Heather and bilberry sward
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Bilberry *Vaccinium myrtillus*

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

Summary

Bilberry is an important species supporting upland birds such as ring ouzel *Turdus torquatus* and black grouse *Tetrao tetrix*, and many invertebrates. It's seed production is influenced considerably by climate. However as it reproduces primarily through vegetative growth, this is unlikely to represent a threat. Climate change is likely to operate through reducing its competitive ability compared to other species such as heather, bracken and grasses. At higher altitudes bilberry may benefit from warming, but in the south and east climate change is likely to pose a threat. Adaptation options mainly consist of ensuring the optimum conditions for bilberry growth and reproduction by manipulating the level of shading and grazing. Addressing *Phytophthora* and competition from other species is also likely to be important in the south of its range.

Description

Bilberry is a deciduous, rhizomatous dwarf shrub. It has a green, three angled stem with two or three ranks of leaves and, if mature, older woody shoots. The leaves are finely toothed and prominently veined on the lower surface. The flowers are 4-6mm long, are borne singly in leaf axils, and have five small calyx segments and a fused pink urn shaped corolla. The fruits are a purple-black berry (Ritchie 1956).

Ecology and distribution

Bilberry is a perennial plant that regenerates primarily by clonal growth of existing plants and only occasionally by seed. It is a major component of upland heaths and some lowland heaths and a range of similar habitats on acid substrates in the UK, extending in altitudinal range from near sea level to high mountain tops. Bilberry has undergone a significant decline since the 1950's in the south and east of England, mainly reflecting the loss and fragmentation of lowland heathland.

Seedlings are sensitive to drought, which may limit germination in areas subject to low humidity levels. Young plants are slow growing and take several years to reach maturity, but when well-established bilberry can spread over large areas via underground shoots.

It is an acid-loving plant that is common and locally dominant in well-drained to poorly-drained heaths and moorland and in the ground flora in acid beech, birch, pine and oak woodland. It also occurs on raised areas in peat bogs in the north and west (Richie 1956) or where drainage systems have lowered the water table. It grows on a range of soil types including deep peat, mineral soils, skeletal soils on scree and rock-faces, and free-draining sands. Bilberry has a markedly northern and western distribution in the UK. It is relatively rare in the east midlands and East Anglia, and where it is present it occupies parts of the landscape with cooler and more humid microclimates (Coudun & Gégout 2007).

Bilberry is relatively shade tolerant, and cover can increase with shading in certain situations (Parlane *et al* 2006). It may form dense stands in woodland. In open areas it can be outcompeted by heather and grasses. Bilberry is somewhat sensitive to selective grazing by deer and sheep, as this tends to reduce the height and competitive ability of the plant, as well as removing flowering tips. It will be out-competed by heather where both occur under moderate and high grazing regimes (Welch 1998). There are indications that bilberry is highly sensitive to uncontrolled heath fires in southern England, suggesting that the rootstock is vulnerable to heat damage in dry soil.

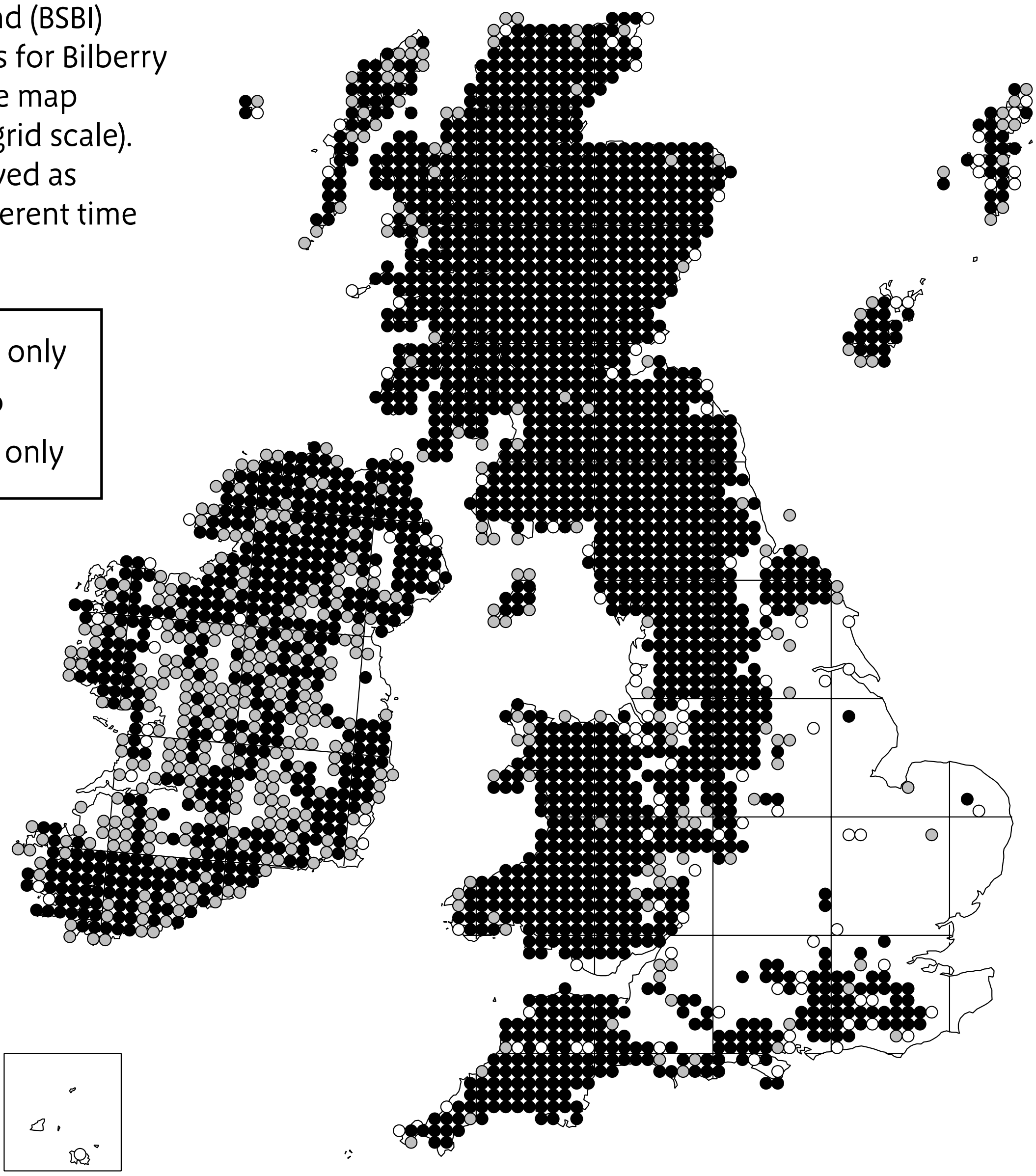
Bilberry is an important nectar-source. Its fruits are eaten by several species of birds and mammals and it is the sole food plant of scarce moths, including the bilberry pug *Pasiphila debiliata*, beautiful snout *Hypena crassalis* and northern spinach *Eulithis populata*. In lowland heathland situations, bilberry-dominated vegetation can provide nesting and foraging areas for birds, and important cover and thermo-regulation areas for reptiles such as sand lizard and smooth snake. Bilberry forms a hybrid with *Vaccinium vitis-idea*, the rare *Vaccinium x intermedium*, which is relatively common in the West Midlands. It is worth noting that if the parent bilberry is impacted by climate change it would also affect the hybrid. Bilberry can be present in 41 NVC communities which occur on approximately 1000 SSSIs across England. Some of these SSSIs are also Special Areas for Conservation (SACs). Bilberry is host to over 100 species of invertebrate.

Bilberry appears to have a high susceptibility to infection by the devastating fungus-like pathogens *Phytophthora ramorum* and *Phytophthora kernoviae*, which are implicated in sudden oak death and the death of beech trees. These are notifiable diseases which are considered a serious economic and ecological threat. In bilberry, the symptoms are stem lesions, leaf drop and rapid die-back of stems, which often affect extensive patches of the plant. The ecology of the pathogen is poorly understood but its spread is thought to be helped by humid conditions. Research indicates that bilberry may represent a potentially important host for the pathogens and therefore, where infected, bilberry may pose a threat to other susceptible plants.

Presence of Bilberry 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 Bilberry are shown on the map opposite (10km grid scale). These are displayed as records over different time slices as follows:

- ◯ (grey) = 1987-2020 only
- ● = 1930-2020
- ◯ = 1930-1986 only



Confidence in climate change impacts[19]

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

Because bilberry seed requires a cold chilling period to break its dormancy (ACIA 2005), projected warming is likely to reduce climatic suitability in the south and east of the country. It appears to be sensitive to late season drought (Taulavuori *et al* 2010) making it vulnerable to the increased risk of more frequent and extreme summer droughts, especially in the south and east. In northern areas, warmer conditions in the winter and spring are associated with early de-hardening (frost tolerance), exposure to drought (Tahkokorpi, *et al* 2007, Rixen *et al* 2010; Selas *et al* 2015), and frost damage (Tolvanen 1997) linked to a reduction in snow cover (Tolvanen 1997; Blume-Werry *et al* 2016).

Seed production is also adversely affected by high temperatures and low or high amounts of precipitation during berry ripening in summer (Selas 2000). As the plant only rarely reproduces by seed, this is unlikely to have an impact on existing bilberry populations but will have an impact on the ability of the plant to colonise new or restored sites and will affect a wide range of species that feed on the berries (Moe *et al* 2018).

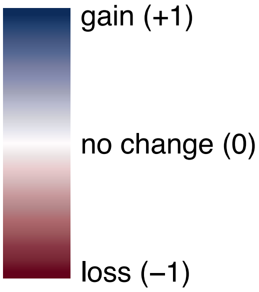
At higher latitudes and altitudes, bilberry responds positively to higher temperatures, if it is not adversely impacted by water deficit (Pato & Obeso 2012; Rixen, Schwoerer & Wipf 2010). It has been demonstrated to benefit from increased CO_2 at the expense of other species (Dawes *et al* 2011).

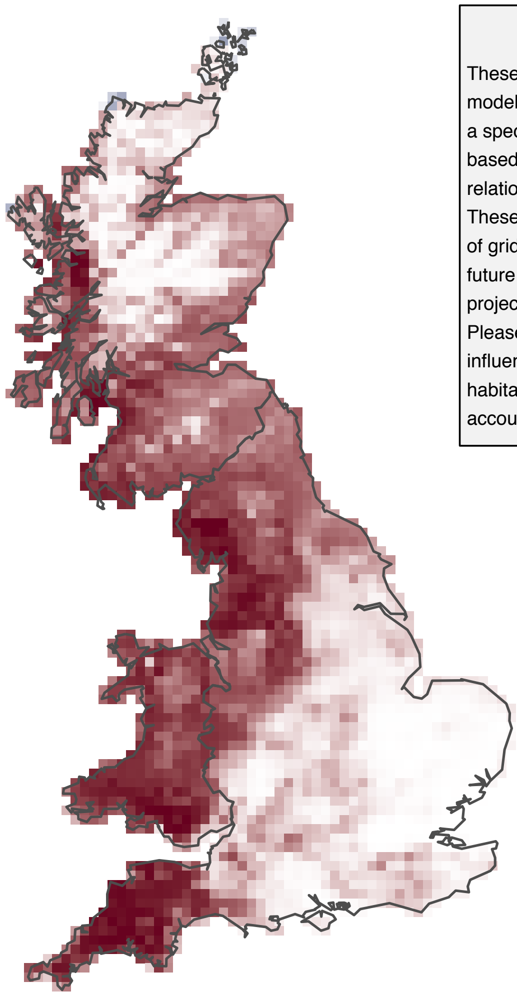
Although tolerant of wildfire to a certain degree in upland situations, regrowth of bilberry has been shown to be slower than other species found within its habitat, such as heathers, grasses and bracken (Taulavuori, Laine & Taulavuori 2013). The impact of fire is likely to be determined by the timing of the event and the environmental conditions at the time.

Bilberry is not at its northern margin in England, and rarely at its altitudinal limit. There is some scope for it to colonise higher altitudes in parts of the Lake District.

19 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 bilberry in the UK with a temperature rise of 2°C (Pearce-Higgins *et al* 2015)





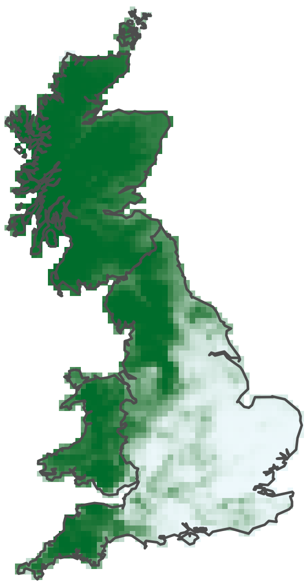
Climate suitability

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.

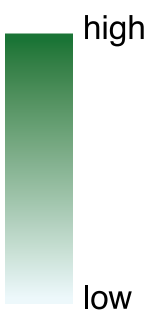
Confidence of change

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

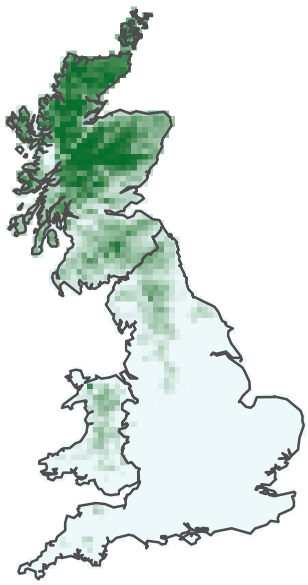
Current climate scenario



Climate suitability



Low (2°C change) climate scenario



Created by:	University of York	Created for:	Natural England	Created on:	August 19 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

Adaptation for bilberry is likely to focus on creating optimum habitat conditions for its growth and reproduction. The main aim in many places will be to ensure grazing is at a level compatible with restoring or maintaining the habitat. Management of woodlands where bilberry is a component of the ground layer should be planned so as to maintain appropriate levels of shade and humidity.

- Manage livestock through low intensity seasonal grazing to promote the growth of bilberry and reduce competition from surrounding vegetation.
- Manage trees and woodland to provide intermediate levels of shade in locations where bilberry populations are declining or are in competition with heather. Seek to retain appropriate canopy cover to maintain high levels of humidity and avoid rapid and excessive opening up of gaps in the canopy where this may encourage the growth of dense bramble.
- In lowland woodlands in particular, seek to control the spread of competing species which may cast high levels of shade such as holly *Ilex aquifolium*, rhododendron *rhododendron ponticum* and shallon *Gaultheria shallon* (the aim for the last two species should be for eradication).
- Manage fire risk and reduce the amount of planned fire management. Follow the **heather and grass burning code**.
- Control the dominance of bracken *Pteridium aquilinum* where it poses a threat to the survival of bilberry through excessive shading and accumulation of leaf litter.
- In the south and east of its range, identify locations that are likely to remain cooler in the face of warming and ensure that they are protected and managed to support bilberry.

Relevant Countryside Stewardship options

LH1 Management of lowland heathland

LH2 Restoration of forestry and woodland to lowland heathland

LH3 Creation of heathland from arable or improved grassland

UP3 Management of moorland

WT10 Management of lowland raised bog

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