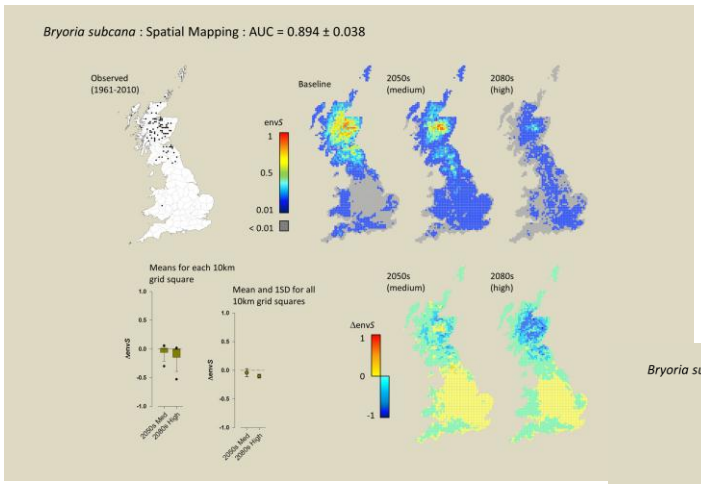
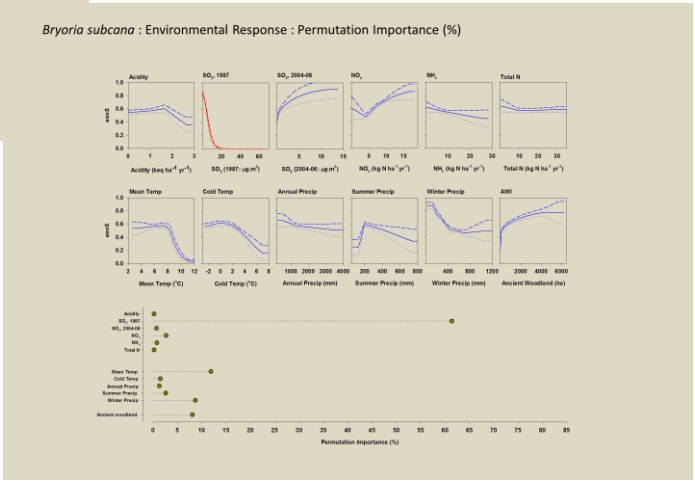
INTERPRETATION AND CRITIQUE

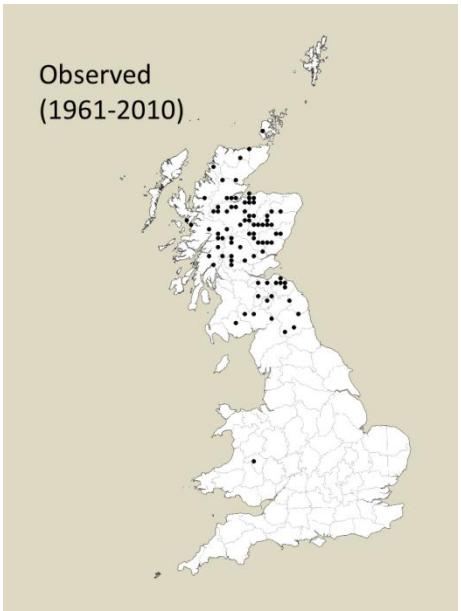
For each of 382 lichen taxa which were successfully modelled (which includes species, in addition to species aggregates and intra-specific taxa), additional bioclimatic details are provided as individual 'species reports'. These reports include two files per species: a spatial mapping file, and an environmental response file.





Spatial Mapping 1

The spatial mapping includes a plot of the baseline distribution used to build the bioclimatic models. These distribution points were compared to the environmental factors in MAXENT. Consider that this is not all the records for a species, but the geolocated records (1961-2010) that are associated with one or more of the 15 native and semi-natural tree species.

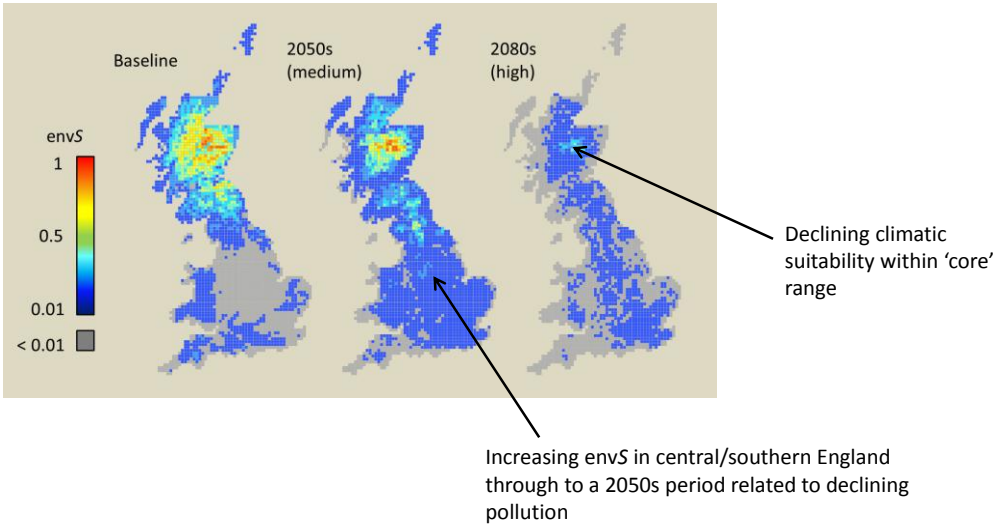


The overall accuracy of the bioclimatic modelling depends on the extent to which the records used here are representative of the species' actual range as an epiphyte.

Spatial Mapping 2

The following three maps show the modelled values of environmental suitability (envS) for the present-day (baseline), and mean env*S* values calculated among climate model variants in the 2050M and 2080H scenarios under a lower SO_2 environment.

Concerning pollution, the interpretation of the scenario values of env*S* may be appropriate across Britain: for example, the env*S* of *Bryoria subcana* is seen to increase in central England presumably as a consequence of an observed decline in SO_2 pollution.

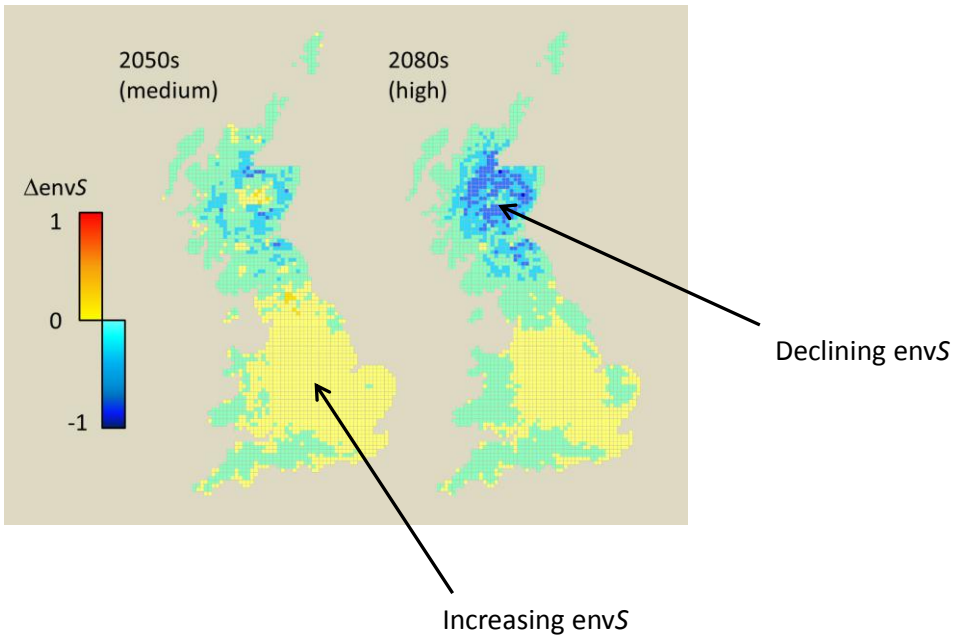


However, the interpretation of scenario values in env*S* explained by climatic effects is likely to be accurate for northern Britain (e.g. Scotland), but increasingly unreliable for central and southern Britain. This is because the observational data under-pinning the bioclimatic modelling were for Britain only, and do not therefore capture the full environmental tolerance of a species where it occurs outside Britain in warmer/drier climates.

It is important to consider the interaction among environmental variables. In the example for *Bryoria subcana*, the increase in envS for central England is potentially offset by a long-term decline in climatic suitability within the core area of its range in northern Britain and especially north-eastern Scotland.

Spatial Mapping 3

Two further maps show the difference in environmental suitability (Δenv*S*) between the baseline and the 2050s medium emissions and 2080s high emissions scenarios. They aid interpretation in the spatial patterns of increasing/decreasing env*S*.

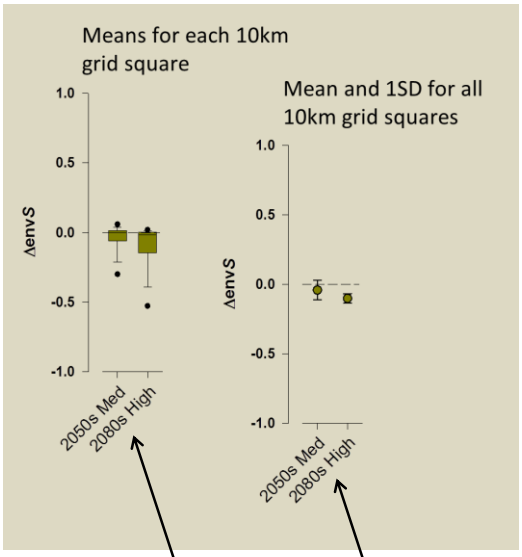


Variability in Climate Models

Two graphs demonstrate variability in a species' changed environmental suitability (Δenv*S*), as (i) spatial variability in Δenv*S* and (ii) variability emerging from uncertainty in the Met Office Hadley Centre's climate models.

Spatial: the first box-plot shows the degree of variation in changed environmental suitability (mean Δenv*S*) across each of the 2616 10km grid-squares (including the median, interquartile range, 10th and 90th percentiles (whiskers), and 5th and 95th percentiles (circles)).

Climate Models: the second point-plot shows an average across all 10km grid-squares, of the mean Δenv*S* and its standard deviation, providing an estimate for each species of the variability contained within the ensemble of climate scenarios.



Spatial variability in mean Δenv*S*, across 10km grid-squares

Overall average of the mean and standard deviation in Δenv*S* related to the 11 variants in a climate model ensemble

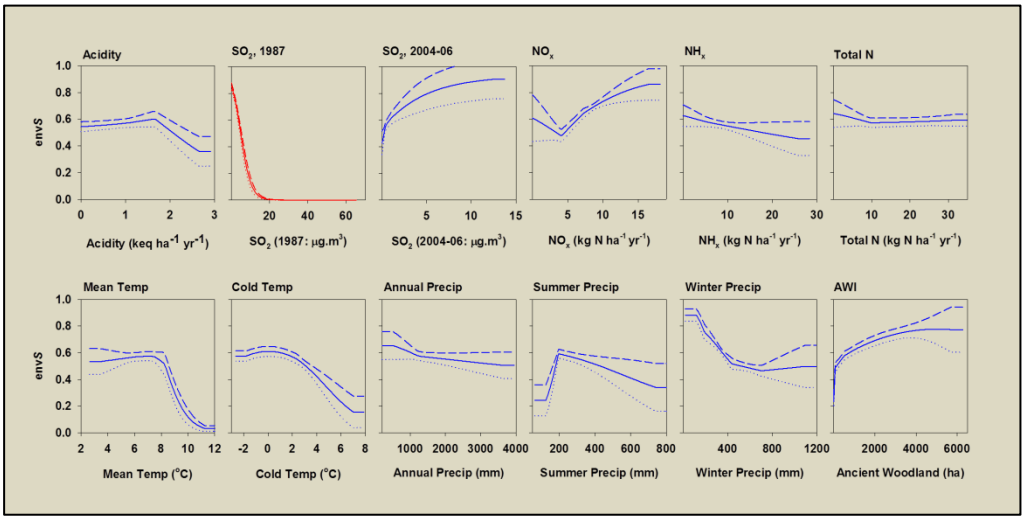
Species Responses

To assess the validity of the bioclimatic modelling – for example, as more autecological data become available – species response curves are provided for each of the 12 environmental variables; with env*S* on the *y*- or vertical-axis.

Note that if two or more variables are correlated, and one of these variables was selected as an important explanation for the species response, then the response to the co-variables may appear negligible.

The most important variable in the model (highest permutation importance) is highlighted in red.

Response curves can be combined with standard UK projections of future climate change to better understand a species' projected



response: see http://ukclimateprojections.metoffice.gov.uk/21708.

Permutation Importance

Permutation tests were performed on explanatory variables; a high permutation importance (%) indicates a greater dependency of the species' modelled response on that variable.

However, other variables can play an important role, e.g. the loss of suitable environmental space for *Bryoria subcana* in north-eastern Scotland appears to be related to its sensitivity to warming temperatures, even though SO_2 has the dominant role in explaining the species' baseline distribution.