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Conservation of Britain's biodiversity: Distribution and status of *Hieracium subbritannicum*, Limestone Hawkweed (Asteraceae)

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Abstract
Hieracium subbritannicum, Limestone Hawkweed, is a British endemic plant. Field surveys indicate at least 745 plants in six semi-upland sites in Wales, and it has gone from seven sites on Old Red Sandstone and in the Wye Valley in England. The IUCN threat status is 'Vulnerable'.

Keywords: England, IUCN threat status, Wales.

Introduction

Hieracium subbritannicum (F. Hanb.) P.D. Sell & C. West, Limestone Hawkweed, is a British endemic of the Wye Valley and South Wales, occurring in v.c.34 (West Gloucestershire), v.c.36 (Herefordshire), v.c.42 (Breconshire) and v.c.44 (Carmarthenshire) (Sell & West 1968; Sell & Murrell, 2006; McCosh & Rich, 2018; Rich, 2020).

Hieracium subbritannicum is one of the many segregates of the informal *H. britannicum* group and was first described as *Hieracium stenolepis* var. *subbritannicum* by Ley (1909). Pugsley (1948) transferred it to *H. britannicum* F. Hanb. var. *subbritannicum* (Ley) Pugsley. It was raised to species status by Sell & West (1955) who designated a lectotype collected at Craig Cille (Craig y Cilau), Breconshire by A. Ley on 5 June 1894 (the lectotype is now deposited in **CGE**).

Hieracium subbritannicum is characterised by having somewhat glaucous, ovate to lanceolate rosette leaves with large, retrorse teeth at the truncate base, no stem leaves, large dark, truncate-based capitula with numerous simple hairs, fewer glandular hairs and sparse stellate hairs on the involucral bracts (Figs. 1 & 2). Two other members of the *H. britannicum* group occur in the Wye Valley and South Wales but not directly with it: *H. vagicola* P.D. Sell occurs in the Wye Valley and differs in having dense stellate hairs on the involucral bracts (Sawtschuk & Rich, 2008), and *H. attenboroughianum* T.C.G. Rich occurs in the central Brecon Beacons and differs in having remotely denticulate, ovate leaves and sparse simple eglandular hairs on the involucral bracts (Rich, 2014).

Following unsuccessful searches in the Wye Valley by T.C.G. Rich and J. Sawtschuk in 2007, there was concern that *H. subbritannicum* may be declining so S. Lee (née Moore) surveyed its population sizes in 2009. The aim of this paper is to

summarise the data and assess its conservation status; full details are given by Moore (2009) with a few recent updates by T.C.G. Rich.

Figure 1. *Hieracium subbritannicum.* Craig y Cilau (type locality)

Methods

Historical records were compiled from **BM**, **CGE** and **NMW** (material determined by P.D. Sell or D. McCosh), the literature, David McCosh's *Hieracium* database (October 2020 version) and the BSBI Database (data extracted 23 December 2020). The records are summarised in Appendix 1.

The 'look-see' method (Hill *et al*., 2005) was adopted for field data collection as it was the most appropriate method to survey sites with many inaccessible areas on cliffs, thus the population counts provide minimum population estimates. At each site, the location was recorded using GPS and the number of vegetative and flowering plants counted. Forty-five 2 m x 2 m quadrats centred on *H. subbritannicum* were recorded and classified in terms of *British Plant Communities* (Rodwell *et al.* 1991-2000).

Results

Distribution and population sizes

The historical records and field work indicate *H. subbritannicum* occurred in nine hectads in 13 sites in four vice-counties (Fig. 3). The sites are described below from west to east.

Figure 2. Details of *Hieracium subbritannicum* showing (above) rosette leaves with large retrorse teeth, and (below) capitula.

Carreg Cennan (v.c.44 Carmarthenshire)
It was first collected on the Carreg Cennan castle walls in 1894 by A. Ley and has been collected infrequently since from the walls and rocks beside the castle. On 3 June 2009, at least six plants were found on ±south-facing Carboniferous Limestone rocks in open grassland. More possible plants were seen on the castle walls but it was not possible to get close enough for an accurate identification (Moore, 2009). A similar small population was observed on the rocks on 18 May 2015 by T.C.G. Rich.

Clogau Mawr and Clogau Bach (v.c.44 Carmarthenshire)
It was first collected in 1954 by C. West and has been collected occasionally since. On 6 July 2009, 117 *H. subbritannicum* plants were found on ±north-facing Carboniferous Limestone rocks spread over several hundred metres in a series of clusters (Moore, 2009).

Bannau Sir Gaer (v.c.44 Carmarthenshire)
Recorded once from 'first cwm Carmarthen Fan' in 1899 by A. Ley but not collected again. The Llyn y Fan Fach area was visited on 10 June, 5 July and 17 August 2009 whilst also looking for *H. breconicola* but no *H. subbritannicum* was found. The steep Old Red Sandstone cliffs are extensive, very steep and heavily grazed by sheep and it might still be present on the inaccessible cliffs (Moore, 2009; Lee & Rich, 2021).

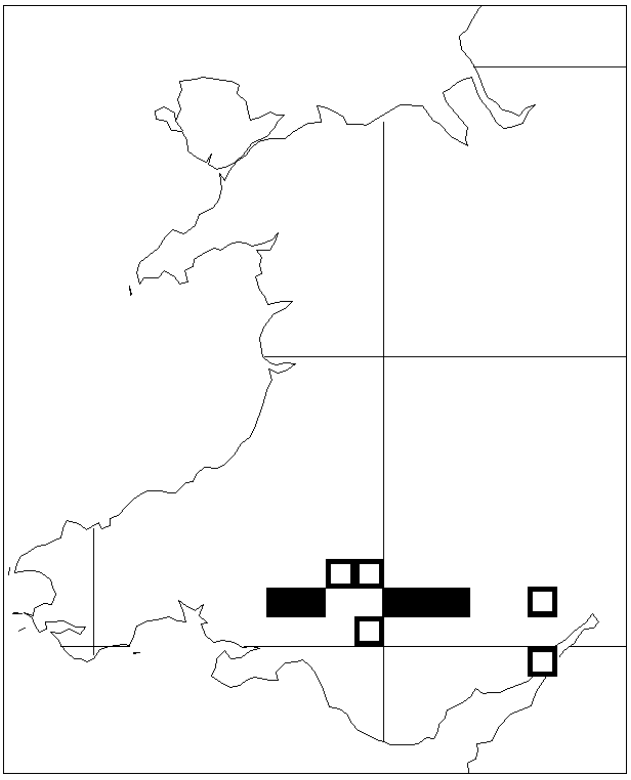

Figure 3: Distribution of *Hieracium subbritannicum.* ■ 2009-2020. □ pre-2009.

Craig Cwm-du (Craig Du; v.c.42 Breconshire)
It was first collected in 1893 by A. Ley from Old Red Sandstone rocks and cliffs and was last recorded from the central cliff in 1964 by B.A. Miles. On 18 July 2009 no *H. subbritannicum* was found despite most of the crags being visited (three other hawkweeds were collected; Moore, 2009). This site has been visited in 2004, 2013, 2016 and 2020 by T.C.G. Rich whilst looking for other hawkweeds but *H. subbritannicum* has not been refound.

Craig y Llyn (v.c.41 Glamorgan)
It was first collected in 1890 by A. Ley and once again in 1896. The Old Red Sandstone rocks above Craig y Llyn were surveyed on 24 June 2009 but no *H. subbritannicum* was found. The vegetation was very long, dense and with lots of damp and largely acidic rocks (Moore, 2009). T.C.G. Rich also searched the cliffs again on 26 July 2020 without success though at least five other hawkweeds were found.

Dyffryn Crawnon (v.c.42 Breconshire)
It was first recorded in 1953 by C.E.A. Andrews. One plant was refound on 23 June 2016 by T.C.G. Rich on ±west-facing Carboniferous Limestone cliffs at the head of the valley with *H. sanguineum* (no quadrat data were collected for this site).

Craig y Castell (v.c.42 Breconshire)
It was first collected in 1937 by J. Chapple & N.D. Simpson and only twice since in a westerly extension the main Craig y Cilau population. On 17 July 2009, 72 *H. subbritannicum* plants were found on ledges and vertical faces of the ±north-facing Carboniferous Limestone rocks (Moore, 2009).

Craig y Cilau area (v.c.42 Breconshire)
Hieracium subbritannicum has been repeatedly collected from the Craig y Cilau area since it was first collected in 1893 by A. Ley, and this is the type locality. On 29 June and 1, 10 and 16 July 2009, 525 *H. subbritannicum* plants were recorded across about 5 km of cliffs on rocks, in crevices and small ledges on Carboniferous Limestone, in about six main areas. Over half of these plants had already gone to seed, suggesting that they had flowered early in the season and apart from a couple, all of the plants had ±north-facing aspects (Moore, 2009).

Darren Disgwylfa (v.c.42 Breconshire)
It was first collected in 1953 by C.E.A. Andrews and again in 2000 by T.C.G. Rich, in an easterly extension the main Craig y Cilau population. On 21 June 2009, at least 24 *H. subbritannicum* plants were found on vertical, ±east-facing Carboniferous Limestone rocks. There were also many inaccessible hawkweeds out of reach near the top of the outcrops so the count may be an underestimate (Moore, 2009).

Ban-y-gor Rocks, Tidenham (v.c.34 West Gloucestershire)
It was collected once in 1894 by W.A. Shoolbred and has not been collected again. It was not found during visits to look for *H. pachyphylloides* and *H. vagicola* in 2007 (Sawtschuk & Rich, 2008). This site now has no public access and was not searched in 2009.

Great Doward (v.c.36 Herefordshire)
It was first collected from limestone quarries in 1886 by F.J. Hanbury and A. Ley, and was last collected in 1894. This is presumably the same quarry that *H. pachyphylloides* was collected from on the same day and the quarries have been filled in and no longer support any hawkweeds (Sawtschuk & Rich, 2008). Two days were spent surveying the Great Doward, Symond's Yat and Coldwell Rocks area on 26 and 27 June 2009 but no *H. subbritannicum* plants were found (Moore, 2009).

Symond's Yat (v.c.34 West Gloucestershire)
There are records for 1907 by W.R. Linton and 1954 by C.E.A. Andrews, but the Symond's Yat area is vast and there are no more specific detail to help clarify where it occurred; it is possible that both records are from Coldwell Rocks (see below). It was not collected during searches of the Symond's Yat area for *H. pachyphylloides* in 2007 (Sawtschuk & Rich, 2008). No *H. subbritannicum* plants were found during the

2009 surveys and many of the rocks are now shaded by trees or covered with ivy (Moore, 2009).

Coldwell Rocks (v.c.34 West Gloucestershire)
It was first collected in Coldwell Rocks quarry in 1886 by A. Ley and from the top of the rocks in 1956 by C.E.A. Andrews. The quarry was searched when looking for *H. pachyphylloides* in 2007 (Sawtschuk & Rich, 2008) and is now overgrown with trees and unsuitable. Coldwell Rocks have also been searched many times including the 2009 surveys and although *H. pachyphylloides* was still present in 2016 and 2017, no *H. subbritannicum* was found.

Other records
Records for Lancaut and Pen Moel refer to *H. vagicola* (Hieracia Study Group, 1984; Sawtschuk & Rich, 2008). Records for the Great Orme and Little Orme refer to *H. britannicoides* (Ley, 1909; Lee & Rich, 2021).

Biology and ecology
Observations of the plants show *H. subbritannicum* is a long-lived perennial which flowers repeatedly. It flowers mainly in late May and June, continuing into July and occasionally with a second flowering in the autumn. Overall about 27% of the plants were vegetative and 73% flowering (range 20-100% flowering in different populations; Moore, 2009). It is a triploid with a chromosome number of 2n = 27 (Mills & Stace, 1974) so is likely to be apomictic (Sell & Murrell, 2006 state it is apomictic but this has not been tested experimentally).

The habitat is open rocks, cliffs, ledges, scree and rubble. Ten of the sites are on Carboniferous Limestone and three sites are on Old Red Sandstone. The altitudes range from *c*. 80–120 m in the Wye Valley, and to 250 m at Carreg Cennan, 350–450 m at Craig y Cilau escarpment, c. 500 m at Craig Cwm-du and potentially up to *c*. 600 m at Bannau Sir Gaer.

The plant usually occurred on vertical rocks with slopes of 80–90 degrees and with a predominantly north-facing aspect (Table 1). The vegetation cover ranged from 1–25(–50)% with an average of 9%. The vegetation height ranged from (2–)5–30(–50) cm with an average of 17 cm. It is susceptible to grazing by sheep and is only found in ungrazed situations.

Table 1. Number (and %) of *H. subbritannicum* quadrats recorded at each ordinal sector.

Ordinal sector	Frequency (%)
North	24 (53%)
North-east	8 (17%)
East	7 (15%)
South-east	0
South	0
South-west	1 (2%)
West	0
North-west	5 (11%)

Hieracium subbritannicum occurred in three main vegetation types on Carboniferous Limestone (Rodwell, 1992-2000). It occurred in ungrazed CG10a *Festuca ovina – Agrostis capillaris – Thymus praecox* grassland *Trifolium repens – Luzula campestris* sub-community, a widespread vegetation type common on calcareous soils in upland areas. On the screes and rocks it occurred in the OV38 *Gymnocarpium robertianum – Arrhenatherum elatius* community which comprises open vegetation on calcareous soils in ungrazed situation or in open scrub and woodland. Stands of this vegetation type were very variable and *Gymnocarpium robertianum* was very rare in the quadrats. On the shaded damp sites at Craig y Cilau, it occurred in OV39 *Asplenium trichomanes – Asplenium ruta-muraria* community, which is a widespread vegetation type of rock and crevices with ferns. As it was not refound in any Old Red Sandstone sites (Craig Cwm Du, Craig y Llyn and Bannau Sir Gaer), it is hard to know which communities it would have occurred in, but they are likely to be only weakly calcareous examples of the OV39 *Asplenium trichomanes – Asplenium ruta-muraria* community or in U4 *Festuca ovina – Agrostis capillaries – Galium saxatile* grassland. The species most frequently associated with *H. subbritannicum* in the quadrats are given in Table 2 which includes many perennial calcicoles.

Table 2. Frequency of species associated with *H. subbritannicum* in 45 quadrats.

Species	**Frequency (%)**
Hieracium subbritannicum	45 (100%)
Festuca rubra	27 (60%)
Taraxacum spp.	21 (47%)
Solidago virgaurea	18 (40%)
Thymus drucei	18 (40%)
Agrostis capillaris	17 (38%)
Festuca ovina	11 (24%)
Leontodon hispidus	10 (22%)
Brachypodium sylvaticum	9 (20%)
Crataegus monogyna	9 (20%)
Cystopteris fragilis	9 (20%)
Asplenium trichomanes	7 (16%)
Ctenidium molluscum	7 (16%)
Campanula rotundifolia	6 (13%)
Dactylis glomerata	6 (13%)
Sorbus aucuparia	6 (13%)
Fraxinus excelsior	5 (11%)
Linum catharticum	5 (11%)
Geranium robertianum	4 (9%)
Mycelis muralis	4 (9%)
Scabiosa columbaria	4 (9%)

In addition, the following species were recorded in 3 or fewer quadrats: *Achillea millefolium, Anthoxanthum odoratum, Aira praecox, Centaurea nigra, Cerastium fontanum, Cirsium palustre, Euphrasia nemorosa, Fragaria vesca, Hedera helix,*

Hieracium acuminatum, Hieracium cillense, Hypnum cupressiforme, Ilex aquifolium, Lotus corniculatus, Melica uniflora, Plantago lanceolata, Potentilla reptans, Prunella vulgaris, Ranunculus bulbosus, Rhytidiadelphus squarrosus, Rhytidiadelphus triquetrus, Rosa canina, Salix caprea, Salix cinerea, Poterium sanguisorba, Saxifraga tridactylites, Stellaria graminea, Trisetum flavescens, Tussilago farfara, Ulmus glabra and *Viola riviniana.*

Discussion

The data show *H. subbritannicum* was found in six out of 13 sites (54% decline), with at least 745 plants. Under the IUCN (2001) threat criteria it qualifies as 'Vulnerable' with a geographic extent of occurrence less than 20,000 km², a severely fragmented population, and no more than 10 locations with fewer than 10,000 mature individuals and no subpopulation containing more than 1,000 mature individuals (Moore, 2009).

Hieracium subbritannicum is now only known from six semi-upland sites in Wales and is extinct in England. The decline in the number of sites appears historic with four sites last recorded before 1900 and the other three sites 1954-1964. It has gone from the lowland Wye Valley, where increased shading resulting from lack of woodland management may be a key factor as for *H. pachyphylloides* (Sawtschuk & Rich, 2008). *Hieracium subbritannicum* is a strong calcicole in its current sites which are all on Carboniferous Limestone, and it may always have been rare on Old Red Sandstone in the Brecon Beacons where there are only very restricted outcrops of calcareous strata.

The largest population of 525 *H. subbritannicum* plants occurs at Craig y Cilau, which is a National Nature Reserve and a very rich site for hawkweeds; it is present on sheer rock faces in areas where climbing is restricted and the clearance of vegetation is forbidden so this population is well-protected. The populations at Clogau Mawr, Craig y Castell and Daren Disgwylfa are moderate in size and tolerably secure in the medium term. The small populations at Carreg Cennan and Dyffryn Crawnon are very vulnerable.

Carreg Cennan, Clogau Mawr, Craig y Castell and Craig y Cilau receive a degree of protection as the populations are in statutorily designated Sites of Special Scientific Interest, though *H. subbritannicum* is not listed as a feature of interest for any so receives little or no protection; as a declining endemic not restricted to Wales *H. subbritannicum* should be added to the SSSI schedules as a feature of interest at the next revisions. The Daren Disgwylfa and Dyffryn Crawnon sites have no designations. All sites are located within the Brecon Beacons National Park which confers little practical protection for such a species.

Seed was collected in 2000 and 2009 has been deposited in the Millennium Seed Bank. There are no ex situ living collections.

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Appendix 1. Summary of *Hieracium subbritannicum* records.

Ban-y-gor, Tidenham (v.c.34 West Gloucestershire): 16 May 1894, W. A. Shoolbred, **NMW**.

Carmarthen Fan (v.c.44 Carmarthenshire): Carmarthen Fan, first cwm, 3 August 1899, A. Ley, **CGE**.

Carreg Cennan (v.c.44 Carmarthenshire): Castle walls, cultivated, 19 May 1894, A. Ley, **CGE**; 16 July 1897, A. Ley, **CGE**; 6 September 1899, A. Ley, **CGE**; 24 June 1921, Herb. J. Roffey, **BM**; SN668191, 25 August 1995, G. Hutchinson & R. D. Pryce, **NMW**.

Clogau Mawr and Clogau Bach (Langadog; v.c.44 Carmarthenshire): July 1954, C. West, **MNE**; 27 July 1957 and 12 July 1959, C. E. A. Andrews, **BIRM**; SN720193, 29 June 1975, P. D. Sell, **CGE**; 26 June 2006, T. C. G. Rich & J. Sawtschuk, **NMW**; SN718193, 24 June 2010, V. Jones, **LDS**.

Coldwell Rocks (v.c.34 West Gloucestershire): Coldwell Rocks, quarry, 9 June 1886, A. Ley, **CGE**; top of Coldwell Rocks, 19 May 1956, C. E. A. Andrews, **BIRM**.

Craig Du (v.c.42 Breconshire): on red sandstone, 13 June 1893, A. Ley, **BM**; cultivated, 19 May 1894, A. Ley, **CGE**. 6 June 1894(?), A. Ley, **CGE**; 3 July 1905, A. Ley, **BM**; middle of cliffs SN946213, 22 August 1964, B. A. Miles, **CGE**.

Craig y Castell (v.c.42 Breconshire): 11 June 1937, J. Chapple & N. D. Simpson, **BM**; 9 May 1980, M. Porter (BSBI Database); 16 June 2000, T. C. G. Rich, **NMW**.

Craig y Cilau (Craig Cille/ Dan y Darren/Darren Cilau/Mynydd Llangattwg; v.c.42 Breconshire): limestone rocks 1000-1500 ft., 12 June 1893, A. Ley, **BM**, **CGE**, **NMW**; 5 June 1894, A. Ley, **CGE**; 27 May 1896, W. A. Shoolbred, **CGE**; June 1899, A. Ley, **NMW**; 14 June 1900, A. Ley, **BM**, **CGE**, **NMW**; June 1901, A. Ley, **BM**; 15 June 1904, A. Ley, **BM**, **NMW**; 15 June 1904, H. J. Riddlesdell, **CGE**, **BM**; 15 June 1909, A. Ley, **NMW**; 24 June 1920, Herb. J. Roffey, **BM**; 6 June 1923, H. J. Riddlesdell, **CGE**; 6 July 1923, H. J. Riddlesdell, **BM**; **NMW**; July 1923, J. Cryer, **BM**; 6 July 1923, Mrs Wedgewood, **NMW**; 10 June 1926, A. Hyde & A. Wade, **NMW**; above Coed-pen, 21 June 1932, A. J. Wilmott, **BM**; 3 July 1935, A. H. G. Alston, **BM**; 3 July 1935, H. W. Pugsley, **BM**; 15 June 1946, N. D. Simpson, E. Vachell and Botanical Exchange Club, **BM**, **NMW**; July 1952, C. West, **CGE**; cliffs SO188159, 22 June 1953, P. D. Sell, **CGE**; SO182166, 5 June 1954, J. R. Raven, **herb. D. J. McCosh**; 7 June 1954, B. A. Miles, **CGE**; 6 July 1955, C. E. A. Andrews & C. West, **BIRM**; 17 July 1955, F. R. Browning, **BM**; 31 May 1964, B. Seddon, **NMW**; west of Llangattock Quarries, 14 June 1964, U. K. Duncan, **CGE**; quarry west of Craig y Cilau, 16 June 1968, M. McC. Webster, **CGE**; SO168163, 8 June 1972, P. D. Sell, **CGE**; SO192157, common in western area, scattered elsewhere, 22 June 1973, P. D. Sell, **CGE**; June 1974, M. Porter (BSBI Database); SO186161, 5 July 1974, P. D. Sell, **CGE**; 7 June 2000, T. C. G. Rich, **NMW**; 16 June 2006, T. C. G. Rich, **NMW**; 1 June 2011, D. Green, **NMW**.

Craig y Llyn (v.c.41 Glamorgan): 31 July 1890, A. Ley, **BM**; 10 July 1896, F. J. Hanbury, **BM**.

Darren Disgwylfa (v.c.42 Breconshire): 20 June 1953, C. E. A. Andrews, **BIRM**; 20 June 2000, T. C. G. Rich, **NMW**.

Dyffryn Crawnon (v.c.42 Breconshire): 21 June 1953, C. E. A. Andrews, **BIRM**.

Great Doward (v.c.36 Herefordshire): 8 June 1886, F. J. Hanbury, **BM**; limestone quarries, 8 June 1886, A. Ley, **BM**; 31 May 1897, A. Ley, **CGE**; 12 June 1894, A. Ley, **NMW**.

Symond's Yat (v.c.34 West Gloucestershire): June 1907, W. R. Linton, **LIV**; 15 May 1954, C. E. A. Andrews, **BIRM**.