Bluebells under oak and hazel coppice woodland

Bluebell *Hyacinthoides non-scripta* (L.) Chouard ex Rothm.

Climate Change Sensitivity:	HIGH	Ability to Manage:	MEDIUM
Non climatic threats:	MEDIUM	Vulnerability:	MEDIUM

Summary

Bluebells are an inconic part of British woodland ground flora, blooming in the spring, often in large numbers. It is a species which has a well defined oceanic temperate distribution within Europe. While it does not presently reach its southern range margin in the UK it may be at significant risk from climate change in southern and central England.

Description

The bluebell is a member of the lily family with distinctive violet/blue flowers. It is perennial, overwintering as a bulb and emerging in the spring to flower, typically in April to early May. By mid-summer, the foliage and flowers die back completely. *H. non-scripta* freely hybridises with the non-native *H. hispanica*, which presents a threat to the true native species.

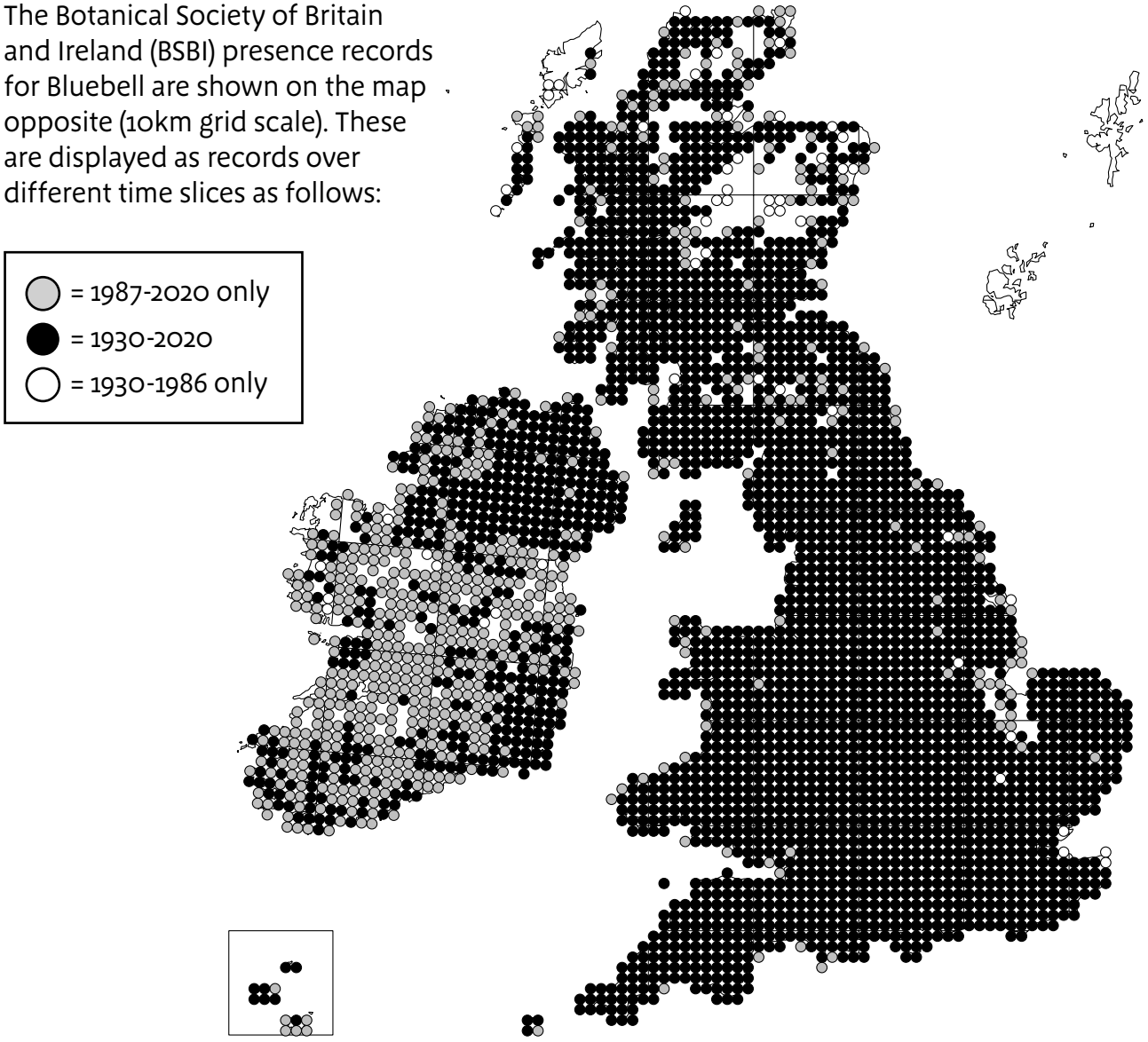
Ecology and distribution

Bluebells occur typically in well drained, deciduous woodland, especially coppice, where they may dominate the ground flora, but can also be found in more open habitats. They are found in most parts of Great Britain except the highest mountains and fenland areas around The Wash. At a European scale, they have a temperate oceanic distribution (Preston & Hill 1997) and are strongly associated with north western areas of Europe with mild, maritime climates. The British Isles contain the largest populations of the species. It occurs on a range of soil types from calcareous to mildly acidic, but is not usually found on very thin soils. There is some evidence that it is drought sensitive (Blackman & Rutter 1954) and more abundant in areas with high rainfall (Kohn *et al* 2009). Seed germination occurs in the autumn and requires a high temperature conditioning phase, with an optimum at 26 to 31 °C, followed by a germination phase at 11 °C (Thompson & Cox 1978).

While the bluebell is an important element of the woodland ground flora, it can grow in both sun and shade conditions and also occurs in grassland, particularly where there is high rainfall and low nutrient conditions (Blackman & Rutter 1954).

Presence of bluebell records at 10km^2 scale provided by the BSBI and are based on records collected mainly by BSBI recorders.

The Botanical Society of Britain and Ireland (BSBI) presence records for Bluebell are shown on the map opposite (10km grid scale). These are displayed as records over different time slices as follows:



Confidence in climate change impacts[20]

Distribution change: **MEDIUM CONFIDENCE** Mechanism: **LOW CONFIDENCE**

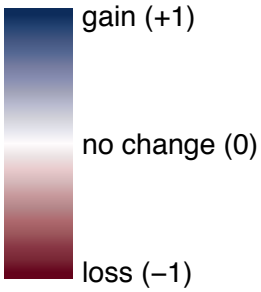
The distribution of the bluebell reflects a clear climatic pattern. Projections (see map below) indicate that there is likely to be a shift in the area of suitable climate, with large parts of southern and central England becoming unsuitable under 2 °C of warming. The distribution of the bluebell is likely to be related to both temperature and rainfall. Increasing temperatures and more frequent summer drought could both make conditions less suitable for the species. There is a range of potential mechanisms, although these have not been tested:

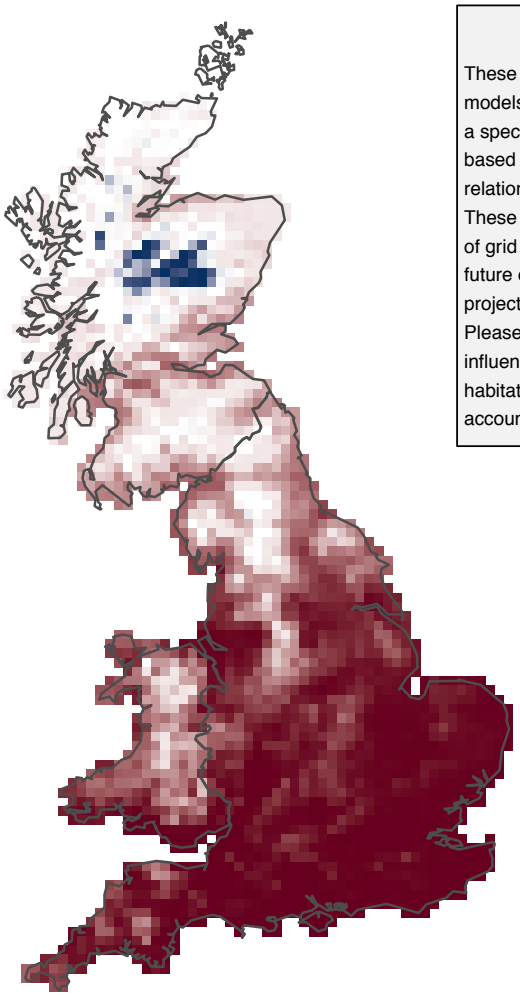
- Drought in spring and early summer may reduce growth and stop accumulation of sufficient reserves in bulbs.
- Earlier leafing of the tree canopy may reduce the potential for carbon acquisition, as while the bluebell's phenology is sensitive to temperature and it can leaf earlier in warm years, day length is shorter earlier in the spring.
- In some years, maximum temperature thresholds for germination may be exceeded.

To date, there is no evidence of any change in range or decline of individual populations in ways consistent with climate change impacts. There is, however, evidence of flowering advancing in a manner consistent with warmer spring temperatures (Tansey *et al* 2017).

20 An assessment of the strength of evidence that distributions are changing and the mechanisms causing change are understood. Refer to Part B, section 5 of the species section introduction for more information.

Projected change in potential distribution of bluebell in the UK with a temperature rise of 2°C (Pearce-Higgins *et al* 2015)





Climate suitability

These maps are created using statistical models which describe the probability that a species will be found in a 10 km grid square, based on its current distribution and its relationship to a number of climatic variables. These can be used to model the suitability of grid squares for a species under possible future climates when climate change projections are taken into account.
Please note that other variables that influence species distributions, such as habitat and land–use change, are not accounted for in the modelling process.

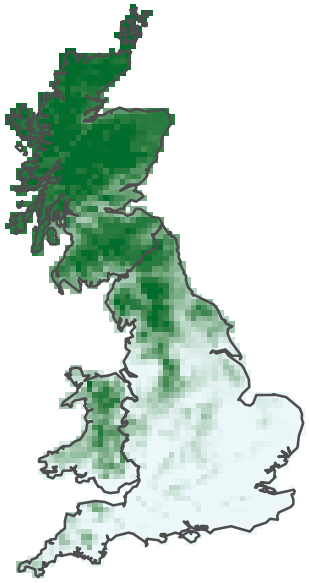
Confidence of change

This species was not included as part of Natural England's Research Report NECR175 assessing the risks & opportunities for species in England as a result of climate change, so no assessment of confidence has been made for this species

Current climate scenario

Climate suitability

Low (2°C change) climate scenario



Created by: University of York Created for: Natural England Created on: August 18 2016

Further information on these projections can be found in the introduction to the species section (Part A, Section 3 and Part B Section 5). Note that this is a guide to where a species may be able to survive, it does not capture other issues such as habitat availability and fragmentation – see text above for further details. Contains public sector information licensed under the Open Government Licence v3.0. Please also see acknowledgement and copyright at the beginning of this manual.

Please read this case study alongside the relevant habitat sheets.

Adaptation options

Adapting management to conserve woodland habitat in which bluebell is found is the most important aspect of adaptation for this species and the woodland habitat sections should be consulted: the following are supplementary notes from a species specific perspective.

At this stage, the best adaptation options to build resilience of existing populations are not clear, but there are likely to be local refugia – areas which are damper and cooler where the species can survive even in a warmer climate in the southern and central areas. It is also possible that interactions with forest stand structure may help to maintain species *in situ*. For example, a more open canopy may reduce the impacts of earlier leafing. Enlarging woodland patches through strategic planting around the edge will help to keep the core area wetter (as water loss is higher at forest edges) and may reduce the impacts of droughts. Annual monitoring of populations in contrasting places and with different management will help to clarify the best strategies.

Bluebell populations in the north and west of England will become crucial to maintaining the status of the species, not just in England but internationally, given the limited global distribution. Climate change is a threat not just to southern British populations but also to populations in France, Spain and Portugal. It is therefore particularly important to protect these populations from other pressures, such as deer, nitrogen deposition and hybridisation with *H. hispanica*.

Relevant Countryside Stewardship options

WD1 Woodland creation - maintenance payments

WD2 Woodland improvement

References and further reading

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