why it is important for Scotland?
Reductions in sewage treatment works performance due to low flows	
Increased impact of discharges on receiving watercourses (at low flows)	
Reduced impact of discharges on receiving watercourses(at high flows)	
Diffuse pollution management issues	
Drying out of peat soils	
Impacts on catchment runoff of altered planting patterns, crop life cycle (link to Forestry sector)	
Failure of governance to respond to changes	
CROSS- AND NON-SECTORAL	
Scottish resilience	Need to maintain core functions, short to long term response and recovery
Political decision making, strategic leadership, lifestyle adaptation	Need this and strategic leadership. There will be competition for political attention. Making the right decisions yes, but need to get to making them – challenging. Need to avoid not being prepared as a result of lack of political leadership. Also what is acceptable to public? To what extent do decision-makers need support and permission to make tough decisions? Costs. Need to move to “Beyond coping” much of what we see is about coping and this is not enough.

4. Session 5: Assessing priority impacts

After lunch participants continued working in their sector groups to describe in detail the consequences of the priority impacts they had chosen in the morning session. Each group completed a Worksheet providing information on:

- The consequences of these impacts;
- Whether they are positive or negative;
- Whether they are economic, environmental or social; and
- How they might be measured.

At the end of the session participants had the opportunity to look at the Worksheets done by other groups.

The impacts that were assessed during this session are the following:

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Impact	Consequences	+/-	Econ, Env, Social	How might these be measured? What data do you hold/know of?
AGRICULTURE				
Impacts 6 and 14: Indigenous and exotic diseases become more prevalent	Image and reputation of Scottish agriculture industry	-ve	Economic	Demand for product base on exports [Possibly an emergent property]. Data on a regional basis may be difficult to get. Customer and Exercise may have something
	Exports banned	-ve	Economic	OIE: global body that deliver what can be done due to disease. SAC – Scottish Agricultural College have done macro-economics Disease surveillance Science and Advice for Scottish Agriculture. Met Offices (Ed) have data on Blue Tongue stress.
	Preventative actions impact on biodiversity	-ve	Environmental	Scottish Crop Research Institute, Dundee
	Destroy livestock	-ve	Economic	
	Crop and animal yield	-ve	Economic	Royal D Vet and Morden Research Institute may have data on loss of productivity due to disease
	Loss of access due to countryside closures	-ve	Social and economic	e.g. Length of footpath closures under BSE. Scottish Enterprise – studies of economic impact on community Fraser of Allander Institute (Strathclyde)
	Wild animals as disease vectors	-ve	Environmental	
	Greater expenditure on treatments	-ve	Economics	Time to develop treatments into country No. of days (climate allows pathogen to survive) temperature greater than X [species specific threshold] No. of wet days greater than Y [crops more vulnerable to disease] Peach Potato Aphid arriving earlier – greater chance.

Impact 3: Seasonal weather patterns change and alter demands on livestock and crop management	Lower livestock productivity	-ve	Environmental	Greater livestock vulnerability
	Expenditure on storage capacity fodder	-ve	Economic	Higher feed costs Great volumes of slurry
	Grazing patterns change habitats	-ve	Environmental	Switch stocks (e.g. cattle to sheep) depending on degree of over winter water logging
	Overspills pollute watercourses	-ve	Environmental	Diffuse impact through run-off and onto bathing waters – days of failure
	Longer growing season	+ve	Economic	Produce more fodder Application for exemptions on spreading slurry (limited to nitrate vulnerable zones) Neil Ritchie
Workshop additional impact: Vulnerability of remote communities	Falling population Loss of employment Loss of skills	-ve	Social	Diffuse pollution – SEPA measures not being followed Correlate point source spills against rainfall McCauley Institute - Rural land use and tourism Land abandonment Crofters association/Commission/Union
	Loss of or change in habitats	-ve and +ve	Environmental	National Agriculture Statistics Climate change makes it more difficult to make a living or allow a switch to different industries/opportunities Marginal land occur may become more important if there is significant migration.
BIODIVERSITY				
Impact 18: Asynchrony between	Asynchrony between e.g. species	-ve (where it is a protected)	Environmental	Use keystone species as case studies, e.g golden plover and crane fly larvae

e.g. species breeding cycle and food supply	breeding cycle and food supply of distribution	species		
		-ve	Economic Environmental	Blue tits/great tits and caterpillars leading to woodland defoliation
	reduction in population size or spread of distribution	-ve	Economic	Midges and human tourists (the prey species) shorten the tourist season results in negative economic impact in rural Scotland
	Protected species	-ve +ve	Economic Environmental and economic	Geese migrating to Scotland in larger numbers and eating crops/grass
Impact 4 + 5 Pest, diseases and invasive species	Invasives impact on native biodiversity	-ve	Environmental (economic)	Correlate abundance of invasive with decline in native? Case studies – red squirrel, rhoddi, Japanese knotweed, native species lost or range contraction? Consider issue of rhoddi in native woodland area and loss of environmental services from woodlands.
	Protected sites decline in condition leads to infraction proceedings with EU	-ve	Social (political reputation)	Protected sites impacted (designated features) by presence of exotic invasives (SNH).
Workshop additional impact: Ecosystem functioning: loss of services through loss of keystone species.	Ecosystem is less productive in terms of the valued service (s)	-ve	Environmental Economic Social	<ul style="list-style-type: none"> - Condition of broad ecosystems – data from NGA project - Keystone species for individual ecosystems is not well known - Water quality derived from bog habitat? - Timber quality and landscape value from a woodland? - Perhaps choose 1 or 2 water catchments and consider in terms of the multiple ecosystems services derived from the catchment - Or look at pollination as a valued ecosystem service linking widely to the health of habitats.
BUILT ENVIRONMENT				
Impact 6: Cultural	Tourism loss of	-ve	economic	Further analysis could include vulnerability to damage. Also

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heritage in flood risk areas	attraction			include importance of site
	Loss of heritage	-ve	social	EASY METRIC – SEPA flood map (coastal and fluvial) with Scheduled Ancient Monuments GIS provides a percentage Future – include pluvial groundwater
Workshop additional Impact: Extreme weather events (Intense rainfall, driving rain, high winds)	Health of occupants (damp and stress)	-ve	Economic Social	Qualitative assessment. Research required – no baseline – need this, it is a future consequence
	Damage to building	-ve	Economic Social	Water ingress METRIC: Insurance claims Roof leak Data from housing associations Beyond scope of this project Test location rather than comprehensive
BUSINESS, INDUSTRY, SERVICES				
Impact 5: Flooding (fluvial and pluvial) affects/leads to loss/ temporary failure of assets and delays	Business continuity	-ve	Economic Social	Insurance industry
<p>METRIC – combine wind loading maps, rainfall figures and projections. Qualitative required. No easy way to measure but of critical importance. Potential for water damage to be recorded by insurance.</p>				

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with increased CAPEX/OPEX, also disruption of assets, (covers energy and business)				
	Loss of essential services (gas, sewerage)	-ve	Economic Social	Difficult to measure direct consequences Historical reports
	Damage to buildings and infrastructure – insurance, redesign	-ve	Economic Social	
	Loss of stock, market share	-ve	Economic Social	
	Un-insurable	-ve	Economic Social	
	Fragile/rural communities more affected	-ve	Economic Social	
Workshop additional Impact: Global markets – changing consumer preferences and ability to get product to international markets	Loss of business has a negative impact on Scottish economy	-ve	Economic Social	SWA Economic Report Food and Drink trade association – economic report Scottish Enterprise data
	Increased demand	+ve	Economic	Macaulay Institute - land use studies. Rural and Environment

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	for Scottish products		Social	Research and Analysis Directorate
	Pressure on Scottish Agricultural land for food production	-ve	Economic Social	
	Product development change the project	+ve	Environmental Economic Social	
	Loss of product	-ve	Economic	
	More container ships required	-ve	Environmental Economic	
		+ve		
ENERGY				
Workshop additional impact: Renewables risk or opportunity?	Growing business sector in Scotland	+ve	Economic Environmental Social	Ofgem – renewables division
	Security of supply	+ve	Social	
	Increase in jobs and upskilling	-ve	Environmental	
	Loss of production	-ve	Economic	
			Social	
	More production	+ve	Economic Social	
FLOODING AND COASTAL EROSION				
Impacts 1a, 2a, 1b and 2b: Flooding (all types)	Agricultural productivity	-ve	Economic Social	FL4 Agricultural Productivity 1. Monetary value – agricultural audit (?) in Scotland 2. Qualitative – Land use categorisation high/med/low. Available in land use data Macaulay Institute

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				3. Area of agriculture SEPA flood map in conjunction with the above.
	Everything productivity	-ve	Economic Social	<u>FL8 Transport</u> Transport Scotland and Network Rail - length of road and rail affected (not preferred - carrying capacity (size/volume economic transfer)
	Community vulnerability	-ve	Social	Needs to be covered by transport or provide datasets
FORESTRY				
Impact 4: Biodiversity loss (and ecosystem service)	Forest health (or design) results in a change in biodiversity value. Loss of biodiversity value most likely to attract early attention if leading to EU infraction for protected sites.	-ve and +ve	all	Protected sites, species? Keystone species? Data sets: UK BAP reports+ Deer numbers increase (FC and Deer Commission)
Impact 5: Windthrow (and waterlogging)	Trees blow over with economic consequences. Raw material for industry supply disrupted	-ve	economic	Wind climate data sets from Forest Research
	Land not suitable for forestry investment	-ve	economic	Soil data/land capability from ML URI
Pests and diseases impact negatively on forests	Loss of raw material for industry	-ve	economic	Spread of diseases threatening economically important species (phythophthora, RBNB (Red Band Needle Blight) etc) Forest research and Forestry commission plant health can supply

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	Loss of new timber forest products/ecosystem services	-ve	all	data. Diseases and pests threaten biodiversity in woodland (esp protected species). Data sources as above.
HEALTH				
This task was not completed by the health group.				
MARINE & FISHERIES				
Extreme weather events	Fish farm structures and escapes	-ve	all	Escape data – marine Scotland – insurance claims.
	Health and safety/lost days at sea	-ve	Economic and social	Lifeboat callouts
	Physical effects on shallow habitats	-ve	all	Natura 2000 site monitoring. Monitoring of marine protected areas
	Wind farm – non-production days	-ve	Economic and social	
	Helicopter no-fly days	-ve	Economic and social	
Ocean acidification	Calcareous areas	-ve	All	Production statistics on aquaculture – Marine Scotland Science Continuous plankton record Partial carbon dioxide measurements (for future)
	Noise transmission			
	<i>General comment: there are others outside of this group who would be better placed to comment on this: EPOCA ocean acidification project (EU funded)</i>			
Increased water temperature and	Effects on plankton bloom	-ve and +ve	all	Environmental monitoring data – Marine Scotland Science Satellite Imagery – Plymouth Marine Lab/SAMS (Scottish

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stratification of water bodies (Number 11 on biodiversity list)	Species shifting	-ve	all	Association for Marine Science) Water Quality monitoring – SEPA/Marine Scotland/SAMS Continuous plankton recorder – SAHFOS/M (Sir Alistair Hardy Foundation for Ocean Science) Marine Scotland Ecosystem monitoring sites Fish: catch statistics – Marine Scotland Survey data – Marine Scotland Surveys for Marine renewables – still commercially sensitive (for future) Monitoring for Natura sites Whales and Dolphins – Sea mammal research unit Shark surveys/tagging
	Migration routes	both	all	
	Pest and disease and invasive species	-ve	all	Marine Scotland Science Food Standards Agency Scotland Fish Farming Notifiable Diseases – Marine Scotland Science
	<i>General comment: General effects.</i>	<i>Generally the immediate effect/consequence</i>		<i>is environmental but all have knock on social and economic</i>
TRANSPORT				
Flooding disruption/delay	Closures roads stations/airports etc. Delays/diversions	-ve	all	Records but not limited to use-data of closures Local climate impact reports/profiles. Exact details of economic impact (airports per minute based on passenger flows etc) Accidents due to weather Impact on tourism How to calculate costs of delay? Impacts on business Modelling needed? Where responsibility lies for flood response? Link traffic data to something else – flood maps etc. Link existing data sets – landslide map/rail records SEPA/Floodline etc/Flood mapping/Infrastructure capacity

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				<p>?? What are metrics designed for?? What are they trying to measure??</p> <p>Not all priorities could be measured – can't focus just on areas where data sets are available</p> <p>Survey of network services to know where links are</p> <p>Flood impact on one mode/route impacts on another mode/route</p> <p>Sick days, first aid calls, compensation?</p> <p>Need investigation in terms of this impact to plan in future</p> <p>Water sold/weather data</p> <p>Avoid transport if temperature too high</p> <p>Increase in energy demand/electricity use</p> <p>Staff productivity</p> <p>Shorter staff working hours</p>
Heat on passengers/staff	Sick days	-ve	All	
	People walk rather than travel by car/bus/rail – longer term policy impact	+ve	All	
Wind/storm damage/disruption	Bridge closures	-ve	All	<p>Insurance industry data</p> <p>Safety/health/issues – number of accidents</p> <p>Wind turbine data</p> <p>Resilience – how manage response – transport</p> <p>Press articles/website hits – Traffic Scotland</p> <p>Calls to emergency service/breakdown services</p> <p>Number of fallen trees/telegraph poles</p> <p>Weather warnings issued</p> <p>Number of vehicles blown over</p> <p>Disruption to ferry services</p> <p>Building standards</p>
WATER				
Water quality – long-term impacts				Data from

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Supply-demand balance				Could track no.s of WRZs in deficit but multiple influences eg availability of funds for investment	Current from SW WRP09
Water demand - public supply				Level of service (eg % of WRZs exceeding target level, or SOSI scores- but poor metrics as depend on investment and politics).	
				Average Distribution input very "noisy" . .	SW
				Could consider ADPW but difficult to generalise across water resource zones, and affected by eg bursts, tourist peaks, leakage levels	SW
				No micro component data available (or being measured) for Scotland	NA
Water demand - other abstractors				Pcc monitor recently established. Again many other factors affecting pcc other than climate change	SW
				Irrigation licensed volume	SEPA
Change in deployable output				Irrigation recorded annual abstraction- very weather-dependent. Might eventually provide a useful time series for relevant parts of Scotland but data only from 2006 at earliest	SEPA
				Possible to track but only reviewed periodically and very dependent on data quality	SW
Changes in water availability for abstraction.				Reduced summer flows causing reduced water availability from direct river abstractions. Some analysis has been done eg rainfall changes between	SEPA/ Met Office

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				standard (Met Office) periods. Rainfall relatively available.	
changes to flow-duration curve, especially Qn95				Changes in Qn95 (or overall flow duration curve) over time.	SEPA has current classification maps/GIS.
changes in groundwater recharge	Locally relevant, significant nos. of abstractions from river floodplain gravels.			?evidence of problems, falling levels	?
changes in flow regimes	impacts on hydropower generation. impacts on food and drinks industries			Would need to correct for other factors eg tariff regime, subsidies. distillery shutdowns due to lack of water	Scotch Whisky Association???
No. of WFD derogations				poor metric as we should be minimising! Again will reflect investment. Only recently started issuing these	
Changes to extremes				?	
Increased sedimentation in sewers due to lower flows, leading to poor performance	poor sewer performance, blockages				
Increased drought frequency				Could count frequency of initiation of drought plans. No data yet, drought plans under development.	SEPA
Increased drought severity	Relative aridity			WAG Population in WRZs at a given risk of deficit. Affected by recent investment. Is this population in water stressed areas- none in Scotland	SW NA

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increased sewer flooding				falling private supplies needing SW support. Noisy as no reliability data. ?	SW
Water quality					
Changes to raw water quality	Increased frequency and severity of algal blooms, treatment problems			Frequency and severity of algal blooms	SW?
				Degree of eutrophication	SEPA?
Reductions in sewage treatment works performance due to low flows	performance (nitrification), compliance issues				
increased impact of discharges on receiving watercourses (at low flows)	need for adaptive management				
reduced impact of discharges on receiving watercourses (at high flows)	need for adaptive management				
diffuse pollution management issues	eg increased nutrient flushing, need for dynamic treatment processes				
drying out of peat soils	impact on colour				
Altered planting patterns, crop life cycle [Forestry]	Impact on catchment runoff				

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Failure of governance to respond to changes [Business/Governance]	Inappropriate regulation, unreliable water supplies, lack of environmental protection, reduced outputs				
CROSS- OR NON-SECTORAL					
Leisure, sports outdoor and tourism opportunities	Growth	+ve	Econ	Visitor numbers, spend (STEAM) increased bed nights (VisitScotland) Length of stay	
	Loss	-ve	Econ	Skiing	
	Variations in seasons (length – longer)	+ve		Ditto for growth (see above). Data from VisitScotland	
	Changes in activities	+ve	Econ	e.g. loss of skiing and increase in hill biking in Cairngorms Employment (type – seasonal) Investment in different activities Operators – stats? Users Club membership	
	Environmental impact	-ve	Environmental	Visitor numbers (SNH, Cairngorm National Park) Loss of biodiversity; Decrease in water quality	
	Infrastructural impacts	-ve	Environmental and social	Costs, usage levels – investment and compare to use User feedback	
	Increase in visitor numbers			Profit gain/benefits per increase in visitor numbers? Link to points made under growth. Cost of investment and infrastructure – develop ratios. Costs/benefits - is it worth it?	
<i>General comment: impacts will vary according to quantity and quality of water – shift in the type of tourists coming? Lowering</i>					

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Emergency response and recovery including planning and implementation. Emergency response and recovery flooding, wind throw and wildfire etc. Include pandemics	<i>of standards</i> Increased property damage loss	-ve	All	Area at risk, number of properties, time for recovery, building costs – repairs etc.
	Civil unrest	-ve	All	Incidents (police, local authority data, fire and rescue services, Measures of responsiveness – attendance. “Qualitative” signals and trends from professional judgements No data available for some aspects but trends discernible through speaking to practitioners.
	Not prepared to deal with events and no recovery plans	-ve	All	Rates of business failure Data: local authorities, trade associations and business organisations, Scottish enterprise, Highlands and Islands Enterprise
	Loss of business	-ve	All	Hospital figures – morbidity (minor also), bed availability – busy times Fire and Rescue Services - data
	Loss of life and health	-ve	All	Loss of life at large scale incidents Loss of life as a result of large scale incidents – see above for data sources
	Competing priorities for response	-ve	All	Loss of tourism figures – downturn in business investment (VisitScotland)
	Damage to reputation and brand	-ve	All	Claims (ABI). Changes to insurance products and geographical locations.
	Insurance costs and availability	-ve	Economic and social	
	Greater impact on vulnerable groups	-ve	social	

	<i>General comments: Very important to consider these impacts in the context of Strategic Co-ordinating Groups (SCG). The metric is to what extent have these impacts and consequences been dealt with by the SCG and their risk registers.</i>			
Scottish Resilience and political decision making – Are we prepared?	Being unprepared Fire fighting	-ve	All	?
	Best positioning for Scotland	-ve	Economic	Financial and demographic trends, national trends/indicators. GDP Net present value. Well-being global performance measures that place Scotland in international context.
	Economic leakage	-ve	Economic	Imports?
	Increased social deprivation	-ve	Social	Various indices – see Scottish Govt website
	Political tension and disturbance	-ve	Economic and social	Affluent migration, loss of expertise, innovation and industry
	Rhetoric not translated into action	-ve	All	% of GDP invested in adaptation techniques, technologies and infrastructure. Capacity building/awareness raising on benefits of self-reliance.

There was a short discussion around the list of impacts to be examined in detailed which was shown just after lunch. This is a record of that discussion.

Floor: Potential issue in relation to the distinction between marine and biodiversity – especially that a number of issues in biodiversity appear relevant to marine – and may be significantly important for marine, though considered less significant in the broader biodiversity category.

Team: This is an issue. For practical purposes impacts had to be assigned to a sector – and in some cases this is arbitrary. Today is an opportunity to reflect where / if an impact is particularly relevant in Scotland / to a particular sector. If in doubt, include.

Floor: It is really important to capture cross-sectoral issues / impacts – and relationships between adaptation in one sector and potential impacts in others.

Team: Yes, and also don't assume that an impact is included in another sector – we want to be as comprehensive as possible today.

5. Session 6: Have our headline messages changed?

After a short break, Clare Twigger-Ross reviewed the post-it wall developed in the “Headline Messages” session in the morning to see whether the headline messages had changed. Participants reflected on the messages and the extent to which these had been captured by the work during the day.

5.1 Plenary – reflections on the headline messages for Scotland

Concern about ecosystem services and biodiversity topics relationship – as they are related but ecosystem services is much broader than just biodiversity – and should be recognised as more cross-sectoral.

Lack of recognition of societal tolerance / what is acceptable / expectations – actions / policy don't play out in isolation

Broad thought: in a Scottish context / public sector, there is a reputational risk in relation to CC – this hasn't been talked about much, and may be missing – risks associated with not responding appropriately, and how responses relate to public expectations.

Risk to “brand” – especially related to tourism in Scotland.

Need to consider a measure of the proportion of GDP allocated to adaptation response – as opposed to e.g. major infrastructure projects etc which are likely to contribute to climate change emissions etc – need a discussion about the relative investment in “climate good” as opposed to “climate bad”.

People invited to review / add to water sheets.

6. Session 7: Next Steps

Ian Townend outlined the next steps for the CCRA for Scotland. In the immediate future, participants will be sent the workshop record to check and will be able to use the online feedback facility to provide additional comments. In a month or so a draft Tier 2 list of impacts for Scotland will be circulated for comment. The draft chapter of the CCRA Report will be circulated for comment in early 2011.

The next steps for the assessment of climate impacts for Scotland were outlined. These are:

- **Workshop record**
 - The CCRA team will circulate a draft within three weeks
 - Participants should send back corrections or changes
- **Online feedback** (<http://ccra.defra.gov.uk/>)
 - Stakeholders can use this facility to post details of additional evidence
 - The online feedback will remain open until 11th October 2010
- **Continuation of data collection**
 - A data spreadsheet is available which shows the information gaps that are currently identified. Stakeholders are invited to provide information to fill these gaps. It was requested at the meeting that this be emailed to all participants.⁹
- **Sector analysis**
 - Draft sector analysis reports will be available in November 2010
 - Details will be provided as soon as possible of future sector stakeholder engagement.¹⁰
- **Tier 2 impacts for Scotland**
 - A draft list will be circulated for comment (date to be confirmed), with approximately two weeks for review.¹¹
- **Scotland's chapter of the DA and English Area Report**
 - A draft will be circulated for comment in early 2011 (date to be confirmed), with approximately three weeks for stakeholder review.

Clare Twigger-Ross invited questions and comments on the next steps. The following points were raised:

Note	Action
Electronic version of data / metrics sheet is available	To be circulated to participants
Some issues for this first CCRA will be given a "light touch" – these won't be forgotten, but followed up through future projects / research.	

⁹ Post workshop note: The data spreadsheet was issued on 5th October 2010 and participants were given until 15th October 2010 to provide information regarding suitable data sets.

¹⁰ Post workshop note: This is likely to take the form of an online feedback opportunity once the draft sector reports become available during November 2010.

¹¹ Post workshop note: The list is likely to be circulated in late October 2010. The primary purpose of this list is to identify what is important for Scotland. However, the list will also indicate which impacts we plan on adding to the detailed analysis.

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Assessment**

<p>What's a risk metric? A risk metric measures the consequence (e.g. no. of deaths) or impact (e.g. flooding) of a climate variable. Most of our selected risk metrics are measuring consequences. See method report for further details – available on CCRA website.¹²</p>	
<p>Tier 2 impacts have not been selected on the basis of what data is available or what we can measure. The aim has been to choose the most important impacts.</p>	
<p>Floor: Sector review workshops – when? Team: We are currently reviewing our future stakeholder engagement activities. For example, we originally planned 3 workshops in England, but there are now going to be 9. We also have a peer review process in place for the sector analysis reports. Whether sector workshops is the best use of people's time at this stage is yet to be decided – we need to make best use of resources – other feedback means may be used instead.</p>	
<p>Floor: Will workshop record include a copy of the Tier 2 list used in the workshop? Team: Yes</p>	<p>Add to workshop record.</p>

¹²

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=15747&FromSearch=Y&Publisher=1&SearchText=GA0204&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

Appendices

Appendix 1: Presentation slides

A. Update on the CCRA (Slides for Session 2 - abridged)



Contents

- Aims of the CCRA
- Products
- Overview of approach and progress
- Examples of work in progress
- Next steps for the Scottish assessment
- How to be involved
- How is Scotland different from the UK as a whole?

Overall aim of the CCRA

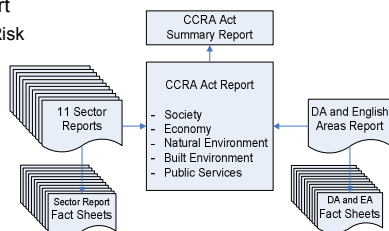
“To undertake an assessment of the risks (including opportunities) from climate change to those things that have **social, environmental and economic value in the UK**, to help the Government create an enabling environment for the UK **to adapt and identify priorities for action.**”

Why is it being done and how will people use it?

- Climate Change Act 2008
- Raising awareness of UK climate risks
- Understand current and future risks (net of anticipated adaptation)
- Learning process – developing capacity
- Inform Government adaptation actions
- New tools for risk assessment
- Policy, pilot studies, monitoring, research.....
- Research needs for CCRA 2017

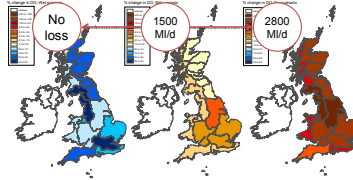
What will the CCRA produce?

- Sector Analysis Reports (11 reports and summaries)
- DA and English Area Report
 - Devolved Administration Risk Assessments (chapters)
 - English areas “*real place/people*” evidence
- CCRA Act Report (themes rather than sectors)



What will the CCRA produce?

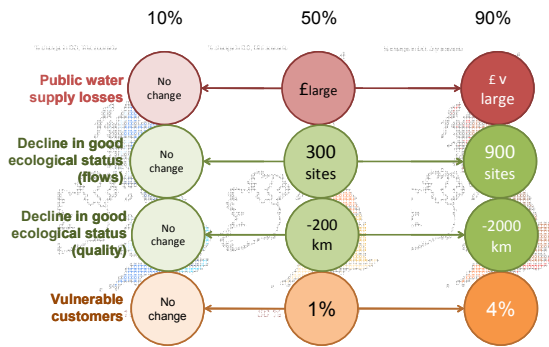
- Consequence Response Functions
- Social vulnerability
- Adaptive Capacity
- Consequences (£)
- Maps
- Comparative risk data
- Inputs to Adaptation Economic Assessment



Scale of assessment: UK, Devolved Administrations with analysis based on UKCP09 Admin areas and basins

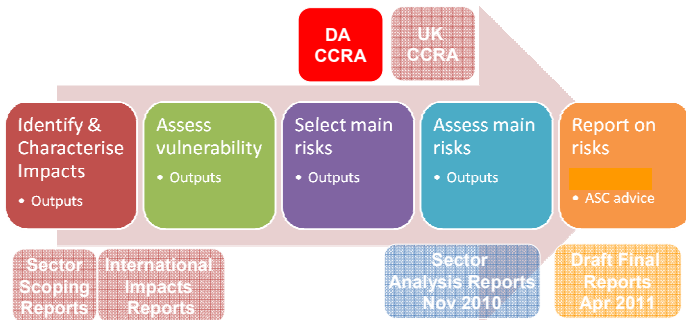
Products – Consequences
Near term (2020s) and longer term (2050s, 2080s)

Example - 2020 Medium Emissions



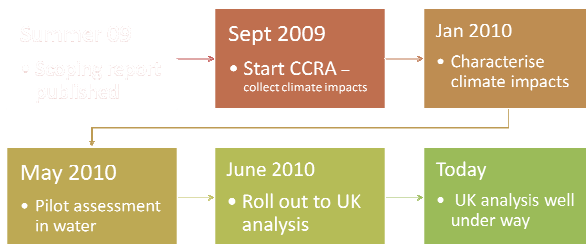
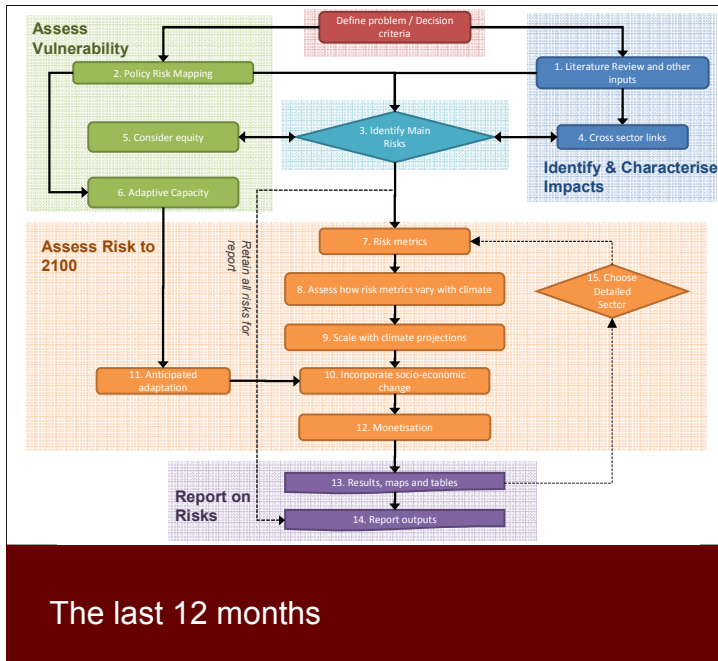
Draft and based on incomplete data – not to be cited

Stages of the CCRA



Work on Adaptation comes later in 2011

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Characterising and selecting the UK-wide impacts

1. Sector scoping reports
2. Initial 'Tier 1' list of impacts
3. Introductory workshops/meetings in Scotland, Wales and Northern Ireland
4. Sector workshops (including stakeholders from Scotland, Wales and Northern Ireland)
5. Revised 'Tier 1' list of impacts
6. Review by Sector Champions (including scoring of impacts)
7. Draft UK-wide 'Tier 2' list of impacts

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Current spatial scale of analysis

	UK scale metric	UKCP09 Admin or basin scale metric
Tier 2 'Definite' impacts	~70%	~30%
Tier 2 'Possible' impacts	~80%	~20%

How will we reflect Scottish priorities?

	High priority for Scotland	Lower priority for Scotland	Does not affect Scotland
Tier 2 'Definite' impacts	Look to include at Scottish scale (if not already)	Continue with current UK-wide analysis	Continue with current UK-wide analysis
Tier 2 'Possible' impacts	Look to include in Tier 2 analysis if clearly a high priority for Scotland (if possible)	Mention in Scottish chapter, but don't undertake analysis	
Other impacts from Tier 1 list			
Previously unidentified impacts			

How to be involved

- Participate in today's workshop
- Review workshop record
- Use the online feedback – for posting details of additional evidence <http://ccra.defra.gov.uk/>
- Help us access relevant data
- Review draft Tier 2 list of impacts for Scotland
- Review Scotland's chapter of the DA and English Area Report

How Scotland differs from the UK as a whole

- **Environmental**
 - Range of extremes
 - Snow cover/melt
 - Hill farming
 - Mountain species
 - Soil, peat & wild lands
- **Economic**
 - Agriculture & aquaculture
 - Forestry & land management
 - Financial sector
 - Whisky
 - Tourism & outdoor activities
- **Social**
 - Rural & remote communities
 - Deprivation levels
 - Health inequalities
 - Population trends
- **Technological & infrastructure**
 - Low population density areas
 - Reliance of road transport
 - Renewable energy

B. The Tier 2 list of impacts (slides for Session 4)

UK Climate Change Risk
Assessment

Tier 2 List of impacts

by Helen Udale-Clarke



The 'Tier 1' list of impacts

- All potential impacts
- Sources include sector reports, workshops and other documents
- About 700 potential impacts identified for the UK

The 'Tier 2' list of impacts

- The 'most important' impacts
- Derivation:
 - Scoring by sector teams
 - Audit including comparison across sectors
 - Review of final list
- Tier 2 impacts will be analysed (where possible) to provide estimates of climate change impacts

Engagement with Scottish stakeholders

- Introductory workshop (March 2010)
- Tier 2 list sent to stakeholders
- Comments collated by Sector Contacts
- Some re-scoring by Sector Contacts
- ‘What is important for Scotland?’ – A version of the Tier 2 list with your comments and scores

Objectives (1): Today

- To identify the most important impacts for Scotland (by sector). New list provides starting point.
- To include:
 - Impacts already identified
 - Impacts missing from the present list
- To identify supporting evidence

Objectives (2): Later

- To produce a list of Tier 2 impacts for Scotland
- Review of Tier 2 list by Scottish stakeholders
- Supplementary analysis (where possible)
- Include Tier 2 list and analysis results in draft Scotland chapter of the CCRA Act Report

Feedback to date (1) - Transport

- Flood disruption and delay ✓
- Erosion and landslides +
- Wind/storm damage +
- Wind/storm disruption +
- Insurance cover/premiums +
- Subsidence ↓
- Energy demands ↓
- Thermal loading on hard surfaces ↓
- Heat stress on rail infrastructure ↓
- Cold weather working/travelling ↓

Feedback to date (2) - Agriculture

- Pests & diseases (crops) ✓
- Stress factors (crops) ✓
- Flooding (crops & livestock) ✓
- GHG emissions ↑
- Biodiversity/wildlife changes ↑
- Breeding habits/reproductive behaviour of species (crops) ↑
- Loss of peat soils +
- Changes in soil & agroclimatic conditions +
- Saltwater intrusion (crops & livestock) ↓
- Drought effects ↓
- Heat stress on workers ↓
- Water demand (crops & livestock) ↓
- Stress factors (livestock) ↓

'Important' impacts

- Consequences high:
 - Social
 - Environmental
 - Economic
- Likelihood high
- Urgent need for decisions

Appendix 2: Tier 2 list of impacts used at the workshop

What is important for Scotland? - A review of the UK-wide Tier 2 impacts

What is this list based on?

The following lists of impacts are based on those issued in the document titled 'Preparatory Materials for Participants', with the exception of Agriculture. The agriculture impacts have been updated.

How is this list different from what you have seen already?

Feedback has been collected by Sector Contacts and the Scottish Government from a number of stakeholders ahead of this workshop. This feedback is presented here and is to be reviewed by this workshop.

Where an impact has been identified as important to Scotland by one or more stakeholders, this has been indicated with a 'Yes' in the appropriate column. Any explanation provided regarding this viewpoint is included in the comments. Additional comments in square brackets are provided by the project team.

Additional impacts identified by stakeholders as being important to consider are listed at the bottom.

What is the difference between the blue and yellow impacts?

Impacts highlighted in blue will definitely be analysed as part of the UK-wide analysis providing that suitable data can be obtained; impacts highlighted in yellow might also be analysed if time permits and suitable data can be obtained.

Where a yellow (possible) risk metric has been identified as important for Scotland, in general stakeholders would like to see it promoted to a blue (definite) risk metric.

What do the numbers in the columns on the right represent?

Part of the process for selecting the impacts for the UK-wide Tier 2 assessment was a scoring exercise, which took into consideration the magnitude of the consequences, likelihood of these occurring and the urgency with which adaptation decisions need to be taken. The UK-wide scores and ranking are given in the column called 'UK score'

For some sectors, Sector Contacts have been able to undertake a rescoreing exercise to help us understand what should be a priority for Scotland. Where this is the case a 'Scot. score' is also given. As a 'rule of thumb', impacts with scores of below 30 are not significant enough to be analysed in detail as part of this first climate change risk assessment.

We are not asking you to do the rescoreing exercise today, but Sector Contacts can provide these if they have already calculated them.

What do the numbers next to the additional impacts represent?

This is the reference number for this impact in our original Tier 1 list of impacts. In other words, we are already aware of this impact, but did not select it for the UK-wide Tier 2 assessment. If there is no number given, this is because this was not in our original Tier 1 list of impacts.

Where might you look for additional impacts?

We have already identified that there could be climate change impacts affecting the following notably Scottish issues. Some of these have not as yet been selected for our Tier 2 assessment (generally because they did not score highly enough for the UK as a whole). Others might only be partially covered. Therefore, this list might help you to identify missing high priority impacts for Scotland.

1. North Sea oil and gas
2. Whisky industry
3. Renewable energy sources (particularly dam storage hydro schemes)
4. Upland/mountain and snow species and habitats
5. Management of peat and wild lands
6. Native woodlands
7. Hill farming
8. Soft fruit/berries
9. Fish farming
10. Freshwater fishing

11. Remote (including island) communities (particularly transport and shipping links)
12. Outdoor pursuits/recreation/tourism
13. Snow related tourism
14. Golf tourism
15. Heritage tourism

Most of the above appear in Scotland's Climate Change Adaptation Framework (The Scottish Government, 2009), whilst others came from the workshop in March.

UK Climate Change Risk Assessment

MARINE

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Harmful Algal and Jellyfish Blooms	MA1 Incidents of non-compliance with EC Directives MA2 Water Quality standards MA3 Water Quality in shellfish waters MA4 Incidents of related human illness			52 (2)	
2	Disease Hosts and Pathogens	MA5 Seawater carbon chemistry MA6 Shell analysis of shellfish MA7 Fish catch data MA8 Catch statistics (cold water fish; warm water fish) MA9 Area designated sites (including freshwater)? MA10 SAFOS data - plankton monitoring data including blooms			44 (4)	
3	Ocean Acidification and dependant species			It would also be helpful to ensure that potential noise transmission (4) effects of ocean acidification are added to this category. This would help to ensure that all closely related impacts will be considered in the next analysis.	44 (4)	
4	Species Shifting (Marine)				44 (4)	
5	Coastal Squeeze			Link coastal flooding (12, 13,47,48,51) and coastal squeeze (14,39,54)	37 (8)	
6	Plankton Blooms (Marine)			Link plankton blooms (18,26), species shifting (15,25) and species migration (21)	37 (10)	
7	Alien / Invasive Species (Marine)		Yes	Should be a definite rather than a possible.	37 (8)	
8	Protected habitat and species (Marine)				30 (13)	
9	Sea Ice and Icebergs	MA11 Reduction/increase in sea passage duration			20 (16)	
ADDITIONAL IMPACTS						
1	Damage to cultured aquatic species (25,65)		Yes	Should be added due to importance of aquaculture sector in Scotland	25 (14)	
2	Scour and stability of offshore			Maybe more of an issue in relation to	10 (24)	

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
	infrastructure (49, 50, 52, 60 , 66)			infrastructure for marine renewables, fishfarming, etc. However, not sure whether this should be picked up under business sector rather than marine.		
3	Breeding / spawning seasons (38)			This has been underscored for economic magnitude. For example, the shift in major zooplankton species has led to a change in timing of plankton productivity, that could have a very serious impact on important planktivorous fish stocks such as herring.	12 (22)	
4	Year Class Strength of Fish (56)			This has been underscored for economic and social magnitude. This definition should be clarified and extended to “commercial fish and shellfish stocks”. Arguably cod recovery is being hindered by climate change and the Scottish demersal industry is suffering considerable economic pain due to the cod recovery plan regulations. Also, shellfish are particularly important to many rural fisheries on the West of Scotland and Scottish Isles. A negative trend in year class strength would have potentially significant impacts on local economies.	10 (24)	

BIODIVERSITY & ECOSYSTEM SERVICES
No feedback received prior to workshop

	UK-wide Tier 2 Impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Increased soil moisture deficits & drying	BD1 Loss of priority habitats (BAP habitats), km ²			85 (1)	
2	Increased water pollution risk & eutrophication	BD2 Number or severity of pollution incidents per year, esp. related to heavy rainfall events. Site specific case studies. <i>Link to Water Sector.</i>			52 (9)	
3	Coastal evolution impacts on intertidal, grazing marsh etc.	BD4 Loss/gain of priority habitats (BAP habitats), km ² related to defence line. <i>Link with Marine and Flood & Coastal Erosion Sectors.</i>			78 (2)	
4	Increased risks from pests	BD5 Case studies of particular pests. <i>Link with Forestry, Agriculture? Aquatic species - Water, Flood & Coastal Erosion?</i>			70 (3)	
5	Increased risks from diseases	BD6 Case studies of particular disease			70 (3)	
6	Major drought events	BD7 Extreme events - combines direct (BD1) and indirect (BD3) impact metrics			49 (11)	
7	Species unable to track changing climate space	BD8 Loss of climate space for priority species (c.f. MONARCH study etc.). Use of JNCC cc indices for vascular plants, breeding birds, butterflies. Habitat			63 (6)	

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
8	Major coastal flood / reconfiguration	connectivity/ fragmentation index. BD10 Case study examples. Major realignment schemes proposed for E England e.g. Broadland area. <i>Link with Marine and Flood & Coastal Erosion Sectors.</i>			57 (7)	
9	Changes in soil organic carbon	BD11 Very complex, hence probably qualitative. Balance of additional biomass against loss via DOC, POC, respiration. Climate change effects confounded by land use change.			57 (7)	
10	Changes in species migration patterns	BD14 Case study examples, certain migratory species migration route, timing over the year, changes of breeding/feeding grounds. BTO data for metrics			47 (13)	
11	Increased water temperature & stratification of water bodies	<i>Link with Water sector via change in ecological status of managed water bodies</i>			40 (14)	
12	Increased societal water demand	BD3 Use metric from Water Sector to link with ecological status of water bodies/wetlands (e.g. via low flows)			35 (16)	
13	Climate mitigation measures	BD9 Case study examples of			67 (5)	

UK-wide Tier 2 impact Blue: definite Yellow: possible (positive/negative)	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
14 Agricultural intensification (i.e. human use of NPP)	BD12 Expansion of agricultural intensification (also related to food security in Socio-Economic scenarios). Measurement using species richness and biodiversity indices. <i>Link with Agriculture?</i>			52 (9)	
15 Increase in flood defence structures	BD13 Either via Foresight Flooding study or Case Study examples. Loss of wetlands, floodplains etc. due to hard engineering OR gain due to better use of natural flood management. <i>Link with Flood & Coastal Erosion.</i>	Yes		47 (12)	
16 Large-scale fire risk	BD15 No of outdoor fires (grassland, heathland, forestry, cropland) per year.	Yes		26 (21)	
17 Generalist species favoured over specialists	BD16 Case study examples (e.g. butterfly data, ruderal			40 (14)	

UK Climate Change Risk Assessment

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
18	Asynchrony between a species breeding cycle & its food supply	spp.). BD17 Phenology Network data.			35 (16)	

UK Climate Change Risk Assessment

WATER
No feedback received prior to workshop

	UK-wide Tier 2 Impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Water supply-demand deficit	WA5 Supply demand deficit WA1 Relative aridity WA6 Population affected by supply shortage WA10 Change in CSO spill frequency			78 (1)	
2	Sewer flooding and CSO spills	WA1 Relative aridity WA2 Change in Q95 WA3 Change in Deployable Outputs (extreme event) WA4 Increase in water demand			59 (2)	
3	Major drought	WA1 Relative aridity WA2 Change in Q95 WA3 Change in Deployable Outputs (extreme event)			52 (3)	
4	Increased demand for water	WA4 Increase in water demand WA2 Change in Q95 WA8 Change from sustainable to unsustainable abstraction			35 (6)	
5	Low flows	WA2 Change in Q95 WA8 Change from sustainable to unsustainable abstraction			25 (9)	

Assessment

FLOODS AND COASTAL EROSION
No feedback received prior to workshop

	UK-wide Tier 2 Impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1a	Tidal flooding (including coastal)	FL1 No. people affected FL2 No. vulnerable people affected FL6 No. residential properties and EAD FL7 EAD commercial properties; counts of commercial property types			52 (2)	
2a	River flooding	FL1 No. people affected FL2 No. vulnerable people affected FL6 No. residential properties and EAD FL7 EAD commercial properties; counts of commercial property types			35 (4)	
3a	Pluvial and sewer flooding	FL1 No. people affected FL2 No. vulnerable people affected FL6 No. residential properties and EAD			30 (7)	
4a	Flood damage to critical infrastructure	FL10 No. installations (water distribution and treatment) FL11 No. installations (energy generation and distribution). <i>Capacity loss covered by energy sector.</i>			35 (4)	
5	Flood insurance collapse	FL13 Properties exposed to			35 (4)	

Risk Assessment

UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
6a Coastal Erosion	1:75 or less. FL14 No properties; No people (and vulnerable people) affected.			25 (9)	
1b Tidal flooding (including coastal)	FL3 Loss of habitat within BAPs			52 (2)	
	FL4 Agricultural productivity loss or land grade change				
	FL8 Road class and rail by frequency for independent flood areas				
	FL3 Loss of habitat within BAPs				
2b River flooding	FL4 Agricultural productivity loss or land grade change			35 (4)	
	FL8 Road class and rail by frequency for independent flood areas				
	FL4 Agricultural productivity loss or land grade change				
	FL7 EAD commercial properties; counts of commercial property types				
3b Pluvial and sewer flooding	FL8 Road class and rail by frequency for independent flood areas			30 (7)	
	FL9 No. people (and vulnerable people) affected by loss of services				
	FL12 No. hospitals				
4b Flood damage to critical infrastructure				35 (4)	

UK Climate Change Risk Assessment

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
6b	Coastal Erosion	FL 15 SAM sites FL 19 Km road/rail affected by class			25 (9)	

UK Climate Change 2012 Risk Assessment

AGRICULTURE ¹³

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
					See ¹⁴ note	
1	Crop Yield	AG1 Mean yield variability with summer rainfall, using wheat, sugarbeet and potatoes as 'reference' crops			78/44/10	
2	Flooding (crops)	AG2 Areas cropped per unit area flooded, including grazing land	Yes	POSSIBLE in Scotland - Rainfall greater than the UK and predicted to further increase.	52/44/_	
3	Flooding (livestock)	AG2a Areas of grazed land per unit area flooded	Yes	POSSIBLE in Scotland - Rainfall greater than the UK and predicted to further increase. The housing should already exist for full stocking capabilities - if animals are indoors for longer (due to flood events) then the need for adequate feed is more important.	_/_/30	
4	Saltwater Intrusion (crops)	AG2b Areas cropped per unit area prone to tidal flooding	No	Even in UK as a whole this will only affect thin strip on coast and not impact on the economy as predicted. Will be Opp for new habitat creation and for biodiversity. Less area effected in Scotland - Some of east coast and some islands	44/44/_	
5	Saltwater Intrusion (livestock)	AG2c Areas of grazed land per unit area prone to tidal flooding	No	Even in UK as a whole this will only affect thin strip on coast and not impact on the economy as predicted. Will be Opp for new habitat creation and for biodiversity. Less area effected in	_/_/37	

¹³ Agriculture stakeholders commented on the spreadsheet scores rather than the original Tier 2 list of impacts provided in the preparatory materials.

¹⁴ Scores are for Arable/Horticulture/Livestock (no rank is given).

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
6	Pests and Diseases (crops)	AG3 Pest incidence with summer rainfall using 'marker' diseases for selected crops e.g. blight for potatoes, rust for wheat	Yes	Scotland - Some of east coast and some islands Agree - could be problem in Scotland.	89/44/37	
7	Drought effects (soil moisture availability)	AG4 Change in agroclimate using potential soil moisture deficit (PSMD) as an aridity index	No	Less likely for Scotland - change to No. Possible in isolated areas of Scotland such as the East.	59/37/_	
8	Stress factors (crops)	AG4 Changes in agroclimate and land suitability and PSMD as an aridity index (using potatoes as a reference crop)	Yes	Could be greater in Scotland due to greater rainfall predicted and unpredictable weather.	67/37/12	
9	Heat stress on workers (horticulture)	AG7 Morbidity effects, derived from health data.	No	Unlikely in Scotland	4/56/_	
10	Human food supply from UK agriculture	Important but unlikely to find suitable risk metric. It may be possible to make a qualitative assessment in the CCRA based on AG1 and AG8			_/_/35	
11	Water demand (crops)	AG5 Volumes abstracted for agricultural irrigation correlated against agroclimate.	No	Irrigation less likely to be major impact in Scotland than in England especially in livestock sector where more grass-fed animals. (Water resources for direct abstraction - More likely in certain areas of the East of Scotland)	30/7/35	
12	Water demand (livestock)	AG6 volumes abstracted for livestock	No	Unlikely to be major risk in Scotland. Depends on source.	_/_/37	

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
13	Crop Development	AG4 Changes in agroclimate and land suitability and PSMID as an aridity index (using potatoes as a reference crop)		Changes in crop development could be detrimental to biodiversity which has adapted to certain cropping regimes etc. Possible earlier and more frequent grass cutting which may affect ground nesting birds (unless nesting also happens earlier)	37/30/11	37/30/15
14	Pests and Diseases (livestock)	AG9 Change in patterns of age at death, linked to reasons for culling, use of animal medicines (legislation)			_/_/30	
15	Livestock yield and product quality	AG8 Age of animals at slaughter, carcass quality indicators			_/_/25	
16	Stress factors (livestock)	AG9 Change in patterns of age at death, linked to reasons for culling, use of animal medicines (legislation)		Less of a risk in Scotland than rest of UK.	_/_/30	
17	Weeds (crops)			Could be beneficial to plant and other biodiversity if weeds can thrive rather than being destroyed.	56/20/10	
18	GHG emissions		Yes	Must be 'yes' for Scotland. This is an important issue in the Scottish context due to the amount of carbon rich soils. Land management will interact with the soil response to climate change. Crops - Likelihood and Urgency scores should be raised to 3 to reflect these wider climate change risks.	30/35/_	67/53/37

Risk Assessment

UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
			<p>Livestock - This was deemed N/A for livestock, however, this is pertinent for Scotland as cattle premises have higher head counts than the rest of the UK (mean 147, median 77 for Scot, compared to 107, 53 for England and 91, 50 for Wales (respectively)). If opportunities for spreading decrease due to periods of drought, waterlogging or frozen ground, more storage for animal wastes will be required and there will be increased potential for more ammonia emissions during spreading and storage.</p> <p>Disagree with 10 considered n/a for Livestock. Scotland holds large area of carbon rich soils and lot of grazing will be found on carbon rich soils. Climate change will impact on these soils; and the climate soil interaction is likely to be also affected by the type of land management. Due to the amount of carbon held in those soils the magnitude of environmental consequence can be considered high.</p>		
19	Biodiversity / wildlife changes	Yes	<p>Biodiversity will be negatively impacted especially in farmland habitats which already inadequate for their needs. Impact, likelihood and urgency all higher than scored. Urgency because of the lag times in making improvements for biodiversity.</p> <p>Cannot see opportunities for many species from climate change with reference to livestock. Some</p>	30/37/12	44/37/37

UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
			<p>new species may use grassland but this is marginal benefit. Opportunities Dependent on significant areas of suitable habitat.</p> <p>Changes of crop (changes of grass/legume varieties, introduction of maize as fodder crop) may decrease the benefits for wildlife (denser vegetation, less food available).</p> <p>This comment is not specific to Scotland. The description of impact 21 is general enough to warrant a score 3 in terms of likelihood. Impacts of climate change on species have already been observed. Some modelling has been carried out (see MONARCH) though acknowledging uncertainties for individual species, change is bound to occur.</p> <p>Based on our sector comments, we believe this should be a yes. There will be changes to biodiversity though it is difficult to predict what will happen. This will also have implications on how we deliver for biodiversity through agri-environment schemes.</p>		
20 Breeding habits/reproductive behaviour of species (crops)		Yes	<p>Much as above. Phenological impacts possibly greatest.</p> <p>Denser vegetation, if more productive grass species are used, may limit birds nesting and foraging ability, improvement of rough grazing</p>	30/37/20	30/37/25

Risk Assessment

UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
			may also decrease availability of breeding habitats. Environmental impact could be raised to magnitude 3 considering the importance of semi-natural pastures in Scotland	30/37/20	
21	Air quality – increasing levels of CO ₂			30/37/20	
22	Water quality		[Covered by water] Agree - for East of Scotland.	30/30/25	
ADDITIONAL IMPACTS					
	Leaching – increased risk of nutrient and pesticide loss due to more frequent high intensity rainfall events (12)		Should be scored for livestock (grassland) as fertilisers and manures used and can be at risk of entering watercourses especially from greater and flashier rainfall. This seems relevant to livestock systems as more frequent high intensity rainfall events will increase the potential for slurry or FYM to be washed off the soil, directly into watercourses, prior to incorporation with the soil. This has off-site implications for water quality rather than on-site implications for productivity. Suggested score: 1,2,1,2,2 = 20	30/25/	30/25/20
	Run-off / erosion risks - increased risk due to more frequent high intensity rainfall events (13)		[scores not high enough to be included in Tier 2] Should be scored for livestock (grassland) as fertilisers and manures used and can be at risk of entering watercourses especially from greater and flashier rainfall. Combined with increased poaching (L6) there is also potential for increased soil erosion and runoff	30/25/	30/25/25

**UK Climate
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Risk
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UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
Trafficability/access/field operations – increased risk due to changing soil conditions (too dry/too wet), particularly in late summer and spring (18)			from livestock systems. Suggested score: 1,2,2,2,2 = 25 [scores not high enough to be included in Tier 2] POSSIBLE in scotland - Rainfall greater than the UK and predicted to further increase. Potentially more important due to reduced window for spreading manure and fertiliser - the cost of lost spreading days falling on farmers or contractors if the land is unsuitable for spreading plus environmental cost (on water bodies and increased ghg emissions) of spreading inappropriately - suggest higher urgency rating of 2 making overall score 25 [scores not high enough to be included in Tier 2]	25/25/12	25/25/25
Use of more on farm energy to help keep animals in their thermo-neutral zone. (L2)			in order to comply with animal welfare regs considerable investment may be needed to maintain poultry productivity if extremes in hot weather become more frequent in summer - suggested score 2,2,1,2,1 = 12 [scores not high enough to be included in Tier 2] POSSIBLE in Scotland - Rainfall greater than the UK and predicted to further increase.	_/_/10	_/_/12
Water logging effects (seasonal, anaerobic conditions) due to due to more frequent high intensity rainfall events (15)			POSSIBLE in Scotland - Rainfall greater than the UK and predicted to further increase.	37/25/_	
Subsidence/landslides – increased risk due to over abstraction (19)			POSSIBLE in Scotland - Rainfall greater than the UK and predicted to further increase. Scotland more hilly. Already increase in landslide incidences.	30/10/7	
Migration patterns of farmland birds			Economic impact may be higher for northern	30/20/10	

Risk Assessment

UK-wide Tier 2 impact Blue: definite Yellow: possible (22)	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
Loss of particular landscapes and associated rural communities, previously managed by livestock keepers (e.g., hill systems) (L4)			<p>regions where overwintering geese number may increase (e.g. Orkney).</p> <p>Changes in migration may be Threat or Opp. Example in Scotland is greater numbers of geese in winter as many no longer fly further south but stay in Scotland.</p> <p>Risk to Crofting and associated landscapes from management changes.</p> <p>This may be more important in Scotland in relation to both rural development and quality of life. Importance of hill farming to maintaining rural communities in large part of Scotland, importance of Scottish landscapes for tourism</p> <p>Scottish landscapes important to the Scottish economy through tourism. Not sure whether the economic impact would be magnitude 2, but this is an issue to be considered. Change to hill farming systems would have bigger impacts in Scotland</p> <p>Research commissioned by SNH on impacts of climate change on landscapes suggested that in the uplands landform is a dominant factor. Here, with the exception of developments such as windfarms and related infrastructure, change may be gradual and subtle</p>	_/_/25	_/_/30

Risk Assessment

UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
Loss of peat soils		Yes	Climate changes including potential for repeated wetting/drying of degraded peatlands is likely to exacerbate current problems of GHG release and biodiversity loss.		
Agricultural land classification and crop suitability – changes in soil and agroclimatic conditions affecting soil and crop suitability (20)		Yes	Disagreed with ratings in arable and livestock. Improvement of land capability for agriculture has already been noticed and trend likely to continue. This could entail not only a change in crops but a change in farming systems. This could have significant environmental impacts. The impacts of agricultural changes on farmland biodiversity are well documented. Consequences would result from both the responses of land managers to the environmental conditions and the impact of climate change on species and habitats. Changes in landscapes will affect quality of life. (+/-)	20/12/12	51/12/44
			This would have a significant adverse impact on landscape and farmland biodiversity. Change in land use could result in increase in GHG emissions from soil with high carbon content. Changes of land capability of rough grazing with potential for reseeding and fertilising currently unimproved grazing may have important impacts on wildlife and carbon sequestration capacity		
			Subtle changes have already occurred and the area of prime land has increased since the 1960s. Very likely that in the next decades there will be changes in farming systems (see macaulay work		

Risk Assessment

UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
<p>Opportunity for improved pasture/fodder quality from currently marginal land categories - - Agricultural land classification and crop suitability – changes in soil and agroclimatic conditions affecting soil and crop suitability. (20A)</p>			<p>on land capability for agriculture under a changing climate) Grazing systems more important in Scotland so economic opportunity greater. Agree that there is also potential for environmental benefits for example more habitat diversity. Agree for score 2 for opportunities, whereas see score 3 for threats above in 20. [scores not high enough to be included in Tier 2]</p>	_/_/12	_/_/15
<p>Poaching of fields from livestock traffic (L6)</p>			<p>Poaching could result in increased GHG emissions (nitrous oxide and methane) and carbon losses from erosion. The environmental consequence can go from a 2 to a 3 because of the large amount of carbon rich soils in Scotland. [scores not high enough to be included in Tier 2]</p>	_/_/19	_/_/22

UK Climate Change Risk Assessment

FORESTRY

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Pests and Diseases (forestry)	FO1 Area of premature felling/suspension of normal management			89 (1)	89 (1)
2	Drought damage / loss of productivity (forestry)	FO2 Productivity per unit area			59 (2)	59 (2)
3	Tree species change	FO4 Area affected			56 (3)	56 (4)
4	Biodiversity loss (forestry)	FO5 Butterfly population			56 (3)	56 (4)
5	Waterlogging (forestry)	FO6 Productivity per unit area			37 (5)	37 (6)
6	Snow and Frost Damage (forestry)	FO7 Productivity per unit area			33 (7)	33 (8)
ADDITIONAL IMPACTS						
1	Wind throw (28,29)		Yes	This should be regarded as a Tier 2 risk, particularly on account of combined waterlogging/winds.	30 (8)	59 (2)

UK Climate Change Risk Assessment

HEALTH

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Temperature (incl. heat wave) Mortality (Summer)	HE1 Excess mortality (based on temperature and population)	No	Heatwave planning is not a priority for Scotland - far more concerned about general severe weather and have obtained Ministerial Agreement not to look into heatwave planning. A report from Health Protection Scotland will be used as the focus for re-prioritising risks (in time for workshop).	89 (1)	
2	Temperature (incl. heat wave) Morbidity (Summer)	HE2 Emergency Department visits/admissions	No	See above	78 (4)	
3	Extreme Event (flooding and storms) Mortality	HE3 Flood related deaths			89 (2)	
4	Summer Air Pollution (ozone)	HE4 Ozone pollution episodes; air pollution alerts			89 (3)	
5	Temperature Mortality (Winter)	HE5 Averted mortality (based on temperature and population)			52 (9)	
6	Temperature Morbidity (Winter)	HE6 Fuel poverty risks			44 (11)	
7	Sunlight / UV Exposure	HE9 Skin cancer cases (linked to global UV index?)			67 (7)	
8	Effect of floods/storms on Mental Health	HE10 Mental stress caused by flooding (based on GP visits/calls?)			67 (8)	
9	Extreme Event (flooding and storms) Injuries	HE7 Flood related injuries			67 (5)	
10	Pollen and allergens	HE8 Pollen alerts?			67 (6)	
11	Demand for Emergency Medicine				37 (12)	
12	Water Quality & Water-Borne Diseases				35 (17)	
13	Winter air pollution				52 (10)	

UK Climate Change Risk Assessment

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
14	Vector-borne diseases				37 (16)	
15	Food-borne diseases				30 (19)	
16	Medicine efficacy				25 (22)	

UK Climate Change Risk Assessment

BUILT ENVIRONMENT
No feedback received prior to workshop

	UK-wide Tier 2 Impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Urban Heat Islands	BE1 Index based on temperature, urban centre uplift and demographic data. Quantitative			100 (1)	
2	Subsidence (buildings)	BE2 No./value of buildings affected			-	
3	Overheating of Buildings	BE3 Building comfort/effectiveness based on building numbers and types. Quantitative			78 (3)	
4	Effectiveness of Green Spaces	BE5 Effectiveness of green space v temperature. Consider linking with socio economic data.			37 (6)	
5	Demand for Heating	BE9 Heating degree days. Link to energy cost. Consider social equity based on population stats.			37 (6)	
6	Cultural heritage in flood risk areas	BE4 Cultural heritage in flood risk areas.			35 (10)	
7	Damage from Heat/Drying (buildings)	BE6 Air quality vs. temperature metric			37 (6)	
8	Pest Infestations	BE7 Derive from insurance claim information. Qualitative.			37 (6)	
9	Waste Management	BE8 Qualitative based on expert elicitation.			25 (11)	

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Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
10	Seasonal Interruptions to construction activities				30 (11)	

UK Climate Change Risk Assessment
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TRANSPORT

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Flood disruption and delay (transport)	TR1 Metric for disruption and delay? TR2 Risk areas: qualitative increase	Yes		89 (1)	89 (1)
2	Subsidence (transport)	TR2 Risk areas: qualitative increase	No	The underlying geology of Scotland is quite different to the rest of the UK, especially SE England where clay and chalk are liable to subsidence rather than landslide and erosion. Scotland is predominately hard rock which has the opposite effect - higher risk of Landslide and erosion and less risk of subsidence (excepting areas of peat land). As a consequence of this, in Scotland, greater priority has been given to Landslide and Erosion and lower priority to subsidence.	52 (2)	25 (7)
3	Energy Demands(transport)	TR3 Cost of Air Conditioning hours in cars	No		52 (2)	25 (7)
4	Thermal Loading on Hard Surfaces	TR4 Cost of carriageway repairs (qualitative)	No	Thermal Loading on Hard surfaces has been given a reduced priority due to lower predicted temperature increases in Scotland.	37 (4)	12 (14)
5	Heat Stress on Rail Infrastructure	TR5 Buckling risk; financial cost of delays	No	Whilst recognising that temperature increases in Scotland are predicted to be lower than the rest of the UK comments regarding Heat Stress on Rail Infrastructure should be expanded to include "Track buckling, speed restrictions <i>and solar gain affecting line-side equipment</i> leading to larger delay costs." Even considering this potential impact the likelihood rating has been reduced due to the lower increases mentioned above.	37 (4)	25 (7)

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
6	Cold Weather Working/Travelling	TR6 Delays; winter maintenance costs; qualitative	No		30 (6)	12 (14)
ADDITIONAL IMPACTS						
1	Erosion & Landslides (7,8)		Yes	See comments regarding subsidence	12 (12)	52 (2)
2	Wind/storm damage (42,43,48,49)		Yes	Having experienced wind and storm damage and disruption during the past few years the trend is anticipated to continue. Subsequently the Likelihood has increased for both this impact and the impact below which increases their respective priorities	15 (10)	44 (3)
3	Wind/storm disruption (44,45,47)		Yes	See above	5 (20)	37 (4)
4	Insurance Cover/Premiums (52)		Yes	As a direct result of the current changing storm patterns (described above) and subsequent disruption and damage, the Likelihood Score for Insurance Cover/premiums has been increased and therefore is also given an increased priority.	15 (10)	37 (4)
5	Leaf Fall (46)		No	Climate change will affect the bio-diversity habitat and life-cycles. This has been recognised with Leaf Fall impact which increases delay costs. This wording should be expanded to include general "Vegetation Management". Species cycles will alter which have the potential to increase costs to deal with more voracious growth of invasive species, accelerated growth patterns and seasonality.	6 (19)	-

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
6	Disruption to Road Repairs (13, 50)		No	Should be reworded to take account of similar difficulties expected to be experienced by other modes of Transport. Furthermore, "Disruption to Transport Infrastructure Repairs and Maintenance" with similarly worded comments would also seem appropriate.	7 (14)	–

UK Climate Change Risk Assessment

ENERGY
Respondents broadly happy with existing list

	UK-wide Tier 2 Impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Flooding of electricity and gas infrastructure: capacity loss	EN1 Capacity losses; Customers affected			52 (1)	
2	Demand for Cooling	EN2 Capacity gap; Customer time lost			44 (2)	
3	Heat Related Damage/Disruption (energy)	EN3 Capacity losses; People affected			37 (3)	
4	Flooding of power stations: capacity loss	Use EN1. No. installations covered in Floods Sector			35 (5)	
5	Transmission Efficiency - overhead	EN10 Capacity losses; People affected			30 (6)	
6	Water Abstraction for energy generation	EN4 Efficiency (Qualitative). Link to Water			37 (3)	
7	Energy demand by Water Suppliers	EN5 Base on deployable outputs available to energy sector (qualitative)			30 (6)	
8	Electricity Turbine Efficiency	EN6 Capacity losses; capacity reduction			30 (6)	
9	Gas Pipeline Compressor Rating	EN7 Capacity losses; People affected			30 (6)	
10	Power Station Cooling Processes	EN8 Loss of efficiency (qualitative)			30 (6)	

BUSINESS/INDUSTRY/SERVICES
Respondents broadly happy with existing list

	UK-wide Tier 2 Impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1	Financial sector fails to mainstream climate change risk considerations into decision making or only focuses on extreme events.	BU1 Case Study - exploration of the impact of a climate type event on funds and fund management (e.g. heat wave 2003, floods of 2007).			52 (1)	
2	Coastal erosion and flooding of natural and tourist assets (i.e. hotels etc) from sea level rise and storm-surge.	BU2 Semi quantitative - number of tourist assets at risk from coastal erosion or flood from sea level rise.			44 (2)	
3	Sea level rise affecting coastal assets leading to loss and increased CAPEX/ OPEX.	BU2 Semi quantitative – based on number of tourist assets at risk from coastal erosion or flood from sea level rise.			44 (2)	
4	Sea level rise, coastal inundation and erosion leads to lost assets and increased CAPEX/ OPEX.	BU3 Semi quantitative - number of business and industry assets at risk from coastal erosion or flood from sea level rise. (Floods will provide EAD and numbers of commercial properties).			37 (4)	

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
5	Flooding (fluvial or pluvial) affects leads to loss/ temporary failure of assets and delays with increased CAPEX/ OPEX.	BU7 Case Study and qualitative metric (given uncertainty in location, risk and resilience of assets). Case study to explore the risk, supplemented by literature and expert elicitation.			30 (9)	
6	Operational disruption and reliability of ICT requiring additional cooling (from high temperatures and heat wave).	BU4 Qualitative - number of days of productivity loss due to disruption/loss of ICT.			37 (4)	
7	Insurance and reinsurance issues for some assets due to frequent impact from extreme events.	BU5 Qualitative - increase in payout costs by the insurance industry per annum.			30 (8)	
8	Incremental climate change may mean that there is an underestimation of decommissioning liabilities and end of life costs.	BU6 Qualitative - increase in number/type of sites which may have additional liability issues at end of life.			30 (9)	
9	Disruption from flooding of assets, transport links and supply chain.	BU7 Case Study and qualitative metric (given uncertainty in location, risk and resilience of assets). Case study to explore the risk, supplemented by literature and expert elicitation.			37 (4)	

Risk Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
10	Changing holiday trend leads to new markets.	BU8 To be decided - this is an opportunity.			30 (9)	
11	Impact on operations from lack of available water resources either through shortage and competing demands of others (including conflict with other users?).	BU9 Qualitative assessment of water availability including discussion with Water Sector, which will provide water availability. BU10 Qualitative assessment of potential increase in risk based on expert elicitation.			30 (9)	
12	Extreme weather and changes to rainfall patterns impacts storage, supply and disposal of volatile and hazardous chemicals.				25 (20)	

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OTHER IMPACTS

Respondents from Emergency and Rescue broadly happy with existing list

UK-wide Tier 2 Impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
1 Customer demands for retail, manufacturing and engineering in a changing climate (opportunities)	GP1 Qualitative assessment of potential market opportunities. (Overlap with the Business Sector)			67 (1)	
2 Emergency response to climate events including planning and implementation	GP2 Events per year of different types (heatwave, flood, etc). GP3 Cost index for imported food?			44 (2)	
3 Changes in UK trading patterns with overseas primary product/raw materials suppliers due to permanent crop production/ecosystem changes	GP3 Cost index for imported food?			35 (6)	
4 Outdoor leisure, sport and tourism: opportunities and risks	GP4 Qualitative assessment of time spent by people out of doors based on changing climate conditions.			40 (5)	
5 Emergency response to increase in grassland and forest fires	GP5 Number of fires per year or area affected.			44 (2)	
6 Key workers unable to get to work due to extreme events or infrastructure failure	GP6 Qualitative assessment of the proportion of key workers unable to get to work because of increases in the number of extreme events.			35 (6)	
7 Immigration to EU countries (including UK) and northwards migration within EU space	GP7 Potential immigration numbers.			35 (6)	
8 Need for international emergency	GP8 Cost of aid.			30 (9)	

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Assessment

	UK-wide Tier 2 impact Blue: definite Yellow: possible	Risk metrics	Important for Scotland	Comments	UK Score (Rank)	Scot. Score (Rank)
9	aid More frequent air pollution episodes over the UK	GP9 Index of pollution days?			22 (13)	

Appendix 3: Information from additional flipcharts

Bike Rack

Bike Rack

Semantic issue: new people might be confused by Tier 2 being more important than Tier 1. Please consider evolving new term as you public next stage in public domain to clarify the importance of each risk elevated to important.

Semantic issue: the 12 sector headings are not strictly sectors as such and some are topics/concerns instead. Please consider re-framing the whole into more appropriate/coherent headings which are understandable/accessible to lay decision-makers and elected representatives, directors of PLCs, public bodies etc – who have not been in the CCRA “bubble”.

Stakeholders – Who else should be here?

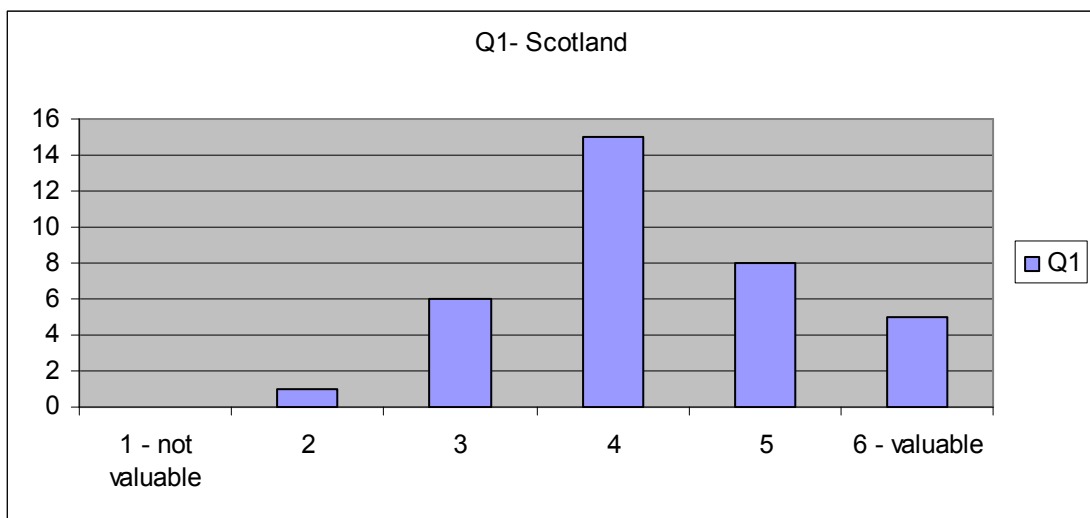
Stakeholders – who else should the CCRA team be involving?

DWQR – Drinking water quality regulator
 CFS
 Met Office
 Farmers/Landowners
 Construction
 Insurance
 Electricity generators
 Gas transmission and distribution
 The public?
 Crown estate
 Local authorities/COSLA
 Academia?
 Hydropower operators

Appendix 4: Feedback forms

48 people attended the workshop (excludes the CCRA team, includes team from Scotland). 36 feedback forms were received. Here is a record of what was in the forms.

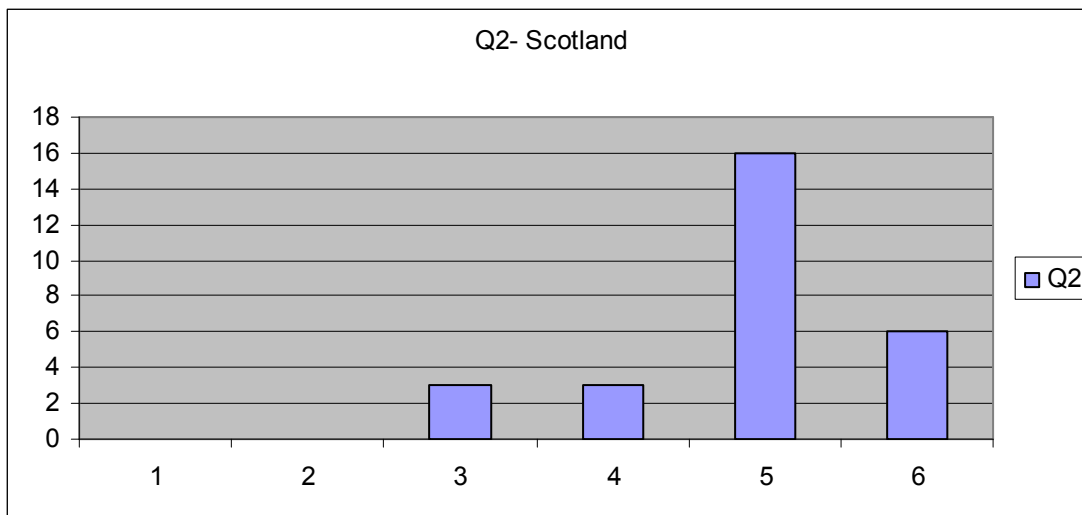
Q1. How valuable did you find this workshop



Comments

1. Very broad range of topics
2. Helped to confirm some of the existing conclusions and some new ones
3. Too much in too little time
4. Dense and complex issues
5. Valuable in highlighting the CCRA process and how/when to feed in. However, it's very late with just 2 weeks to go. Also, need real discipline to separate out impacts, consequences and risks, and everything that will follow from those to ensure effective and timely actions.
6. Valuable, but to a long term process – not so valuable in terms of work back in the day job now.
7. Helpful and constructive, interactive and engaging.
8. Not valuable to me personally. Concerned that cc response seems to be at such an early stage

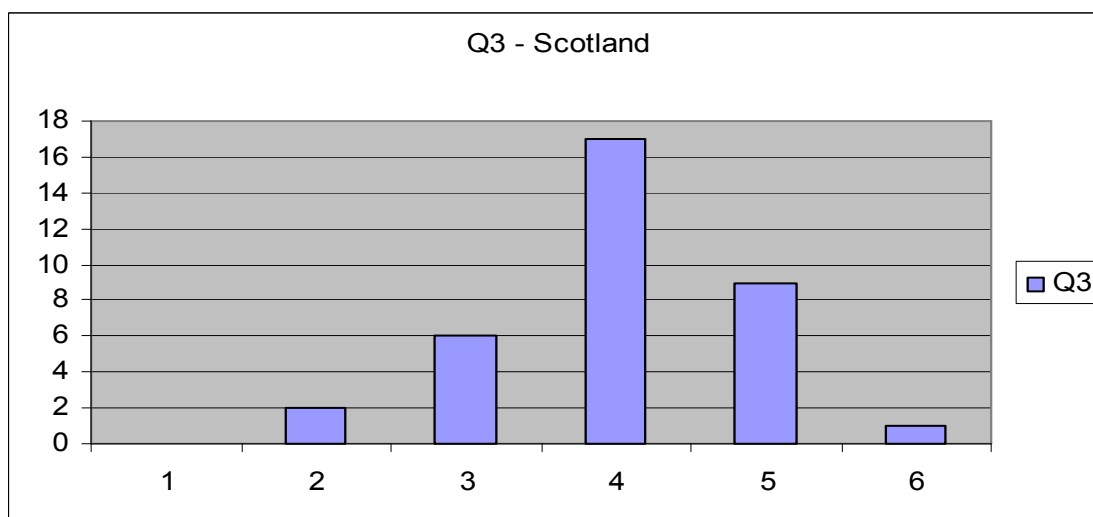
Q2. If you had questions during the workshop, how well were they answered?



Comments

1. Team seem to be well on top of issues and dilemmas
2. Good, well structured facilitation

Q.3 How well did the workshop format enable you to address the issues?



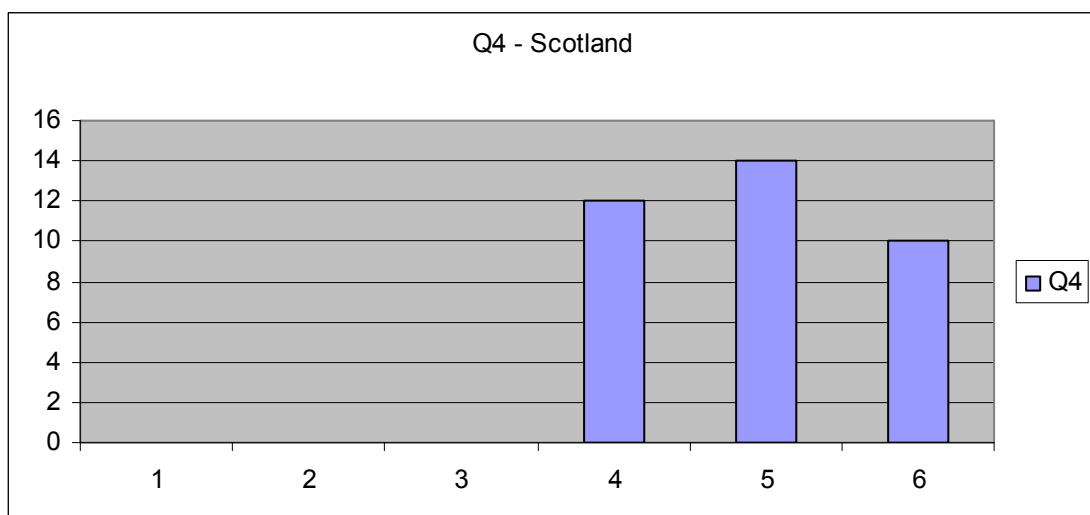
Comments

1. Template for afternoon did not allow capture of notes and comments

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2. Good opportunity to raise the issues - need to wait and see if they are addressed
3. Fairly well. I observe that process seems slightly constrained by headings and terminology inherited so far. DON'T let this hinder you making some things more fit and understandable necessary wider audiences.
4. Lack of discipline over definitions led to confusion over impacts, consequences, etc. Also lumping e.g. water and health (latter had insufficient participants) meant that neither (esp health) were covered adequately for what's required and seriousness of the subject.
5. The first part (post-its) was not particularly useful (but may have been for the organisers)
6. May be due to being restricted to risk assessment.
7. Many of the issues required more discussion than the time allowed for – ambitious programme.
8. A good catalyst but ideas needed significant further development.
9. too many complex issues to discuss in time available.
10. Timing rather short to achieve full resolution of the issues but good results for time available.
11. Information lacked history.
12. Could have had more stakeholders (e.g no potato rep) to provide more rounded views on issues.
13. There seemed insufficient time for discussion, particularly during the morning for the section on impacts.

Q4. How effective were the facilitators?



Comments

1. Very helpful but didn't have all the answers

Q5. What would you have liked more time for?

Comments

1. Discussion of the Tier 2 impacts. We had to a rush conversation
2. Not enough time for considering/scoring Tier 2 pre-lunch
3. Assessing metrics for key impacts
4. Review of impacts, did not fully reflect sector
5. To bottom out the issues – sessions 2 and 3
6. To discuss the Tier 2 list
7. Focussing on the process, the group discussion on sectors were too short and ill focussed
8. Look at Tier 1 issues
9. Discussion on the sectors and the links to other areas of work using similar methods and metrics (e.g flood risk management act national flood risk assessment via SEPA/Scottish Govt.)
10. More time on specific sectors rather than discussion of general issues
11. Further discussion of key issues particularly cross-sectoral
12. Robust evaluation of the risk factors
13. How this will link to locality planning
14. The prioritisation exercise – within more than one sector
15. Reading the material pre-event
16. Start looking at adaptation rather than just assessment
17. Exploration of some options and consequences before concluding our position.
18. Visit other sectors. Debate key sectoral issues.
19. A more strategic focus on the provision of a climate change solution/way forward.
20. A wee bit more time for the afternoon session would have been good.
21. Context of how this work fits into the Scottish Government action plans and policy

Q6. What would you have liked to spend less time on?

Comments

1. Feedback from session 1 with the post-it notes. The feedback/grouping of notes added little to the consideration of the issues
2. Headline issues - too many impacts, 8 post-its – too many
3. Initial 8 messages session
4. Nothing
5. Post-it session
6. Nothing

7. Initial brainstorming – largely the same issues as previous sessions
8. Going over lists of clearly important priorities
9. The initial exercise
10. Exercise 1
11. Post-it notes
12. Post-it session, these have little value, I have done too many.
13. Post-it exercise

Q7. Any other comments

Comments

1. Richness of conversations and interventions was strong
2. In time available did well
3. Tried to cover too much in one day – not a criticism, merely a function of the size of the issues under consideration
4. Not fully clear on final output and our involvement going forward
5. Well structured day would not wish to suggest more or less of anything as the entirety was important.
6. A lot to cover in one day
7. May be useful to involve more research institutes.
8. It is really quite difficult to engage in a process that is well underway. A large part of the time today was spent trying to fully understand the process to get to grips with exactly what was wanted.
9. CCRA process description included adaptation stage but no indication given as to how our contribution would be taken forward into this and whether we would get feedback. Would take a keen interest in the metrics and response functions. Would like a link to more technical details.
10. Was good to get to detail quickly and get into the issues.
11. It seems that if there is no metric a risk will not be included in the risk assessment.
12. A good day I thought, with a positive response, well handled by the facilitators. Consultants were more honest and open than before.
13. A much more focussed event than the marine event in May 2010.
14. Perhaps felt that it is quite late in the process to be holding such a workshop.
15. I am concerned about the sketchy nature of the business sector issues.
16. Health sector needs to review impacts and consequences to inform adaptation risk and action planning exercise and its coordination.
17. I will provide further comment on behalf of the Scottish Fire Services on line.
18. Put a short news item/article into wider public domain explaining in words of one syllable what is happening/stage of process/upcoming timelines.
19. Food very good.
20. Hope thought is going to be given to high priority issues even if they don't have data giving baseline information.
21. Limited attendees from Transport sector – whose fault was this?

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22. Not sure all participants kept focus on risk – it's easy to think about actions!! Slightly concerned at lack of attendance from wider energy sector.
23. Very good.