

Indicator name			Version
(NB15) Climate change pressure on Scotland's notified species			15/04/16
Indicator type:	Risk/opportunity	Impact	Action
		X	
SCCAP Theme	SCCAP Objective	CCRA risk/opportunity	
Climate Ready Natural Environment	N2: Support a healthy and diverse natural environment with capacity to adapt.	<ul style="list-style-type: none"> • BD1/BD2 Risk to species and habitats due to drier soils/ coastal evolution • BD3/BD4 Risk of pests/ diseases to biodiversity • BD5 Species unable to track changing climate space • BD11 Generalist species more able to adapt than specialists 	

At a glance

- There is growing evidence of the impact of climate change over the last few decades on Scottish and wider UK biodiversity. Impacts include range shifts, changing species community composition, and altered life-cycle timings.
- In recognition of this, monitoring cycles for species of conservation interest in Scotland now include 'climate change' as a pressure category. However, how this pressure is identified and the category is applied during monitoring is currently under review.
- Conservation targets for individual species will need to take into consideration the implications of climate change and changes in climate space. Management will need to differentiate between changes that can be influenced through intervention and those that cannot be prevented.
- Maintenance of underlying ecological processes and associated habitats, is likely to be the best way of maintaining the resilience of species vulnerable to climate change in Scotland.

Latest Figure	Trend
<p>Suitable data currently not available</p> <p>NB It is intended that once the use of the climate change pressure category in Site Condition Monitoring is more firmly established and the resulting data is more robust, then this will form the basis of the indicator <i>NB15 Condition of climate sensitive species</i>:</p>	N/A

Number of species identified as under pressure from climate change	
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Why is this indicator important?

Climate change poses one of the greatest challenges for Scotland's wildlife, altering the natural environment at a faster rate than some species can adapt (Scottish Government, 2009). Current projections are that by the 2080s Scotland will experience warmer, drier summers; milder, wetter autumns and winters; an increase in extreme weather events; and changes in sea level and surface temperature around Scotland's coasts (SNH, 2015c). Rising average temperatures and changes in seasonal rainfall will result in the shrinking or even disappearance of habitats that some native species depend upon, and new species moving into Scotland, tracking the changing climate space. Interactions between species may also be altered- warming has already resulted in earlier timing of spring events such as leaf unfolding, bird migration and egg laying (SNH, 2009). Many species will be directly impacted by these changes, but indirect effects will potentially impact upon an even wider number of plant and animal species, for example via interactions with pollution, or habitat loss and fragmentation, which may prevent an effective response to climate change (Scottish Government, 2009).

Understanding the current condition and potential threat to species enables policymakers to make connections between climate change, habitat loss and species response, and to direct policy appropriately (SPICe, 2009). Site Condition Monitoring (SCM) is Scottish Natural Heritage's (SNH) programme for monitoring the condition of nature conservation features¹ of special interest on designated sites in Scotland. The monitoring determines whether the natural feature is likely to maintain itself in the medium to longer term under the current management regime and wider environmental or other influences (SNH, 2015a). An important aspect of the SCM process involves inspecting the site for factors which have the capacity to impact upon the feature in a detrimental or positive way- these factors are termed 'Pressures' and can apply to both man-made and natural activities (SNH, 2015b).

In recognition of the threat climate change poses to Scotland's natural environment, in the last cycle of SCM, SNH introduced a new pressure category of 'climate change'. Currently, however, there is a need to provide more robust guidance regarding the application of this category and a distinction between evidence for current impact as opposed to a risk of future impact from climate change based on species vulnerability. Therefore, whilst this reporting category provides some useful insight into climate change pressures on notified species, it does not currently provide adequate data to form an indicator of notified species under pressure from climate change.

Related indicators:

- NB3 Extent and condition of natural landscape connections: hedgerows and ponds
- NB4 Proportion of ancient woodlands with declining overall suitability for lichen epiphytes
- NB12 Condition of key habitats: Proportion of notified habitats in unfavourable condition
- NB13 Condition of key habitats: Area of modified deep peat soils
- NB19 Proportion of notified habitats and species in 'positive' condition

What is happening now?

¹ 'Features' are divided into Habitats, Species and Earth Science Features

Since 2011, Site Condition Monitoring has identified 13 species features with climate change as a specific pressure (Figure 1). Eleven of these features are Atlantic salmon populations; two are aggregations of breeding birds (capercaillie and kittiwake); and one is an assemblage of vascular plants (including the Red Data Book species Alpine bartsia *Bartsia alpina*, Woolly willow *Salix lanata*, Mountain bladder fern *Cystopteris montana* and Alpine woodsia *Woodsia alpina*).

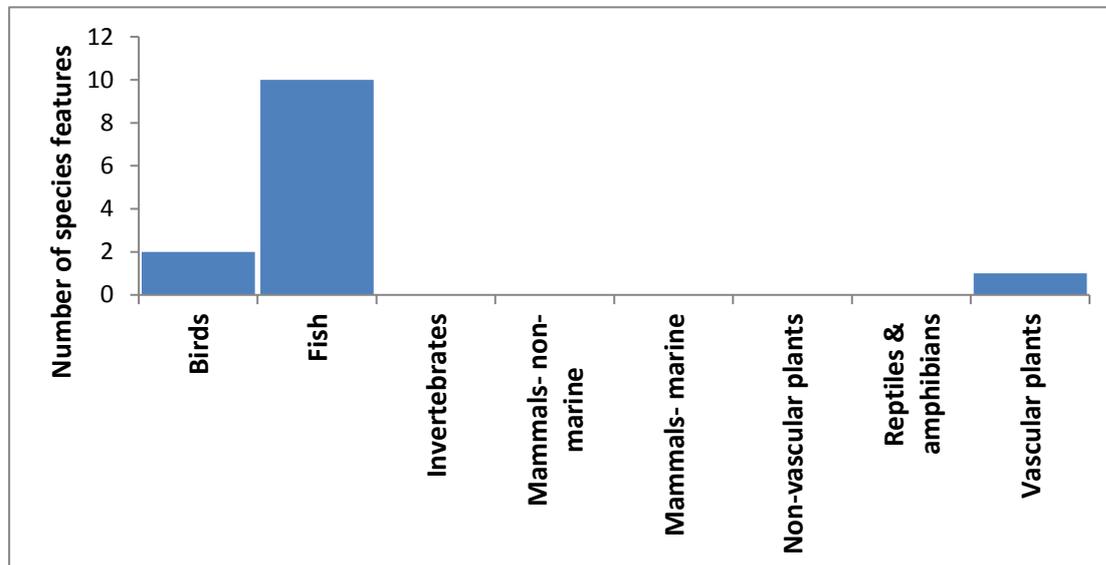


Figure 1 Number of notified species features with climate change pressure identified by SNH Site Condition Monitoring (March 2015)

Whilst currently only a small number of notified species features have had climate change attributed as an identifiable pressure, a large number of other pressure categories are potentially directly or indirectly influenced by climatic changes e.g. presence or changing extent of invasive species, plant pests and diseases, water availability and water quality. Currently over 500 species features have been assessed as being negatively impacted by pressures which can be exacerbated by projected changes in Scotland’s climate.

What has happened in the past?

There is growing evidence of the impact of climate change over the last few decades² on Scottish and wider UK biodiversity (Morecroft & Speakman, 2013). Impacts include range shifts, changing species community composition, and altered life-cycle timings. Although the species identified as under climate change pressure during SCM should not be seen as an exhaustive list, they nonetheless provide some insight into the some of the direct and indirect impacts climate change is already having on Scottish wildlife.

- **Capercaillie:**
The decline of capercaillie in Scotland has largely been attributed to lower breeding success (Moss et al, 2001). Whilst a number of pressures have been identified as impacting upon capercaillie populations (deer grazing, predation, forestry management and pollution), pro-active management is able to keep much of this pressure at relatively low levels and research has shown that changes in spring temperature since 1975 could account for much of the observed drop in breeding success (Moss et al, 2001).

² SCM data includes pressures first reported 1995 until present, however ‘climate change’ as a pressure category was only introduced during the last cycle of SCM (2011-present)

- **Kittiwake:**
Kittiwake productivity has declined since 1986 and this is largely attributed to declines in abundance of their sandeel prey and in certain regions is negatively correlated with sea surface temperatures, which have risen due to climate change (JNCC, 2014).
- **Montane vascular plants:**
Frequent burning, heavy grazing and extensive draining have been the main pressures on montane plant communities in the past, along with the fragmentation and overall reduction in habitat (exacerbated by changing climatic suitability). There has been a general declining trend in less-competitive species associated with nutrient-poor sites, and a slight increase in more generalist or grazing-tolerant species (Preston et al, 2006).
- **Atlantic salmon:**
Scottish Atlantic salmon do not constitute a single population that can be summarised in a single trend line, however the number of adults returning to many spawning areas has declined severely in recent decades. There is some evidence that sea surface temperature may affect the survival and growth rate of young salmon as well as reducing food availability. Predator numbers may also be affected by temperature. Other pressures included habitat change, predation and targeted fisheries (Eatherley et al, 2006).

What is projected to happen in the future?

Currently the number of species that have had climate change attributed as a pressure under SCM is very small, however there is mounting evidence that more species will begin to be significantly impacted by this pressure. The MONARCH (Modelling Natural Resource Responses to Climate Change) programme was a seven-year programme developed to assess the impacts of projected climate change on a number of rare and important species named in the UK Biodiversity Action Plan. Of the 32 the project examined, eight are projected to lose substantial climate space and in the case of six of them, all suitable climate space (or the vast majority of it) is projected to be lost by the 2080s under a High climate change scenario (Walmsley, 2007).

The current objective for protected sites is the maintenance of the features for which the sites were designated. Conservation targets for individual species that are considered priorities for action will need to take into consideration the implications of climate change and changes in climate space. Management will need to differentiate between changes that can be influenced through intervention (e.g. controlling grazing rates), and those that cannot be prevented (e.g. changes in precipitation patterns or temperature). Maintenance of underlying ecological processes and associated habitats, is likely to be the best way of maintaining the resilience of species vulnerable to climate change in Scotland (SNH, 2009).

SNH's Adaptation Principles also includes the potential to consider translocation where there is a 'likely loss of a species despite new management measures, and where there are suitable areas for nature to adapt' (SNH, 2012). Translocations are viewed as a last resort, however, as they can be high risk and costly. Given limited resources, the long-term implications of climate change for each species needs to be taken into account, and the loss of a species from a region, or even from Scotland, may need to be accepted (SNH, 2009).

- **Capercaillie:**
Climatic space modelling shows a complete loss of suitable climatic conditions for capercaillie across the entirety of their range in Scotland by the 2050s (Warmsley et al, 2007). This is largely due to their confinement to cooler, mountain regions.
- **Kittiwake:**

The RSPB issued a warning in 2014 that based on current trends, due largely to the impacts of climate change, remaining kittiwake colonies in areas that were once their core strongholds (e.g. Orkney and Shetland) are severely threatened (RSPB, 2014).

- Montane vascular plants:
The SSSI at Meall na Samhna includes an exceptionally large number of nationally rare vascular plant (and lichen) species. Sustained pressure from climate change is likely to impact upon other species which rely on these for suitable habitat- such as the Northern Emerald dragonfly which is considered to be under threat in the UK (SNH, 2010).
- Atlantic salmon:
Warming in the marine environment is resulting in changes to the pelagic layer of the ocean and the consequential squeezing and degrading of traditional feeding areas for Scottish salmon. The freshwater environment is also under increasing pressure from flood, drought and temperature extremes (Atlantic Salmon Trust, 2012).

Patterns of change

Interpretation of indicator trends

Limitations

It is intended that once the use of the climate change pressure category in Site Condition Monitoring is more firmly established and the resulting data is more robust, then this will form the basis of the indicator *NB15 Condition of climate sensitive species: Number of species identified as under pressure from climate change*

SCM data includes pressures first reported 1995 until present, however 'climate change' as a pressure category was only introduced during the last cycle of SCM (2011-present)

References

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Further information

Site condition monitoring:

<http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/site-condition-monitoring/>

Climate change impacts on Scotland's natural environment:

<http://www.snh.gov.uk/climate-change/impacts-in-scotland/>

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Bob Bryson and Brian Eardley (SNH) for supplying and advice regarding SCM data

Mary Christie and Sue Marrs (SNH) for review

Appendix One: Indicator metadata and methodology

Table 1: Indicator metadata

	Metadata
Title of the indicator	(NB15) Climate change pressure on Scotland's notified species NB It is intended that once the use of the climate change pressure category in Site Condition Monitoring is more firmly established and the resulting data is more robust, then this will form the basis of the indicator <i>NB15 Condition of climate sensitive species: Number of species identified as under pressure from climate change</i>
Indicator contact: Organisation or individual/s responsible for the indicator	Anna Moss (CXC, University of Dundee)
Indicator data source	SNH Site Condition Monitoring
Data link: URL for retrieving the indicator primary indicator data.	Provided directly by SNH

Table 2: Indicator data

	Indicator data
Temporal coverage: Start and end dates, identifying any significant data gaps.	SCM data includes pressures first reported 1995 until present, however 'climate change' as a pressure category was only introduced during the last cycle of SCM (2011-present)
Frequency of updates: Planned or potential updates	Rolling programme. Update frequency for individual sites based on assessment of need
Spatial coverage: Maximum area for which data is available	All sites monitored by SNH across Scotland
Uncertainties: Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	
Spatial resolution: Scale/unit for which data is collected	Designated site level
Categorical resolution: Potential for disaggregation of data into categories	Individual species or species assemblages

Data accessibility: Restrictions on usage, relevant terms & conditions	
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Table 3 Contributing data sources

Contributing data sources

Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.

Table 4 Indicator methodology

Indicator methodology

The methodology used to create the indicator data
