Mountain ringlet
© David Morris

Mountain ringlet *Erebia epiphron* Knoch.

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

Summary

The mountain ringlet is found in mountainous areas of England and Scotland, generally between altitudes of 450 and 700 metres above sea level. Difficulties in surveying this species means it is probably under-recorded within its range, particularly at remote sites in Scotland.

There is evidence that the mountain ringlet has been lost from lower altitude sites in a pattern consistent with a warming climate (Franco *et al* 2006, A. Suggitt pers. Comm.). Potential climatic drivers of observed changes in the mountain ringlet's distribution are poorly understood, but may include increased mortality of overwintering larvae due to warmer winters or higher summer temperatures exceeding the thermal tolerance of developing eggs and early instar larvae.

Under projected climate change, the distribution of mountain ringlet is likely to contract further with lower altitude and south facing sites most at risk.

Altering the management of sites to promote both the host plant and nectar sources, together with the creation of a range of suitable microclimates through appropriate grazing management, may increase resilience to a degree.

There may be opportunities to use local translocation to establish new colonies within the Lake District to increase population size in potential refugia.

Description

The butterfly is the smallest "Brown" (*Nymphalidae)* family found in England. It has a hairy body and dark brown wings, both of which are adaptions to cold conditions. Its wings have rows of black-centred orange eyespots. The female is somewhat larger than the male, and the bands or rings are paler. Scottish individuals are larger than those found in the Lake District. They also tend to have larger eyespots and pupils, although there is considerable variation within each region.

Ecology and distribution

The mountain ringlet is the UK's only truly montane species of butterfly. In England, it is restricted to a relatively small number of colonies in the Lake District. There are also populations in the West and Central Highlands of Scotland, with isolated populations in the Cairngorms. The English and Scottish populations are genetically different and are not likely to have interacted for thousands of years (M. Minter, pers. comm.). Field surveys suggest that 26% of historic English populations (with a pre-2000 record) are now extinct (A. Suggitt 2019 pers. comm.; Franco *et al* 2006). (The localised distribution of the butterfly means that these changes are not picked up at the 10km^2 resolution of the national distribution maps.)

It is most abundant in areas with a combination of mat-grass *Nardus stricta* and abundant nectar plants. Heath bedstraw *Galium saxatile*, meadow buttercup *Ranunculus acris*, and tormentil *Potentilla erecta* are preferred in heavily grazed sites, but where grazing permits a wider range of flowering plants are also utilised, such as thyme, hawkweeds and marsh thistle.

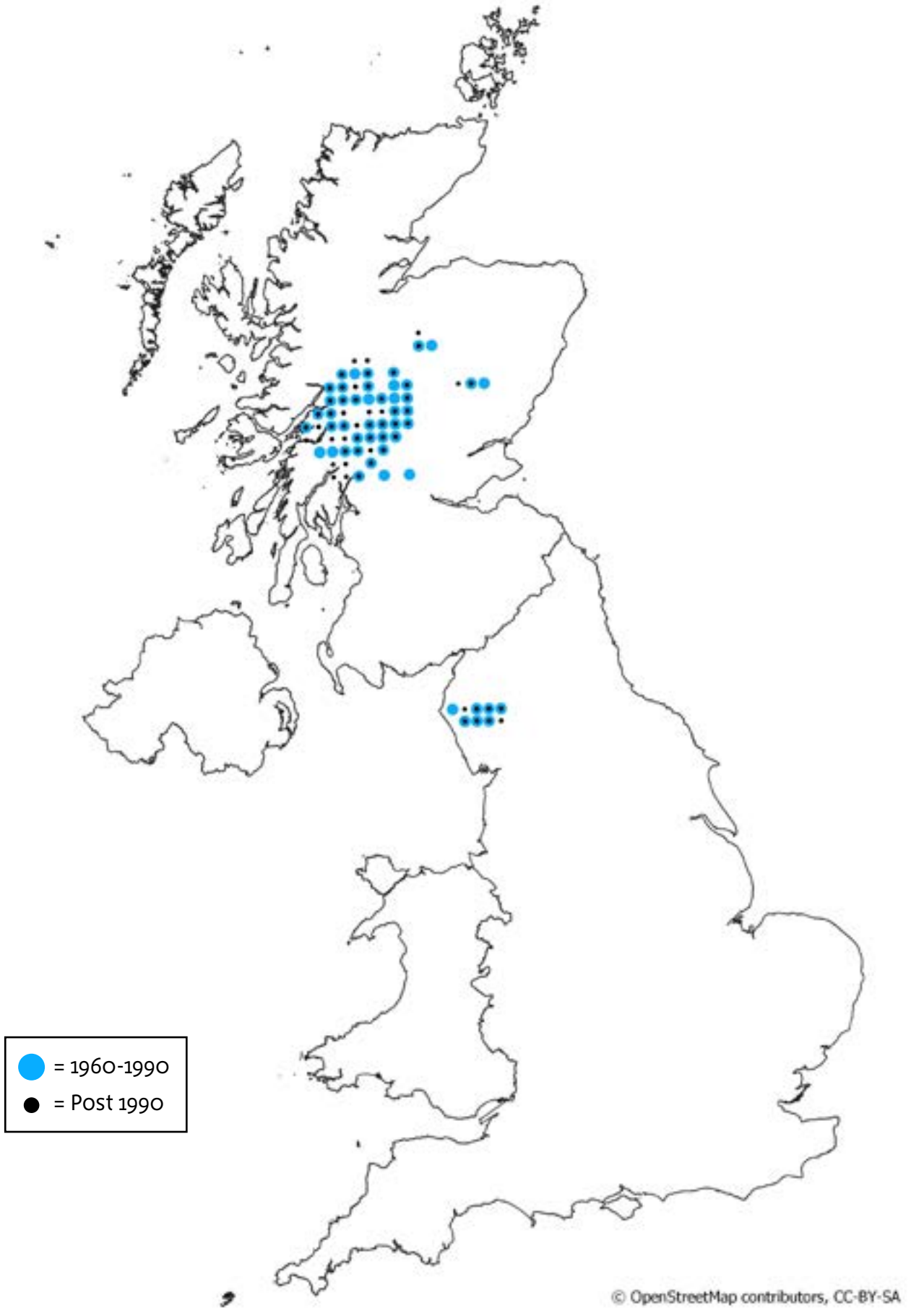
Eggs are laid singly and close to the ground on the dead leaves of mat-grass or sheep's-fescue *Festuca ovina* (Ewing *et al* 2019) although other plants are occasionally used. Swards with a high abundance of the main host plants are preferred. The larvae feed at night and hide by day at the grass base. The larvae hibernate within the sward as third instar caterpillars during late August or September. After resuming feeding in the spring, pupation occurs in late May or June on the ground or in grass tussocks. In captivity the species has been shown to have the potential to have a two year life cycle, which could act as an adaption to potential poor summer conditions preventing mating.

The short flight period often extends from the middle of June to late July, and varies with altitude. Warmer, low lying sites can see individuals on the wing in May, while at cooler, high altitude sites, the flight season can extend well into August. There are also marked differences in the peak emergence from year to year. Adults are relatively short lived and their activity is highly dependent on temperature. In cooler conditions, flights are confined to sheltered locations rich in nectar plants, whereas in warmer conditions, adults may be found more widely across south-facing slopes.

The mountain ringlet is found in discrete colonies. Adults tend to remain sheltered deep in grass tussocks in overcast and cool conditions and only fly in bright sunshine. They are relatively sedentary, and populations on different mountain ranges are unlikely to mix.

Butterfly Conservation's presence records for mountain ringlet over 2 timeslices, 1960-1990 and post 1990, are shown on the map below (10km grid scale).

Presence of mountain ringlet records, 10km².
Source: Butterfly Conservation: Butterflies for the New Millennium.



Confidence in climate change impacts[31]

Distribution change: **HIGH CONFIDENCE** Mechanism: **LOW CONFIDENCE**

The loss and high turnover of mountain ringlet colonies from lower altitude sites is consistent with adverse impacts associated with a warming climate (Franco *et al* 2006, Suggitt 2019 pers. comm.). The mechanism driving the decline remains uncertain. One potential mechanism via which climate change may impact mountain ringlets is via reductions in snow cover leading to increased mortality of overwintering larvae due to greater exposure to cold (Vrba *et al* 2016, Ewing 2019 pers. comm). Alternatively, periods of unseasonal mid-winter warming, followed by resumption of cold conditions, may disrupt hibernation of mountain ringlet larvae, also impacting larval survival, or spring warming may disrupt the synchrony between the emergence of males and females (Konvička *et al* 2016).

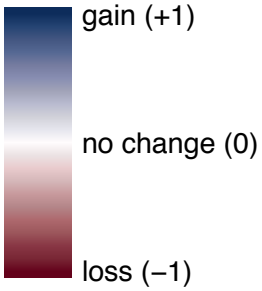
The species' preference for warm sites for oviposition suggests that hotter summer temperatures are unlikely to be the direct cause of its decline to date, however with increased warming the temperature of currently preferred oviposition sites may become increasingly unsuitable and/or leave these sites more prone to drought.

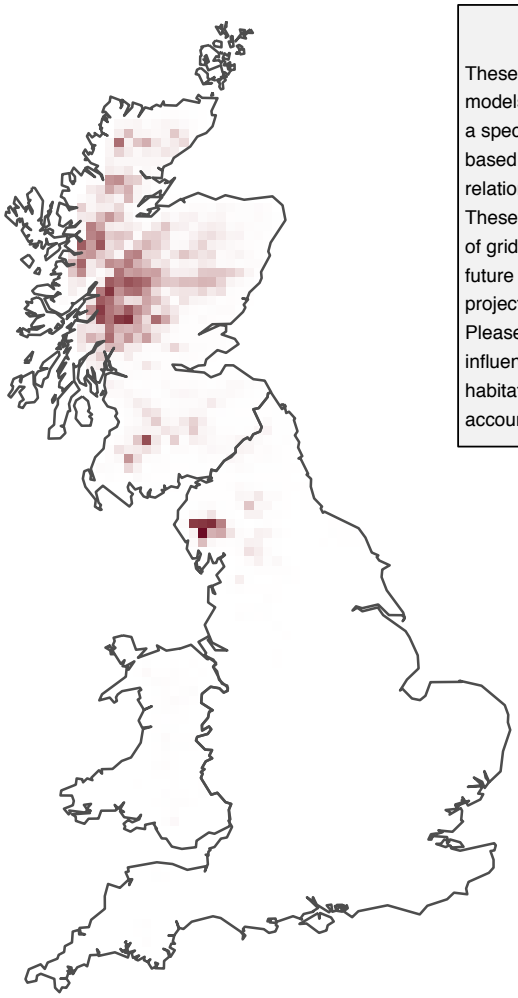
Under projected climate change, the distribution of the mountain ringlet is likely to contract further, with lower altitude and south facing sites most at risk.

Its altitude-restricted distribution means that the potential area of suitable habitat for mountain ringlet in England will continue to decline. A limited number of higher altitude locations (with sufficient shelter from the wind) could become more climatically suitable, but this will be more than offset by losses at lower altitude.

31 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 mountain ringlet in the UK with a temperature rise of 2°C (Pearce-Higgins *et al* 2015).





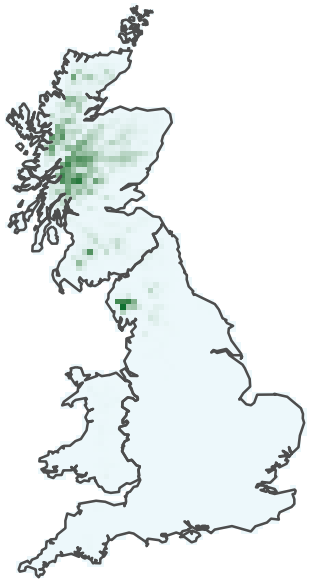
Climate suitability

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

The simultaneous loss of this species from sites at lower altitude and the observed preference for warm oviposition sites presents a challenge in developing adaptation options. Changes to management to ensure the availability of a suitable swards and oviposition sites across a broad topographic and altitudinal range may increase chances of maintaining the species at its range margin in England.

- Ensure optimum management of existing sites through grazing to encourage a sward that supports high populations of mat-grass and sheep's fescue, moderate levels of litter and a wide range of nectar sources. Avoid over- or under-grazing.
- In south-facing and lower altitude sites, manipulate management to promote a broad range of microclimates from short to taller swards, potentially accepting the presence of scrub to create shaded areas.
- Within existing sites, identify and protect areas that have the potential to act as climate change refugia, such as sites with topographic variation or close to flushes or streams.
- Identify potentially suitable higher altitude locations and manage to promote suitable swards and connectivity with existing populations to promote natural colonisation.
- Monitor known populations to determine the extent of any change and, where possible, seek to identify the mechanisms driving change. Monitor the impact of any adaptation actions.
- Undertake research to understand colonisation processes, to improve the targeting of habitat restoration and creation.
- Consider local translocation within the Lake District to establish new populations in potentially suitable but currently unoccupied sites with the potential to become refugia where natural colonisation is not likely.
- The English sub-species *E. e. mnemon* found in the Lake District is distinct from the Scottish sub-species *E. e. scotica* in the Scottish Highlands. This should be recognised prior to consideration of translocation outside its current natural range.

Relevant Countryside Stewardship options

UP3 Management of moorland

UP4 Management of moorland vegetation supplement

SP9 Threatened species supplement

Case Studies

Farming with nature at RSPB Haweswater

The RSPB has carried out research on mountain ringlets at its reserve in Haweswater, and at other sites in the Lake District and Scotland, to better understand the autecology of the mountain ringlet, particularly in relation to patterns of habitat selection. With an improvement knowledge of the species' basic habitat requirements, the project then hopes to develop options to improve the likelihood of this species successfully adapting to climate change.

References and further reading

Ewing, S.R., Menéndez, R., Schofield, L. & Bradbury, R.B. (2019). Vegetation composition and structure are important predictors of oviposition site selection in an alpine butterfly, the mountain ringlet (*Erebia epiphron*). Journal of Insect Conservation. In Press.

Franco, A.M.A., Hill, J.K., Kitschke, C., Collingham, Y.C., Roy, D.B., Fox, R., Huntley, B. & Thomas, C.D. (2006) Impacts of climate warming and habitat loss on extinctions at species' low-latitude range boundaries. Glob. Chang. Biol. 12, 1545–1553.

Konvička, M., Beneš, J., Čížek, O., Kuras, T. & Klečková, I. (2016). **Has the currently warming climate affected populations of the mountain ringlet butterfly, Erebia epiphron (Lepidoptera: Nymphalidae), in low-elevation mountains?**. Eur. J. Entomol 113: 295-301.

Masterman, A.J. (2011). The distribution and habitat of mountain ringlet *Erebia epiphron* (Knoch) in Scotland. Atropos. 41, 10-18.

Masterman, A.J. (2012) Changes in mountain ringlet *Erebia epiphron* (Knoch) Habitat with Altitude in Scotland, Associations with Topography and Possible Effects of Climate Warming. Atropos 47, 43-54.

Pearce-Higgins, J.W., Ausden, M.A., Beale, C.M., Oliver, T.H. & Crick, H.Q.P. (eds). 2015. **Research on the assessment of risks & opportunities for species in England as a result of climate change**. Natural England Commissioned Reports, Number 175.

Ravenscroft, N.O.M. & Warren, M.S. (1996) **Species Action Plan mountain ringlet (Erebria epiphron)**. Butterfly Conservation. Wareham.

Thomas, C.D., Hill, J.K., Anderson, B.J., Bailey, S., Beale, C.M., Bradbury, R.B., Bulman, C.R., Crick, H.P.Q., Eigenbrod, F., Griffiths, H.M., Kunin, W.E., Oliver, T.H., Walmsley, C.A., Watts, K., Worsfold, N.T. & Yardley, T. (2010) A framework for assessing threats and benefits to species responding to climate change. Methods in Ecology and Evolution 2: 125–142.

Vrba P, Konvicka M, Nedved O (2012) Reverse altitudinal cline in cold hardiness among Erebia butterflies. CryoLetters 33(4): 251–258.