Nature in Cambridgeshire

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Results of the great storm of 16 October 1987 by Bury road (Cambs), near Newmarket, the site of the rare orchid *Epipactis phyllanthes*: January 1988 G. Crompton

Professor Paul Richards cuts the cake to celebrate fifty years of the Cambridge Bryological Excursions (see p. 46). D.E. Coombe

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Cover illustration:
Pasqueflower *Pulsatilla vulgaris*, reproduced by kind permission of the Cambridge University Librarian from Richard Relhan's (1785) *Flora Cantabrigiensis*

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Editorial

The content of this issue of *Nature in Cambridgeshire* is mainly botanical, but this is perhaps appropriate in a year which marks half a century of the Cambridge Bryological Excursions led by Professor Paul Richards and Dr Harold Whitehouse (see pp. 41-49 and inside covers), when the two-year Monitoring Scheme of the Botanical Society of the British Isles (see pp. 54-59) will be completed and in which work has begun in earnest on a Historical Flora of Cambridgeshire (vice-county 29) to be published by Cambridge University Press (see pp. 27-28 and 59). The re-examination of early Floras for this five-year project has provided background information for John Trist's detailed account of the flora of Hildersham Furze Hills (pp. 4-12) and has also led to the choice of the cover picture.

The pasqueflower *Pulsatilla vulgaris* was painted in 1784 for his friend, the Rev Richard Relhan, by the Yorkshire botanist James Bolton, best known as the author, artist and engraver of the first British monograph on ferns, *Filices Britannicae* (1785-1790). The original painting is now in the Library of King's College, where Relhan (1754-1823) was Chaplain; this engraving for Relhan's *Flora Cantabrigiensis* (1785) was done by James Sowerby (1757-1822), the famous artist of *English Botany*. As John Trist says in his article, the pasqueflower was first recorded at Hildersham, and indeed in Cambridgeshire, by John Gerarde in his famous *Herball* (1597). He wrote: "Those with purple flowers do growe very plentifully in the pasture or close belonging to the personage house of a small village sixe miles from Cambridge, called Hildersham; the parsons name that liued at the impression heereof was master *Fuller*, a very kinde and louing man, and willing to shewe vnto any man the saide close, who desired the same." The English names, he said, were "Pasque flower, or Passe flower: and after the Latin name *Pulsatill*, or Flawe flower; in Cambridgeshire where they grow, they are named Couentry bels."

On the zoological side, it is a pleasure to publish an account by Martin Popplewell of his A Level project carried out on Fulbourn Educational Nature Reserve (pp. 35-41). Another nature reserve of the Cambridgeshire Wildlife Trust, Hayley Wood, features in a paper by Dr Henry Disney on its scuttle flies (pp. 21-22) and in notes by Peter Sell about its birds (pp. 23-25). The former author is evidently too modest to mention the names of three of the flies new to science that he found to occur there. The *Cambridge Evening News* was greatly excited, and *The Guardian* published a news item on 28 August 1987 and a letter from Dr Angela Risebrow of the CWT a few days later stressing the value of a wood "older than the renowned Ely Cathedral and any of the Cambridge colleges". One of the flies, *Megaselia hayleyensis*, is named after Hayley Wood itself and another, *M. unwini*, after its collector, Dennis Unwin, who was previously a member of the Editorial Board of this journal; the third, *M. oligoseta*, has a descriptive name - "few-bristled".

An even longer-established Cambs nature reserve, Wicken Fen, is again the subject of articles in this issue, one on bumblebees and comfrey (pp. 16-20) and another on "an aquatic carnivore" (pp. 50-54) - not, as might be expected, an animal but a plant, greater bladderwort! The National Trust's Warden at

Wicken, Tim Bennett, has contributed (pp. 31-35) what he points out is the first article primarily about butterflies since Dr Jack Dempster's on the swallowtail at Wicken Fen 12 years ago and only the second since 1963.

Dr David Coombe has followed up his paper of last year on the spiked speedwell with more about the intriguing soil patterns with which it is associated (pp. 13-15), and Dr Hilary Belcher and Dr Erica Swale describe an alga (pp. 29-31) that grows at the edge of the tarmac of quiet road in Cambridge, was once thought to be "the wreckage of shooting stars" and is accounted "a delicacy in China"! The bill of fare is completed by a book review by Dr Max Walters (pp. 25-26), the usual records of new plant finds (pp. 59-63), John Clarke's weather notes (pp. 63-64), which have now covered 29 years, and Graham Easy's indispensable drawings.

We are deeply grateful to all our contributors, to Mrs Ann Maxwell for her typing, to Dr Ken Joysey of the University Museum of Zoology for the use of its new Macintosh LaserWriter, and to Stuart Wallace for help in assembling the figures and illustrations.

It is with great sorrow that we record the death last summer of Nick Warner, who supplied many photographs and three articles published in Nos 22-26 of this journal.

Since 1986, *Nature in Cambridgeshire* has been independent of its two 'supporting bodies', the Cambridgeshire Wildlife Trust and the Cambridge Natural History Society. Whether or not you belong to the CWT or CNHS, if you are not already a registered subscriber to this journal, we need your money to keep it going; so please apply to the Herbarium, Botany School, Downing Street, Cambridge, CB2 3EA.

Philip Oswald

The *Cambridgeshire Wildlife Trust*, founded in 1956 as the Cambridgeshire and Isle of Ely Naturalists' Trust (CAMBIENT), aims to protect wildlife in the 'old' county of Cambridgeshire and to help you and your children enjoy it. Like other county-based Trusts, it is affiliated to the Royal Society for Nature Conservation (RSNC). Membership rates are £11.00 (individual), £14.00 (household), £18.00 (family, including subscription to WATCH for children of 8-18), £5.00 (students, unwaged, senior citizens) and £15.00 (schools and voluntary organisations). There are also corporate and life membership terms. Members receive the RSNC's magazine, *Natural World*, as well as the Trust's own publication, *Cambridgeshire Wildlife*. The Trust and its local groups organise a full programme of talks, visits, conservation tasks, open days and other events. The Trust's address is 5 Fulbourn Manor, Fulbourn, Cambridge, CB1 5BN (Tel. Cambridge 880788).

The *Cambridge Natural History Society* brings together all those who are interested in the scientific study of animals and plants and in their interactions with man. A wide-ranging programme of lunchtime and evening talks is arranged every Michaelmas and Lent Term in the fields of general natural history, applied biology, botany, entomology and zoology. A 'conversazione' with exhibits and displays is held each May. Membership is open to all and costs £2.00 for a year, £3.50 for two years and £5.00 for three years. Members of the University should apply to the University Secretary, Miss Fiona King, Department of Applied Biology, Pembroke Street, Cambridge, CB2 3DX; others should apply to the Cambridge City Secretary, Dr B. Evans, 61 Castle Street, Cambridge, CB3 0AH.

Hildersham Furze Hills

P.J.O. Trist

Introduction

The Furze Hills are known to have attracted botanists for almost 400 years, and records show that, in spite of the hazards of farming and of time, most of the special flora of these hills has survived. The recent past and present condition of these hills is recorded here and a brief historical account of the flora is provided.

The hills lie about 1 km north-east of Hildersham at 52/553.487 on a slope surrounded by arable land. There are three small hills, which occupy an area of about 3 ha and will be referred to as the west, central and east hills. The botanical interest lies in a small collection of plant species which have an affinity with the soil conditions of some parts of the West Suffolk Breckland.

The soil textures of the hills and their surrounding land are complicated. Burton (1986) wrote: "Some small knolls, such as Furze Hill, are capped by glaciofluvial sands and gravels in which the St Albans series (argillic brown sands) is developed." The series is described as "dark brown, moderately flinty sandy loam or loamy sand". However, in crossing the arable away from the pits on the west hill, the soil texture becomes a sandy clay loam with an abundance of large flints. Burton describes how "leaching of the coarse deposits has produced accumulations of strong brown illuvial clay in the subsoils above calcareous sands and flinty gravels". So we find that weathering over some 10,000 years has, in places, reduced the hill surfaces to the level of the formerly underlying brown illuvial clay and calcareous sands, on which we now find the chalk grassland flora. Where some of the overlying leached coarse sands remain, the soils retain little mositure and are subject to drought.

Description of the hills

The west hill has been subject to much alteration through sand extraction. Ken Cramp recalls the occasional few loads of sand taken for farm tracks during the 1930s, as no other suitable material was in the area. Undoubtedly this occasional operation could have been going on for several hundred years. During the 1939-45 war, there was considerable sand extraction for concrete on aerodromes, and this continued into the 1950s for general building construction.

The depth of the pit base is irregular and varies from 3 to 6 m to the ridge adjoining the arable; the chalk is now exposed in places. There is evidence of a little sand extraction at the north end and on the east of the central hill. The east hill has also been disturbed by excavation, to give the spine its outline in the centre. Here the soil is a dark, coarse sand with small stones and is similar to areas found in Breckland. In places the calcareous exposures are evident, with extensive growth of common rock-rose *Helianthemum nummularium* on the north of this hill, as also on the north-east of the central hill and on the south ridge of the west hill.

The soil and topography have not been of farming interest to any occupier,

except for occasional income derived from the sale of sand; however, the sand and its ease for burrowing have clearly been an attraction for the rabbit. Here it has played two parts. As a grazier keeping turf short and controlling scrub growth, it has been a first-rate conservationist. On the other hand, it has been a menance to the adjoining farmer, and to this day large areas of cereals surrounding the hills are grazed to the ground and do not recover.

The recent past history

John Faulkner has known the Furze Hills since the mid 1950s, when he recalls a large rabbit population and much crop damage to adjacent farmland. On the east hill, annual rabbit damage to the flowers of pasqueflower *Pulsatilla vulgaris* was intense. The spine was often bare of grass and other vegetation as a result of scratching, burrowing and grazing by rabbits. After the advent of myxomatosis in 1953, the disease rapidly spread and arrived in Cambridgeshire late in 1954. For areas such as the Furze Hills, the loss of the rabbit was the loss of a conservator. Faulkner recalls the growth of the grass, which the rabbits kept very short and which after 1955 was gradually getting out of control. He remembers that the excavated pit on the west hill was clear of scrub; on the margin there were a few hawthorn bushes and there was some gorse on the north side, where there was a strong colony of maiden pink *Dianthus deltoides* which extended over about 30 m. Three-quarters of the central hill was covered in blackthorn and the small open area on the north side had some gorse bushes, which survive. On the east hill, blackthorn at the north end had only penetrated down the slope for about 5 m and the east, central and south of the hill were clear of scrub. On the slope above the ditch on the east side, *Dianthus deltoides* was found in scattered small colonies for the length of the slope. At the present-day site on the spine, Faulkner recalls *Dianthus* more spread out at either end. An earlier recollection is from Cramp, who remembers that the *Dianthus* in the 1930s extended south from its present site to the base of the east hill as far as the arable headland. There can be little doubt that this extended area of *Dianthus* later succumbed to cereal spray drift.

The east hill is the only local site for *Pulsatilla vulgaris* and dyer's greenweed *Genista tinctoria*. Cramp remembers the former on the spine and on the grass to the south. In the 1950s, Faulkner only recalls it on the spine, with an annual variation of 20-30 flowers. Both recorders are emphatic that there never were more than three or four groups of *Pulsatilla* flowers and that their numbers were annually controlled by rabbit-grazing.

The deterioration on the hills by scrub invasion is clearly the result of a reduction in the rabit population by myxomatosis. The disease is still prevalent. The sand of the east hill is large-grained and provides for rapid drainage, so that drought is severe in dry times. On these occasions, when fodder is short, the rabbit resorts a little more often to the flower-heads of *Pulsatilla* and the stems of the grass *Phleum phleoides*, but over the years this does not appear to have adversely affected these populations.

Current record of condition

Some gorse on the pit banks of the west hill has been fired to make gassing of rabbit burrows easier, but other scrub has made little headway. In autumn a couple of spindle bushes *Euonymus europaeus* are visible with their pink

berries. The central hill is a rabbit warren under complete cover of trees and scrub. It is dense with blackthorn and hawthorn of 3-5 m height with a few oaks and an understorey of privet, elder and bracken. Some of this growth indicates that on this hill there has been little control for the past 50 years.

There are two small areas free of scrub, which, although grassed over, are probably former areas of sand extraction. One is on the north, where a few plants of hoary cinquefoil *Potentilla argentea* battle against thick growth of long false oat-grass *Arrhenatherum elatius* and cock's-foot *Dactylis glomerata*, in spite of the adjacent rabbit stronghold. The other open area, with a little bracken invasion, is a south- and east-facing bank on the north-east corner of the hill, which the records show has supported *Phleum phleoides* for a very long time and is the only confirmed site in the vice-county. All along this L-shaped bank there is an excellent ground-cover of *Helianthemum nummularium*, with a resident rabbit community.

On the east hill, blackthorn has made an unimpeded advance but is now being checked. In the north corner of the slope it is 30-50 m in depth and covering a bank of *Helianthemum nummularium* and salad burnet *Sanguisorba minor* which should be allowed to see the light of day. On the lowest section of the east boundary, above the field ditch, blackthorn is 20-45 m in depth and about 2 m high, but the top and sloping sides of the spine remain clear. Here, in 1987, *Dianthus deltoides* was in flower over an area of 6.5 x 2.5 m with three flowering plants of *Pulsatilla vulgaris*.

The botanical records

The 1987 record of the number of higher plant taxa found on the Furze Hills exceeds 170. A number of illustrious botanists have left us records since John Gerarde (1597), but Thomas Martyn (1763) was the first to record a list of plants, seen on one of his excursions in the county on "a small hill near Hildersham, overrun with Furze":

Thesium linophyllum (*Thesium humifusum*)
* *Dianthus deltoides*
Rosa eglanteria (*Rosa rubiginosa*)
* *Potentilla argentea*
Tormentilla erecta (*Potentilla erecta*)
* *Cistus Helianthemum* (*Helianthemum nummularium*)
Genista anglica
* *Trifolium arvense*
Hieracium umbellatum
Jasione montana
Osmunda Lunaria (*Botrychium lunaria*)

* Still extant. *Pulsatilla vulgaris* was not listed, from which we may presume that the list was made after its flowering period.

Potentilla argentea L. (hoary cinquefoil)

John Martyn (1727) records "Quinquefolium folio argenteo" "In many Places about Linton". Thomas Martyn (1763) records this species from the Furze Hills (see above). Richard Relhan (1785) records it "Among the Furze

near Hildersham". There are specimens of 1841 in Joshua Clarke's collection at the Saffron Walden museum (**SWN**). C.C. Babington (1860) records it at "Furze Hills, Hildersham" and also quotes from the second appendix to Ray's *Catalogus* edited by Peter Dent (1685): "Many places about Linton".

It is a rare species in Cambridgeshire and has only been recorded elsewhere in recent years at Chippenham and Kennett. At Hildersham it is annually variable in quantity relative to grass growth and rabbit-grazing. It has been reported for a long time but in little detail. Philip Oswald recorded it on the "central hump" on 10 June 1952. Some time between 1952 and 1955, Faulkner photographed *Potentilla argentea* on the central hill. He recalls at least two areas of about 1 m^2 "dense with flowers" in short rabbit-grazed grass on the north boundary. Franklyn Perring (1959) found plants on a B.S.B.I. field meeting in 1957 "on the middle of the so-called 'second Furze Hill'". In 1979 I noted a few flowering plants early in the season; later in the same year, Gigi Crompton recorded about 50 plants.

Pulsatilla vulgaris Mill. (pasqueflower)

This species was first recorded in Cambridgeshire at Hildersham by Gerarde (1597). Ray (1670, 1690) gives "about Hildersham, six Miles from Cambridge" and J. Martyn annotated his copy of Ray's *Catalogus* (1660) "about Hildersham". Relhan (1785) and Withering (1787) record *Anemone pulsatilla* at Hildersham, and Babington also wrote "at Hildersham" in his annotated copy of Relhan (1820).

The 19th-century specimens in **BM** include sheets by Hanbury of 1864, T. Henderson of 1874 and A. Bennett of 1875. A.W. Graveson (**CGE**, 1914) recorded "one flower on the hill nearest Linton" and wrote: "there is still a fair quantity of this plant" (an indication of rabbit-grazing). Evans (1939) wrote: "on Fleam Dyke has almost been exterminated, as is also the case at the Furze Hills, Hildersham". Perring (1959), recording a B.S.B.I. meeting in 1957, noted that the pasqueflower was "frequent on the southern slopes" of the east hill. In 1966 T.C.E. Wells noted "4 plants in a dense *Festuca rubra* sward with *Saxifraga granulata*": this location was the spine on the east hill, where both *Pulsatilla* and *Saxifraga* are still present.

In 1976 Crompton and Faulkner recorded "13 clumps in the main colony and one plant c. 40 m from the arable margin": this latter station is still extant but in most years is a casualty to rabbits. On 28 April 1980 I recorded three plants on the spine, with rabbit damage to four flowers. At this date the main plant associates with *Pulsatilla* were *Anthoxanthum odoratum, Arrhenatherum elatius, Festuca ovina, Filipendula vulgaris, Helianthemum nummularium, Myosotis ramosissima* and *Rumex acetosa*. In 1981 four clumps (with four, 11, 14 and seven flowers, many damaged) were recorded on the spine and one plant (with about 10 flowering stems) at the foot of the hill by Crompton and Jenny Heap of the Nature Conservancy Council. In 1983 there were a plant with nine buds and another with three buds on the spine and a clump of 16 flowers and another with one flower at the foot of the hill. In 1984 three plants were seen on the spine, with seven, two and two flowers; no flowering was seen at the foot of the hill. In 1985 three plants were again counted on the spine, with 12, two and two flowers. A further visit on 3 May by Heap and Crompton recorded much rabbit damage to flowers. In 1986 there were

again three plants on the spine, showing 10 flowers, and a one-flowered plant 20 paces from the arable headland, where it had last been recorded in 1983.

Phleum phleoides (L.) Karst. (purple-stem cat's-tail)

This perennial grass has attracted more attention than any other taxon on the Furze Hills. The forma *blepharodes* Aschers. & Graebn., with ciliate keels on the glumes, occurs with the forma *phleoides*, which has minutely scabrid keels; neither of these forms has previously been recorded on these hills. *P. phleoides* was first collected in Britain by Israel Lyons in Cambridgeshire before 1780, when the species was first recognised in Norfolk by James Crowe and Thomas Woodward (Smith and Sowerby, 1798). Perring *et al.* (1964) record: "Formerly in a few localities on dry soils in the east of the county. Now known at Hildersham Furze Hills and Isleham Plantation."

In his copy of Relhan (1820), Babington annotated "Hildersham Furze hills" under *P. phleoides*. There are a number of sheets in **BM** of specimens collected between 1846 and 1932, and likewise in **CGE**. In 1831 J. McNab acquired a specimen, now in **CGE**, "probably from Cambridge", so an annotation of 1911 records. There are specimens collected by J.A. Power and Miss L. Waddington in 1838, followed by G.C. Druce in 1860. Later, in 1904, E.S. Marshall entered a specimen collected by A. Hosking; F.R. Tennant and J. & A. Bennett collected in 1907, and A.J. Crossfield and F. Robinson added sheets in 1917-18. J.E. Lousley was on the hills in 1932 and 1952 collecting for the Botanical Exchange Club. Evans (1939) wrote: "abundant at the Furze Hills, Hildersham, ever since Lyons gathered it before 1780". (Lyons' specimen in the Banksian Herbarium was not in fact collected at Hildersham but on the Devil's Ditch.) Humphrey Gilbert-Carter and Cyril West collected in 1940. Max Walters took specimens in 1953 and 1956 and on the latter occasion noted that *P. phleoides* was "abundant on the third (east) hill . . . absence of rabbits reveals it." Peter Sell collected it in 1961. It was A.S. Watt (1971) who first noted the resistance of this grass to rabbit-grazing.

P. phleoides has two sites on the Furze Hills. On the east hill it is on the spine, whilst on the central hill it is on the south side of the bank in the north-east corner and adjoining where another sloping bank faces east. Both of these stations are burrowed by rabbits and the adjacent blackthorn area on the central hill is a warren. The annual difference in the number of culms noted at these sites over the past eight years is clearly not seasonal but relative to the rabbit-grazing.

In 1976 Crompton saw no *Phleum phleoides* on the east hill owing to "heavy erosion from rabbit grazing and the vegetation was burnt up by drought". In 1979, on the small east bank on the central hill, I recorded 45 culms. Later, on 10 August, Crompton recorded about 200 culms over an area of 125 m^2, and on the same date on the east hill she recorded about 20 culms on the spine and about 10 "towards the bottom of the hill". In 1981 Crompton and Heap observed that *P. phleoides* was "still locally frequent on the central hill and possibly more frequent on the east hill" than in 1979. In 1982 Crompton noted good populations on the central and east hills, but no plant count was made.

In 1986 very few plants were seen on the south slope of the central hill and only one culm was seen on the east bank, where electric cable poles had been

dragged over and dumped on the site! The very wet summer of 1987 proved to be a good year for *P. phleoides* on the Furze Hills and in the West Suffolk Breckland. Rabbits were very numerous on the central hill; on 6 July only two culms were seen on the south slope, but 31 on the east slope. On the east hill there were more than 70 culms in a 2 m^2 area and stems were 40-60 cm in height and competing with dense *Arrhenatherum elatius*. *P. phleoides* was set in a great array of herbs and grasses including *Thymus pulegioides, Arenaria serpyllifolia, Galium verum, Pilosella officinarum, Phleum pratense* subsp. *bertolonii, Trisetum flavescens, Vulpia bromoides, Festuca ovina* and *Koeleria macrantha*, with a background of *Helianthemum nummularium*. As already mentioned, the soil of the east hill is similar to that of areas in the West Suffolk Breckland, and at Icklingham Plains in 1987 I recorded the densest growth I have ever seen of *P. phleoides*, which is normally seen as widely-spaced single culms.

Dianthus deltoides L. (maiden pink)

Ray (1670) recorded "Caryophyllus Virgineus" of Gerarde "on a little hill or brow whereon Furze grows, next to Juniper-hill, on Hildersham-side in Cambridgeshire". In 1690 he added that it was found "by Mr. Dent". It was also recorded by T. Martyn (1763). Relhan (1802) gives "Hildersham, on the Furze-hill next to Linton". From W.W. Evans there is a sheet in CGE of var. *glaucus* collected in 1847, a variety with white flowers and glaucous leaves. The Rev Cookson's specimen of 1858 is in CGE and is recorded by Babington (1860). Further records were by T.H. Corry in 1882 (BEL), S.H. Bickham in 1891 (CGE: var. *glaucus*), A.S. Shrubbs in 1900 (CGE),

Maiden pink *Dianthus deltoides* (var. *deltoides* above and var. *glaucus* below) and purple-stem cat's-tail *Phleum phleoides* (forma *phleoides* above and forma *blepharodes* below)
Graham Easy

F.R. Tennant in 1901 (**CGE**) and A.J. Crossfield in 1917 (**CGE**). Evans (1939) records varieties *glaucus* and *deltoides*, which were later collected in 1953 by Walters and in 1954 by Sell (both in **CGE**).

In 1974, the west hill colony, on the north-east margin of the pit, was reported by Professor Rodney Hill as consisting of only one plant. John Raven reported flowering in 1975 on the east hill, but with no detail. For 1979 I have a note of 12 flowering stems on the north-east margin of the pit on the west hill, and on a second visit on 9 July I counted more than 70 flowers. At the same time on the east hill there were 160 flowering stems in an area of 2.8 x 3.7 m, with one white flower of var. *glaucus*. The last record of this *Dianthus* on the west hill was on 22 June 1981, when Crompton and Heap recorded and photographed five flowering stems and about 70 with buds. On the same day on the east hill they noted "large dense clumps studded with flowers, over 7 x 7 m with *Phleum phleoides*". In 1982 I recorded 111 flowering stems on the east hill. A search in 1983 on the west hill was abortive, and it must be assumed that *D. deltoides* was killed by cereal spray.

Good growth of the plants on the east hill was noted in 1984, but no flowers were out on the early date of 11 June. In 1985 about 170 flowering stems were recorded, and in the following year good flowering was noted but numbers were not recorded, except that on 21 September six flowers were seen still in bloom. There was another good flowering year in 1987 after heavy rainfall, when 275 flowering stems were counted and a further four in a new colony about 1 m south of the main colony, on the margin of the spine. The var. *deltoides* was present but no var. *glaucus* was seen.

Other species

Other interesting species of the past include *Genista anglica* L. (petty whin). T. Martyn (1763), recording an excursion, listed it on "a small hill near Hildersham, overrun with Furze". Babington (1860) attributes the record from "Furze-hills, Hildersham" to John Martyn. Relhan (1785, 1802, 1820) records this species from "Furzes near Hildersham". Perring *et al.* (1964) say: "Recorded from Hildersham Furze Hills where it was last seen in 1930".

In his copy of Ray (1660) J. Martyn annotated *Medicago sativa* L. subsp. *falcata* (L.) Arcangeli (sickle medick) as *Medicago silvestris* Fr. at Linton. It has not been seen in recent years. *Astragalus hypoglottis* auct., non L., i.e. *A. danicus* Retz. (purple milk-vetch), was recorded from "Furze Hills, Hildersham" by Babington (1860) but is now extinct there. Relhan (1802, 1820) reported *Nardus stricta* L. (mat-grass) on "Hills near Hildersham" - an interesting record which has never been confirmed. On a similar soil type, there are only two small colonies known in the West Suffolk Breckland. The rare *Hypochoeris maculata* L. (spotted cat's-ear) is now extinct on the hills, but it was recorded by Relhan (1802, 1820) from Hildersham and by Babington (1897) on the "last" Hildersham Furze Hill from Little Abington on 4 July 1855 and "in bud" on the Furze Hills on 2 June 1857; there are herbarium sheets in **CGE** (Babington, 1855) and in **BM** (W. West, 1895). After these records, Evans (1939) wrote, "it was lost sight of till 1908 when it was refound in its old station at Hildersham by the present writer".

Genista tinctoria L. (dyer's greenweed) was annotated by Babington "Hildersham Furze Hills" in his copy of Relhan (1820). Faulkner (1963), in a

report of a visit to the hills on 7 July 1962, lists it from the east hill. In 1979 I noted it sparingly on the east hill, where it was also seen by Crompton, who reported it with Heap in 1981 "on the east hill with *Pulsatilla* and *P. phleoides*, more frequent than in 1979". This species is infrequent and occurs in very small patches; the long grass of wet years makes it difficult to find.

Festuca trachyphylla (Hack.) Krajina has one site adjacent to the farm track on the west of the west hill. It is new to the hills, being reported only in 1982 by Crompton and Heap, and was at first incorrectly determined by the author of this paper as *Festuca guestfalica* (CGE, 1982, and see Trist, 1986). *Lamium hybridum* Vill. (cut-leaved dead-nettle) is described by Perring *et al.* (1964) as "common in the Fens, local elsewhere". It is often frequent on the arable headland around the east hill, but rather subject to the hazards of crop spray. It was formerly common on all of the arable land around the hills and on the land on the other side of the road to the south. It is now an uncommon arable weed in the county. *Apera interrupta* (L.) Beauv. (dense silky-bent) occurs sparingly on the headlands of winter-sown cereals between the central and east hills, provided that the crop is fairly open. This is a Breckland species and grows only on dry, well-drained sand.

Recent conservation measures

In 1979 I was invited to join the Gogs Area Committee of the Cambridgeshire and Isle of Ely Naturalists' Trust to represent the interests of the Hildersham Furze Hills. With the agreement of Mr Sam Alper of Chilford Hall, the tenant of the Furze Hills and the surrounding 80 ha, I had free access and a tenant who was interested in the natural history. The hills were not quite detached from the farming, as their 'rabbit conservators' were in conflict with it.

The Furze Hills have been designated a Site of Special Scientific Interest by the Nature Conservancy Council. There is, however, no agreement with the Cambridgeshire Wildlife Trust. Apart from occasional visits by Mrs Gigi Crompton and field officers of the N.C.C., the hills have been left to their own devices, other than for occasional rabbit control.

In 1982 I removed 40 small blackthorn bushes from the *Dianthus deltoides* flowering area, but realised that more serious work would have to be carried out to control the scrub that was advancing on the site. Circumstances forced delay, but in 1985, with the approval of the Gogs Committee and Mr Alper, I acquired the help of the Cambridge Conservation Volunteers. Two visits a year have slowly had some effect on the scrub.

Mr Alper surrendered the tenancy of the land in 1987, and it is now being farmed by the new owner, Mrs Killander (formerly Miss Arabella Binney) of Pampisford Hall, who intends to continue the tradition of the Binney family.

Acknowledgements

I am grateful to Mr Sam Alper for his interest, generosity and permission to walk the hills and to his farm manager, Mr John Howkins, for his co-operation. I thank Mrs Gigi Crompton for the loan of personal records and guidance on the historical references to the hills. For a review of times past, I thank Messrs Ken Cramp and John Faulkner. I am also grateful to Dr Norman Pizer for guidance on the soils. I am pleased to find Mrs Killander's

interest and I am grateful for her permission to continue my interest in the conservation of the Furze Hills.

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More about soil stripes, polygons and fairy rings

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Figure 1 shows the pattern of soil stripes and polygons, caused by periglacial freezing and thawing more than 10,000 years ago, under mown grassland on Burwell Heath between the July Course and the Rowley Mile, in Cambridgeshire near Newmarket. It was drawn from vertical photographs specially commissioned from the Cambridge University Department of Aerial Photography and taken on 17 July 1987, eleven months after I had noticed faint stripes from the top of the Devil's Ditch. I subsequently found first heather (or ling) *Calluna vulgaris* and then a large colony of spiked speedwell *Veronica spicata* subsp. *spicata* some 6 km from its other two Cambridgeshire patches, known since 1973, in Swaffham Prior parish (Coombe, 1987). The dark lines indicate deep (1-2 m) acid sandy soil with common bent *Agrostis capillaris* and four patches of *Calluna*; these stripes are on slopes of 1-3° and

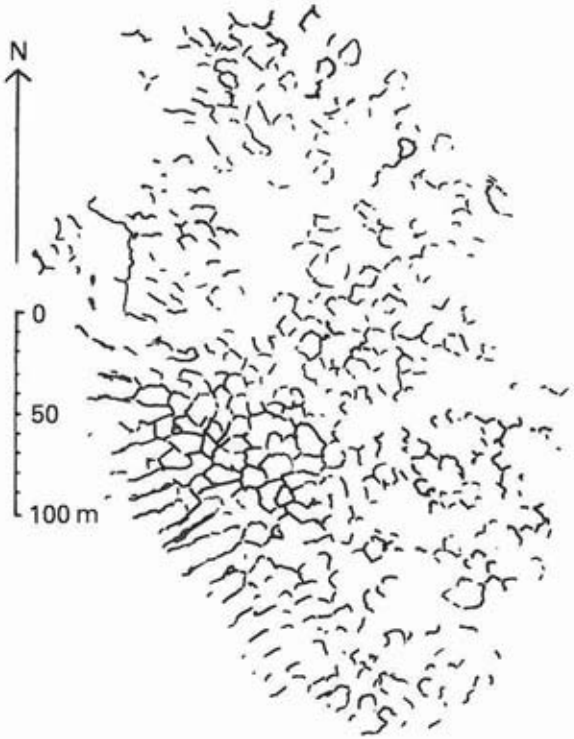

Figure 1: Pattern of soil stripes and polygons on Burwell Heath

are 8-9 m apart. Between the stripes and in the centres of the polygons (or reticulations) the soil is chalky, with upright brome *Bromus erectus*, tor-grass *Brachypodium pinnatum* and a rich calcareous grassland flora including, for example, the early-flowering hairy violet *Viola hirta*. On the other hand, the May-flowering heath dog-violet *Viola canina* is abundant both in the acid stripes, with *Calluna*, and also among the polygons on level ground for at least 200 m to the east. *Veronica spicata* is virtually confined to the striped area, extending for some 200 m by 20 m, with a mean soil pH of about 5.5 (i.e. moderately acidic). Other interesting plants here are saw-wort *Serratula tinctoria*, here mainly on acidic soils, purple milk-vetch *Astragalus danicus* (widespread) and spring cinquefoil *Potentilla tabernaemontani*, very scarce at this site but locally abundant on striped soils near the *Veronica spicata* in Swaffham Prior parish.

The drawing is based on photographs RC8-JP73, 91, 100 and 101, taken at a scale of about 1:2500, so that very fine detail is shown, e.g. the hoofprints of horses on the training gallops. Fortunately this area of patterned ground lies between a number of gallops, canters and walks parallel to the Devil's Ditch and watered gallops at some distance away near the Rowley Mile.

Although photographs taken on 23 March 1982 show stripes at the start of the Beacon Course and especially well on Long Hill east of Newmarket (where *Calluna* just survives and *Viola canina* forms superb stripes, but *Veronica spicata* is absent), none showed up then on Burwell Heath, possibly because the grass had just been mown. This fact emphasises the desirability of repeated aerial photographs of the same site.

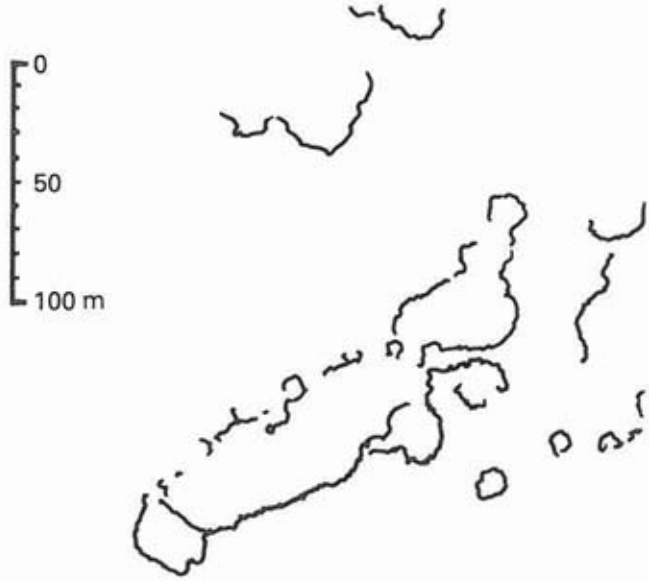

Figure 2: Irregular shapes of old fairy rings near the Rowley Mile

Last year (Coombe, 1987) I mentioned the way in which fairy rings, often of the fungus *Marasmius oreades*, tend to obscure the periglacial patterns associated with *Veronica spicata*. Figure 2 shows the irregular shapes of old confluent rings near the Rowley Mile. An almost perfect circle is rarely seen, e.g. one near the top of Warren Hill, which was 25 m in diameter in 1982; this one was probably at least 35 years old, possibly a hundred. Those near the Rowley Mile are certainly centuries old: a print by Peter Tillemans of about 1720 at the Jockey Club shows that, while Exning Heath and the fields close to Swaffham Prior and Burwell were then under cultivation, much of the land close to the Devil's Ditch and on Cambridge Hill was unploughed over 250 years ago. Chapman's map of Newmarket (c. 1768) tells a similar story.

It must not be assumed, however, that *Veronica spicata* only grows on uncultivated land: at Weeting Heath, in West Norfolk, one patch first seen in 1986 is on ground that was ploughed (but not cropped) in 1954, and Mrs G. Crompton has produced evidence that the slope at Weeting where the three patches grow on stripy ground was cultivated at least in part in the past. It is good to be able to report that these three patches, described as "none too happy" in 1986 (Coombe, 1987), had, through more effective control of rabbit-grazing, produced some 170, 33 and seven inflorescences in 1987 and that the new patch on recent ex-arable had 19 inflorescences on 10 July 1987. This augurs well for reintroduction experiments currently planned for some extinct Suffolk and/or Norfolk sites under the aegis of the Nature Conservancy Council.

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Buzz pollination of comfrey at Wicken Fen

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Introduction

One of the commonest flowers at Wicken Fen in July and August is common comfrey *Symphytum officinale*. The nectar at the base of the tubular flower is protected by a palisade of anthers buttressed by corolla scales (Figure 1). The only bees that can reach the nectar from the mouth of the flower are those with long tongues, like the brown bumblebee *Bombus pascuorum*. Other bees, perhaps including *Bombus pratorum*, sometimes gain access to the nectar through holes bitten through the base of the flower by the short-tongued bumblebees *Bombus terrestris* and *B. lucorum*. The creamy-white petals turn brown where the tissue is damaged, at the base by the mandibles of robbing bees or around the mouth of the flower by the clawed feet of legal visitors seeking nectar or pollen. Most flowers bear numerous brown scars and so have probably received several visits by bees.

Bees approaching the mouth of the flower collect nectar or pollen or both. Sometimes a bee hangs upside down below a flower and closes and vibrates her wings, producing a brief high-pitched buzz. Buzzing behaviour like this is performed only by certain types of bee. Bumblebees do it; honeybees do not (Buchmann, 1983, 1985). Further, it occurs only on certain flowers, among which can be recognised groups sharing certain features. Buchmann (1983, 1985) recognises two main groups of such flowers. Both typically have apically dehiscent anthers, as in *Solanum*. Members of one group have numerous anthers massed in a shaving-brush arrangement, as in kiwi-fruit *Actinidia chinensis* or dog rose *Rosa canina*. Members of the other group have few anthers, often grouped into a cone and held out clear of the petals, as in the tomato *Lycopersicon esculentum*. Comfrey flowers do not represent either of these recognised buzz-pollinated flower types. Their anthers dehisce longitudinally and are within the corolla - but they often elicit typical buzzing behaviour.

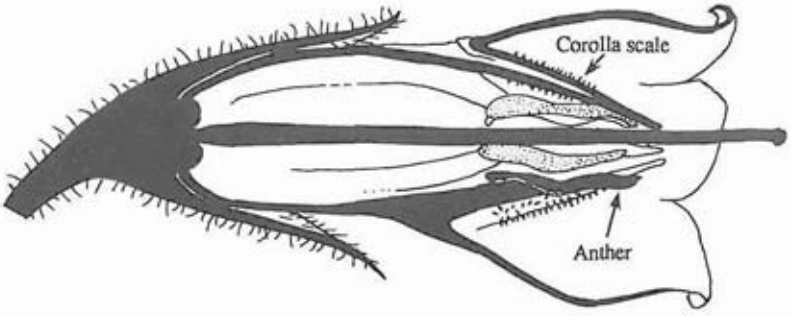

Figure 1: Simplified half flower of comfrey *Symphytum officinale* with cut surfaces black

The buzzing of inappropriate flowers is sometimes regarded as 'carry-over' behaviour by a bee that has recently moved from a buzz-pollinated type of flower to another type and has not yet abandoned buzzing (Buchmann, 1983). We monitored a patch of comfrey flowers through 24 hours to see whether or not buzzing could be regarded as mere carry-over behaviour and to learn something about the circumstances in which it occurred.

Methods

We observed a patch of comfrey flowers beside the new pond-dipping pit just south of the head of Wicken Lode from 11.00 hours on 28 July to 12.00 hours on 29 July 1986. All bees seen on the patch were *Bombus pascuorum*. At hourly intervals, one observer scored the number of bees entering the patch during a 20-minute period and the number having pollen loads on their legs. Individual bees were followed for up to 10 flower visits, and we noted how many of those visits involved buzzing ("% buzz visits"). The other observer used an optical tachometer (Unwin and Ellington, 1979) to find the wing-beat frequency of several bees during buzzing and during foraging flight. Air temperature and relative humidity were measured at a point within a few centimetres of the flowers with a miniature wet-and-dry thermocouple psychrometer (Unwin, 1980) at the beginning and end of each 20-minute observation period.

Results

Many bees were probing for nectar as well as collecting pollen. To test the hypothesis that buzzing is a means of pollen collection (Buchmann, 1983), we compared the percentage of buzz visits in bees carrying pollen loads with that in bees without pollen loads. Most (63%) individual bees buzzed either nearly always (on at least 90% of visits) or very rarely (on not more than 10% of visits). A chi-squared test showed a significant association between buzzing and pollen carrying ($X_1^2 = 14.31$; $p<0.001$).

The incidence of buzzing varied through the day (Figure 2), correlating better with vapour pressure deficit (Spearman rank correlation coefficient $r_s = 0.98$, $p<0.001$) than with temperature ($r_s = 0.96$, $p<0.001$), absolute humidity ($r_s = 0.92$, $p<0.001$) or relative humidity ($r_s = -0.89$, $p<0.001$).

The wing-beat frequency during flight varied little, but the median wing-beat frequency for buzzing varied markedly through the day (Figures 2 and 3). This correlated better with temperature ($r_s = 0.50$, $p<0.1$) and vapour pressure deficit ($r_s = 0.43$, $p<0.1$) than did median wing-beat frequency during foraging flight ($r_s = 0.39$ for temperature, $r_s = 0.29$ for vapour pressure deficit, $p>0.1$ for both). High buzz frequencies were observed only when the air temperature was above 21°C (Figure 3).

Discussion

The association between pollen loads and a high percentage of buzz visits supports the view that buzzing is a means of pollen collection. Bee numbers, the percentage of buzz visits and the pitch of the buzz were all greater at times when air temperature and vapour pressure deficit were high. Typically the pollen grains of buzz-pollinated flowers are small, smooth and powdery when

dry (Buchmann, 1983). Vibration at a particular frequency releases the dry surface layers of pollen in an anther (Corbet, Chapman and Saville, in press), and the amount of pollen dry enough to be released by the next buzz may be expected to depend on the drying power of the air in the interval between visits. This in turn will rise with temperature, for a constant absolute humidity (see Unwin, 1980). Thus buzzing is expected to give a higher reward at higher temperature and vapour pressure deficit levels and at lower relative humidity. (In this study, the local absolute humidity rose with temperature, presumably because transpiration supplied water to the air faster at higher temperature. This effect was not great enough to abolish the correlation between temperature and vapour pressure deficit.)

On comfrey flowers, buzz visits by *B. pascuorum* were frequent and regular. They sometimes involved a large proportion of the bee population. Individual bees sometimes buzzed on nearly all their flower visits. We do not

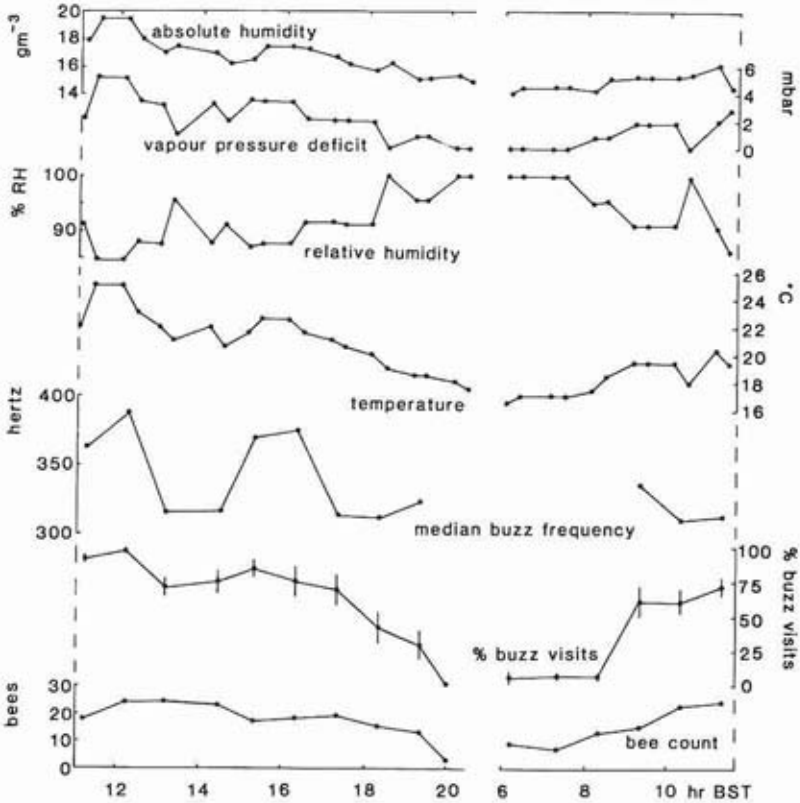

Figure 2: Microclimate and behaviour of *Bombus pascuorum* on comfrey, 28-29 July 1986
The percentage of visits on which buzzing took place was scored for 3-20 individual bees at each time and is shown as the mean ± standard error of the mean.

think that this buzzing represents a 'carry-over' from buzz visits to some other type of flower. This study indicates that comfrey flowers are buzzed regularly, even though they do not belong to a type already described as associated with the buzz pollination syndrome. We have observed elsewhere that flowers of borage *Borago officinalis* and Solomon's-seal *Polygonatum* x *hybridum* are also buzzed frequently by bumblebees. Like comfrey, these flowers have a small number of anthers, which open inwards by a longitudinal slit and which are grouped around the style.

An individual anther of *Solanum* forms a tubular resonating chamber from which the powdery pollen grains surge out through the terminal pore when the anther is subjected to vibration at certain frequencies (Buchmann and Hurley, 1978; Buchmann, Jones and Colin, 1977). In comfrey, perhaps the resonating chamber consists not of a single anther, but of the corolla and the anther cone, buttressed by corolla scales (Figure 1).

The pollen-foraging behaviour of bees on comfrey has proved more interesting than expected. Nectar-foraging behaviour on comfrey remains to be explored. Meanwhile, visitors to Wicken Fen who hear high-pitched

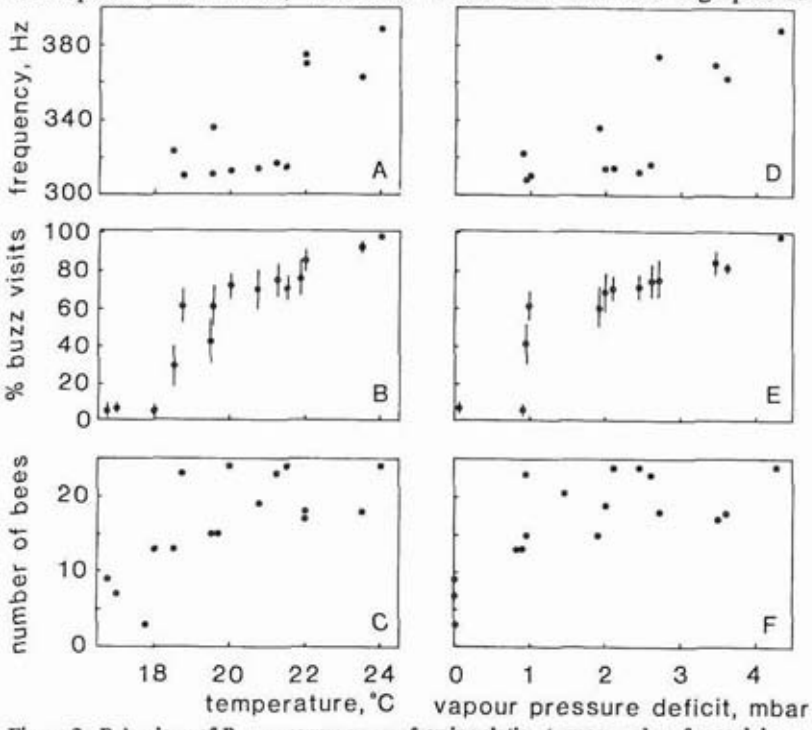

Figure 3: Behaviour of *B. pascuorum* on comfrey in relation to mean values for each hour of temperature (A, B, C) and vapour pressure deficit (D, E, F) on 28-29 July 1986

A, D: median buzz frequency (mean ± standard error of the mean); B, E: percentage incidence of buzzing; C, F: numbers of bees entering the sampling area in 20 minutes

buzzing in the comfrey may take it as a sign that the air is fairly dry and that bumblebees (probably *Bombus pascuorum* or *B. pratorum*) are at work collecting pollen.

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Bumblebees visiting flowers of common comfrey *Symphytum officinale*: *Bombus pascuorum* (left) and *B. pratorum* (right) Graham Easy

Scuttle flies in Hayley Wood

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The scuttle flies, Phoridae, are a large family of distinctive small flies. They range in size from just under 1 mm in length to about 7 mm. The majority are 2-4 mm long. The British species are mainly dark brown to black in colour, but a few are more yellowish or orange-yellow. They run with a characteristic scuttling gait. The family is of interest primarily because of the species' astonishingly varied larval habits. They include the infamous coffin fly *Conicera tibialis* Schmitz in corpses, an inhabitant of root nodules, many fungus-breeding species, specialised predators such as those specialising in eating the eggs of spiders or others which feed on root aphids, and parasitoids and parasites. These attack hosts such as the pupae of ladybird beetles, the larvae of lesser fungus gnats (Sciaridae), millipedes, small snails (*Vitraea* species), ants and (in Japan at least) even man.

The study of this fascinating family has been impeded by immense taxonomic confusions, making identification of specimens very much something for the specialist only. Since 1975 I have directed my attention to the task of sorting out some of the taxonomic mess, with the initial aim of producing a two-volume handbook on the British species (Disney, 1983, 1988).

In order to carry out revision of the British Phoridae I have worked mainly with newly collected specimens. I have resorted to museum collections mainly to solve problems of identity or nomenclature. When I started, there were 278 species on the British list; 33 have been removed by synonymy or uncovering misidentifications, and 70 species have been added, including 27 new to science, to give a present total of 315 British species.

One of the more interesting collections I have examined, in the course of these revisionary studies, is one from Hayley Wood made by Dennis Unwin during 1980 and 1981. In the write-up of this collection (Disney, 1987) it was noted that eleven species were additions to the British list. However, it was the three species new to science that attracted publicity in the media! The report noted 81 species in the collection from Hayley Wood. Subsequent revisionary studies have added a further new species, *Megaselia spinolabella* Disney, which has long been confused with *M. pulicaria* (Fallén). It proves to be widely distributed but much rarer than the common *M. pulicaria*.

This total of 82 species is by no means a complete list for Hayley Wood. It was with good cause I entitled the report "A *preliminary* survey of the scuttle flies of Hayley Wood, . . .". Dennis Unwin had mainly employed a tent-like trap (a Malaise trap) as his collecting method. All collecting methods for insects are selective (Disney *et al.*, 1982). In the report I noted the absence of the common genera *Metopina, Phalacrotophora* and *Phora* from Dennis Unwin's collections and the presence of only one species of *Triphleba*. I am confident that more collecting will raise the list of scuttle flies for Hayley Wood above the 100 species mark.

What does such a list for a single nature reserve tell us? First, any site supporting about a third of the British scuttle fly fauna must be regarded as especially rich, particularly when it is noted that a significant number of British species have limited distributions. For example, a number of species are restricted to Scotland, some of these occurring at higher altitudes only. In other words Hayley Wood supports considerably more than one third of the scuttle fly fauna of lowland England. The precise percentage can only be determined by further studies.

Secondly, the Hayley Wood list includes a high frequency of 'uncommon' species. It is not yet possible, however, to quantify this. National distribution information is still very patchy. For many species the status, in terms of rarity, is still based on a mixture of hard data and distortions due to uneven collecting effort in terms of coverage and of collecting methods employed. The latter point is often ignored. However, the non-comparability of survey results for one site based, for example, on pitfall trapping and the results for another site surveyed by means of sweep-netting is a serious problem (see Disney, 1986). As an example, one of the 'rare' species recorded at Hayley Wood is *Megaselia correlata* (Schmitz). At the time it represented only the third British locality for this species. Since then I have analysed collections of Phoridae collected by insecticide knockdown from the canopies of oak trees in woods near Oxford by Professor Sir Richard Southwood and his colleagues. The results show that this species can exceed 10% of the scuttle fly fauna in the canopy of an oak tree. I guess the species is common in lowland England. It just happens to be rare near ground level.

Thirdly, the diversity of larval habits for the species from Hayley Wood whose basic natural history is known suggests the ecosystem as a whole is species-rich. In particular, fungus-breeding species are well represented. Advancing knowledge is likely to reveal that the list of Phoridae is a particularly good index of the species-richness in general of the Hayley Wood Nature Reserve. I would certainly be prepared to predict, on the basis of the preliminary survey of the Phorid fauna, that Hayley Wood would be likely to score high in any conservation evaluation exercise designed to rank the site in relation to other woods in lowland England on the basis of the diversity of their invertebrate faunas.

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Notes on birds in Hayley Wood

Peter Sell

These remarks have been stimulated mainly by reading Tony and Joanne Williams' survey of the breeding birds of Hayley Wood published in the 1987 volume of this journal. Although most of their conclusions are in agreement with my general impressions, some statements are made which seem to me to be very misleading.

My experience of the wood extends almost continuously from 1952. Unfortunately, from the point of view of recording birds, my many visits to the wood have usually been for another purpose - either as the shooting tenant or as a botanist. However, on the numerous visits made to the wood as the shooting tenant between 18 October 1970 and Christmas 1982 I recorded most of the birds I heard or saw without the aid of binoculars. A written account of each visit was given to CAMBIENT, and even more detailed accounts were made in my personal diary. A botanist's eyes are mostly on the ground, but he can use his ears, and most birds heard were recorded. Tony Vine had also made many notes on the birds of the wood and, when Oliver Rackham was preparing his book, *Hayley Wood*, we combined our notes into a fairly detailed account. This was drastically edited by Peter Conder before publication. Unfortunately I do not have a copy of my original notes, nor of my combined account with Tony Vine. To get together all my records for Hayley Wood I should have to go through the 52 volumes of my personal diary and the 20 volumes of my field notebooks. Contrary to most recorders of birds in the wood, almost the whole of my time has been spent off the rides and footpaths. There is probably hardly a square yard of the wood I have not examined, and I have been there at all hours of the day and many of the night, at all seasons of the year. To make a proper assessment of the birds of Hayley Wood it would be necessary to get as many individual records as possible onto a card index.

The great difference in the wood since I first visited it in 1952 is the opening-up of the coppiced area. This has not only benefited the plants but has increased enormously the population of birds.

The following are my principal comments on particular species.

Canada goose The geese that used regularly to fly over Hayley Wood came from Hatley Park, not Longstowe (Madin, 1979). They have now been destroyed.

Pheasant It is extraordinary that T. and J. Williams make no mention of this bird as a breeding species. The coppiced area often resounds to the nuptial call of the cocks in April and May, and they are frequently seen fighting. In the non-breeding season they roost in trees all over the wood, not just along the margin. In the breeding season, in my experience, they usually roost on the ground.

Herring gull This gull does not seem to have been recorded passing over the wood, but I have seen them on many evenings passing northwards, although I can find only one written record, on 27 October 1979. On 26 December 1978 a few were feeding with other gulls on the offal heap at the corner of the wood.

Woodpigeon A total of 17 breeding pairs for the wood is far too low. The breeding habits of woodpigeons in West Cambridgeshire have changed dramatically. When bird's-nesting as

a boy in the 1930s, I used to find the first eggs in late March and then on and off right through the summer. I believe that the main breeding of woodpigeons is now as late as July or August and that there are many young still in the nest in September and October. Certainly this is so at Hayley, where I have seen 20 or more nests (though I have never actually counted them) still occupied in these months. Even in 1965 Murton said that 70% of all young were reared in August and September, the young being fed on ripe corn. The number of nests that can be seen at Hayley in the winter months is enormous, and many are blown down before the next season.

Collard dove Apparently not recorded for the wood, but I have seen or heard them along the old railway line and in the coppiced area on 6 November 1976, a pair in the wood on 11 December 1976, calling on the east side of the wood on 27 December 1976, several round the margin and in the wood on 26 November 1977, and one calling in the Glade on 26 January 1980.

Tawny owl In their initial summary T. and J. Williams give this species as one of those for which breeding records were "confirmed or extended", yet in their final list they say that one pair "probably bred", basing the record on the fact that a pair were present throughout the year. I am old-fashioned and believe that breeding is only proved by seeing an occupied nest. I have always thought there were several pairs at Hayley, and one of my pleasures was to listen to them singing to one another, particularly in January and February. Individuals have a great variety of notes, but different individuals have different tones. They breed very early, and in the nearby village of Bassingbourn I used to find eggs in the last week of February or early in March. They still nest in the same tree near our house, but both the tree and I are getting old and rotten and I can no longer climb to see if they have eggs at that date. At Hayley Wood I have never seen a nest or young, but I have assumed that they probably bred. They may have trouble with grey squirrels, which probably enter almost every hole if it is left unattended.

Magpie This species was common in West Cambridgeshire in the 1930s and 1940s. It declined in the 1950s and was absent from many areas by 1960. Its reappearance in the 1980s coincides with the records for Hayley.

Marsh tit and Willow tit Only one record of each of these species seems very odd. I think I see one or the other or both on nearly every visit. The suggestion by Conder (1975) that a few pairs of both species may breed seems more realistic. Both species were present on 10 May 1984 on the same day as I recorded the nightingale.

Nuthatch This species has become more frequent in the last few years and may be heard on almost any visit. It almost certainly breeds.

Nightingale The total omission of this bird seems to be incredible. On my first visit to the wood in 1952 it was present. Then for a long period it was absent. It was not heard again until a Cambridge Bird Club excursion on 19 May 1974. The following year it occurred in the coppiced area of the wood and it has probably been present every year since. I have heard as many as six different birds on the same morning, and there may have been more, as they are ventriloquists and it is difficult to tell where the song comes from. My only actually written record for 1984 was on 10 May, but by then I would have regarded it as an established species and would not have written additional comments.

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Book Review
New thinking in the identification of flowering plants

A New Key to Wild Flowers
J. Hayward. Cambridge University Press, 1987. 278 pp., with many line-drawings. £8.95 ring-bound with soft covers; £25.00 hardback.

Collins Guide to the Wild Flowers of East Africa
M. Blundell. Collins, London, 1987. 464 pp., incl. 175 pp. of colour photographs, 8 pp. of line drawings and 4 cover-maps. £12.95 hardback.

Both these new Floras break some new ground in plant identification, and they make an interesting and instructive contrast. John Hayward's book is a 'key', not a full Flora, and its purpose and plan are admirably explained in the first few pages. The book grew out of the author's experience in running Field Centre courses on wild flowers for amateurs. Faced with a keen but uninstructed class of would-be botanists, he soon learnt what many of us know - that "the full keys of . . . Bentham & Hooker, and later 'C. T. and W.' were much too technical and long, and entirely unsuitable for carrying in the pocket". So he produced, experimentally, his own "simplified keys" to obvious groups of British wild flowers, such as the yellow Composites, and found they worked. Refined by years of practice, the keys are now available to all, published with the keen support of the organisation called AIDGAP run by the Field Studies Council.

Although the layout of Hayward's book bears a general resemblance to the Flora, originally published in French, by Gaston Bonnier and familiar to many older British botanists as *Name this Flower*, the actual procedure of the key is different and, I believe, unique. Like all keys, it proceeds by offering a series of statements to which, armed with the specimen plant, the student has to assent; but in this format you proceed down a vertical series of statements until you find one that fits your plant. You then move horizontally into the second column and repeat the process. If necessary, you do the same in the third column. The fourth and last column gives you the answer. The procedure is clear, ingenious and 'user-friendly', and the student is particularly encouraged by the instruction that "in cases of doubt it will not usually matter whether any statement is regarded as true or not. The key will work whichever conclusion is made."

The book is ring-bound so that it opens flat and two facing pages can be readily inspected. Many details throughout are clearly illustrated by Michael Hickey's accurate line-drawings, which so often illuminate a character not

easily expressed in words. As one who has struggled rather ineffectually to explain petal shape differences in *Silene*, for example, I congratulate the authors on pp. 89-90, where the key even allows for male flowers in *Silene nutans*! A particularly ingenious device is to use the third column, in cases where the solution is arrived at in the second column, for any kind of corroborative statement, often ecological or distributional.

Apart from a beautiful colour photograph of a primrose in flower on the cover, Hayward's book is in black and white throughout and depends upon traditional taxonomic description of carefully-observed structures, mostly of flower or fruit. To that extent, Hayward's key is a natural development of a long botanical tradition. The book by Sir Michael Blundell devoted to the wild flowers of East Africa, on the other hand, adopts a very different approach. He aims to "give the resident of, or traveller in East Africa an introduction to the beautiful wild flowers of the region" and hopes to do it "primarily through colour photographs, which will provide an invaluable guide to recognition of the various species". The middle section of the book, containing 864 colour photographs, most of them close-ups of flowers, is arranged, not systematically, but by colour - an arrangement which, as the introduction tells us, "is one immediate approach to identification". This is undoubtedly true: anyone seeing *Gloriosa superba* in flower will have no difficulty in identifying this remarkable 'flame lily' in the red section of the photographs - but one might reasonably ask what proportion of the depicted flora would work anything like so well.

This approach to identification, which depends on general appearance rather than detailed morphological comparison, is of course a common-sense approach. The fact that we botanists on the whole use it rather sparingly - or even pretend that it is somehow '*infra dig.*' - is a remarkable feature of our European botanical tradition, and we cannot explore it further here. Blundell's Flora sensibly breaks away from that restrictive tradition and, following the lead set by the ornithologists (who have never operated in this rigid way, with detailed characters set out in fixed dichotomous keys), he gives us a beautiful and partially successful introduction to a rich and unfamiliar flora. The more the pity, therefore, that he has not had the courage of his convictions and made a clear statement. I have read the introductory material carefully and find myself totally baffled by the explanation of the purpose of the Systematic List on pp. 13-17. Taken from the severely professional - and in their own way admirable - works emanating from Kew, the list merely serves to mystify the earnest student. It is <u>not</u> (in spite of the statement on p. 10 which apparently refers to it) a key, and it is quite obscure to me how the author thinks it can be used "in conjunction with the colour index" (whatever that is!).

My recommendation to naturalists travelling to East Africa is that they should buy this book, but use it only in the obvious way: look through the (mainly excellent) colour photographs when you see any coloured flower, and see if you are lucky; then check with the description - particularly whether you are in the right geographical region - and you may have the right answer. The book is beautifully produced, and remarkably good value for money.

S.M. Walters

Highlights of a botanical year

G. Crompton

This has been the first year since I became county recorder that I have been able to explore Cambridgeshire in much the same way as when I first learnt botany during the B.S.B.I. Maps Scheme thirty years ago. This time I was fortunate to have the help of Barbara Jackson and Robert Payne.

In small areas on the county boundary, west of Gamlingay and east of Kirtling, we were able to make over 80 additions to the vice-county records for these little-visited sites. But in the north, on the Lincolnshire boundary, the small Cambridgeshire saltmarsh had become more eroded at each visit, and by September tomatoes and Jerusalem artichokes were growing through the sewage sludge. Few saltmarsh plants survived, except for *Glaux maritima* just south of Foul Anchor. North of the stile we found only four plants of *Bupleurum tenuissimum* and one small patch of *Juncus gerardii* and *J. compressus*.

At Gamlingay Cinques, thanks to conservation work, we saw the last bush of *Calluna vulgaris* there, and in Woodbury Cinques we found two more large patches of *Chrysosplenium oppositifolium* with their shining golden flowers visible from quite a distance in the late April sunshine. On the same day I made my first visit to the legendary White Wood, and it was difficult to believe that I was still in 'old' Cambridgeshire, so different in character was this wood on the greensand from our woods on the boulder clay or chalk. *Adoxa moschatellina* appears to have spread, but *Convallaria majalis* was difficult to find; more noticeable was an old notice marking the spot where now we saw very few leaves scattered about. The absence of any more recent records for *Adoxa* at its only other site in the county, discovered thirty years ago, was probably due to a slip of the pen in the grid reference in the Natural History Society's card index: John Faulkner very kindly showed me the site where he found it, and here also it has spread considerably. In the same lane we saw the very rare hybrid between the oxlip and cowslip, still there in small quantity.

The highlight of the Woodbury area was to find *Genista tinctoria* and *Astragalus glycyphyllos* surviving in some small remnants of rough grassland associated with the site of an old airfield, but on each visit we found that another piece was either being ploughed up or being cleared for a piggery, while other areas had already been improved for paddocks over the past ten years. Nevertheless we found *Bromus racemosus* and *Euphorbia platyphyllos* roughly in the site where only Philip Bourne had recorded them previously, in 1962. The most unusual sight of the year was to find *Ophioglossum vulgatum* growing in the completely bare earth of a cornfield - probably sprayed, as there were no other 'weeds' present and some of the 50 or so fronds were rather yellow. A few fronds were also present in the adjacent rough grassland, but this was ploughed up later in the year.

In the east of the county Barbara Jackson found one of our only confirmed trees of black bullace. 1987 was one of the most spectacularly fruitful years for plums of all kinds. Crickseys, bullaces, sloes small and sloes large,

gages, 'wild' plums, cultivars growing in hedgerows, and cherry plums - red, yellow and orange - they all bore fruit, some in enormous quantities, and this great opportunity was taken to collect specimens for the Cambridge University herbarium.

Bromus commutatus has become a frequent plant on the edges of wheat fields, but *B. secalinus* was a surprising associate with it at Upend. The most exciting and unexpected find was a new site for herb-Paris *Paris quadrifolia* and for ramsons *Allium ursinum* in a wood near the Suffolk border. Over the boundary stood the largest stand of *Heracleum mantegazzianum* I have ever seen. Spread over two or three acres, the largest plants were as tall as the highest elder trees.

At Ditton Park Wood, despite drastic changes to the woodland structure, we found *Lysimachia nemorum* still thriving on shaded wet rides; here also Alan Leslie demonstrated *Hypericum maculatum* (see p. 57) in its classic site and refound *Carex pallescens*.

The only other site for *L. nemorum* had been recorded by T.G. Tutin in 1931 as in "West Wickham Wood" and by R.G. West and C.D. Pigott in 1950 as in "Hill Farm Wood", but these place-names do not appear on the maps. I think we must have been the first botanists to find and get permission to visit this site since 1950. It is a splendid small relict oak–ash wood with *L. nemorum* thriving on the wet, rutted rides; also present were *Luzula pilosa* and *Carex pallescens*. Although we found the latter two species in woodlands managed by the Forestry Commission, such as Little Widgham Wood, where the rides were extremely wet and *C. pallescens* was quite frequent, it is mainly only on the rides that interesting species associated with old woodlands now survive.

Graham Easy showed me the huge area of railway sidings which have such an adundance of interesting plants, including many very large plants of dittander *Lepidium latifolium*. (I had always imagined that the only approach to this site was to scramble down a steep embankment and had never ventured there - only to find that access was by car!) Another surprise, although of a very different kind, was to be shown by Robert Payne a stand of *Valerianella dentata* in Great Chishill which was, according to my field notes for 1957, in exactly the same corner of a cornfield in which I had found it 30 years ago. We were interested to see that the crop was bearded wheat, now rarely seen. And on surely the hottest day of the year David Coombe showed me *Calamagrostis canescens* in the small and remote fen carr where he had refound it in 1986 after a lapse of 150 years.

There were also memorable days on Newmarket Heath, where I accidentally found not only the spotted cat's-ear *Hypochoeris maculata* but later on a beautiful specimen of the green-winged orchid *Orchis morio* in almost the same spot where a groundsman had shown it to Frank Perring in 1964.

Perhaps the weather was bad in 1987, but, with so much to explore and see, the sun seemed to shine on most days, and especially on the glorious day of the Botany School's excursion to Hayley Wood, where the nightingales sang and there were carpets of oxlips in abundance.

A mass occurrence in Cambridge of *Nostoc commune* Vaucher, a conspicuous terrestrial blue-green alga

Hilary Belcher and Erica Swale

"Nostoc" or "Nostoch" is a name given by the 16th-century chemist Paracelsus (Theophrastus Bombastus von Hohenheim) to the terrestrial blue-green alga now known as *Nostoc commune*. In this, beaded filaments (Figure 1B) are embedded in wrinkled and contorted flat gelatinous colonies (Figure 1A) up to several centimetres across, of various shades of yellow, brown, purplish or dull green. These dry up completely in dry weather and become inconspicuous, but swell to full size again with the coming of rain, thereby giving the illusion of a sudden appearance. An alchemical work of the early 17th century (Ruland, 1612) describes it thus: "Nostoch - a Ray or Radiation of a certain Star, or its offscouring, superfluity, etc., cast on earth. It falls, chiefly during June, July and August, upon broad fields or meadows, being like a large fungus or sponge in appearance, and of a yellow or dark tawny colour, like a coagulated juice, and to the touch like a jelly." For at least a thousand years these gelatinous masses, together with certain similar objects, were thought to be the wreckage of shooting stars that had fallen to earth, and in North Wales at least this belief was held by some people within living memory (William Condry, personal communication). Remarkable properties were attributed to them by alchemists, and they have been referred to by Shakespeare, Dryden, Sir Walter Scott and other authors (see Belcher and Swale, 1984).

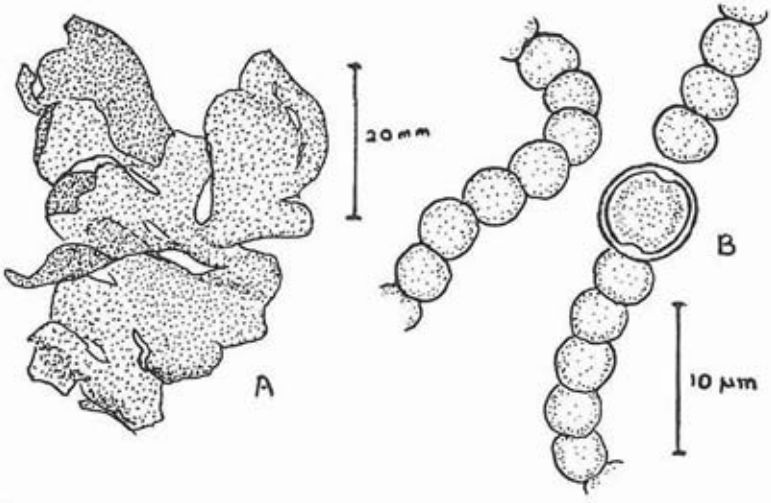

Figure 1: *Nostoc commune* from Cambridge
A: Colony (natural size)
B: Filaments in mucilage (x2,000)

Large numbers of these colonies were seen in the autumn of 1987 forming a band at the moss-covered grassy edge of the old tarmac along the southern side of the quiet track which runs west from Grange Road in between the Rugby football ground and Clare Hall flats in the direction of Coton. The distribution of the colonies began at the southern margin of a semicircular expansion of the track about 100 m beyond the Bin Brook and continued along the tarmac edge for approximately 100 m further (TL 434582). They were previously seen there in 1980 and 1981, but for several years following were not noticed, although probably present in small numbers.

Some colonies that we collected on 1 December were translucent olive green to brown and took the form of flattened membranous bags, mostly very torn and ragged, so that as they lay on the ground they somewhat resembled burst rubber balloons. One relatively intact colony was circular in outline, with a diameter of 5 cm. A colony which we dried down in a warm place began to swell five minutes after being placed in water, and after two hours it had recovered its original size. Another colony lost 92.5% of its weight when dried at room temperature.

Although *N. commune* is abundant at this place, it appears to have been rarely recorded in Cambridgeshire in the past. G.S. West, an authority on blue-green algae, did not mention it in "The alga-flora of Cambridgeshire" (1899). Mr E.A. George has told us that it used to grow on gravel in the garden of Dr A.S. Watt in Chesterton Hall Crescent and that he has seen it occasionally also on bare ground, but always in small colonies, never larger than a thumb-nail. We have seen similar small colonies around rabbit burrows near Wimpole Hall.

Since December 1987 we have looked for *N. commune* elsewhere on grass, tarmac and moss at the edges of quiet roads and have found it to be common to abundant at the southern end of the layby near Impington Farm, in the south-west angle between the A45 and the Histon road (TL 442614), and, again at the edge of the tarmac, on the bridge by which the Girton--Madingley bridle path crosses the A45 (TL 408608).

There seems to be no obvious reason why the alga should flourish so well at the site near Grange Road, except that the edge of the track is often damp, because, being slightly below the level of the field, it receives drainage water from both track and field and the moss retains water. Since *Nostoc* fixes nitrogen, it is likely to be independent of nutrients in agricultural run-off.

Geitler (1932) states that *N. commune* is eaten by various primitive peoples, without specifying which. According to Fogg *et al.* (1973) it is a delicacy in China, and Hisauchi (1960) gave an account of its variety *flagelliforme* (Berk. & Curtis) Born. & Flah., which grows in spaghetti-like strings. This was collected (and still may be) from the upper basin of the Yellow River in China, whence it used to be transported, partly by camel caravan, to the cities of China and Japan, where it was sold as a gourmet item. It could still be bought, at a high price, in Tokyo in the late 1950s. We have not found any record of *Nostoc* being eaten in Britain and have not tried it ourselves.

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Butterflies and butterfly-watching in Cambridgeshire

T.J. Bennett

The fact that there has been only one article primarily about butterflies published in the last 23 issues of *Nature in Cambridgeshire* might lead one to the conclusion that there is little interest in the group within our area. When one then appreciates that less than half of the butterflies on the British list occur within 'old' Cambridgeshire (v.c. 29), the assumption seems even more reasonable. Indeed, until the last five years or so it probably was the case that anyone interested in butterflies and unfortunate enough to live in one of the poorest areas in the country would have done most of his butterfly-watching in richer parts. However, in common with the country as a whole, there has been an undoubted surge in public interest and concern about our butterfly fauna. It is the intention of this article to demonstrate that revival of interest locally by highlighting current activities of the butterfly-watchers themselves and some recent changes in the status of the insects within our area. I hope that this will lead to more frequent contributions on the subject in the future.

Although initially opened as a response to this new enthusiasm, the increasing number of Butterfly Farms must surely be generating even greater interest. We now have two of these establishments almost on our doorstep, with the opening in 1987 of one at Barrow near Bury St Edmunds and another at Long Sutton in Lincolnshire. Obviously one can question the true motives behind the opening of such tourist traps, but it is nevertheless true that they have raised the consciousness of the public at large to the wide-scale decline in the number of individuals and range of species to be found in the British countryside. The fact that butterflies are bright and colourful and thus easy to spot, on the whole readily identifiable in the field and particularly sensitive to environmental changes makes them ideal indicators of the general health of our countryside.

This point is not lost on those joining the British Butterfly Conservation Society, an organisation that has great credence because of the mix of amateur and professional enthusiasts within its membership. A local Cambridgeshire and Essex Branch was formed some four years ago and has been steadily increasing the range of its activities as well as its membership. Not only are

the usual talks and field outings held and bulletins sent out, but members are encouraged to become involved in one of the more scientific projects that the branch is now undertaking. The Society works closely with the Biological Records Centre at Monks Wood, to keep up to date with the current national distribution of species, and encourages habitat studies. The local branch now holds regular work parties at a number of sites, including the Devil's Ditch, in attempts to enhance the habitat, while at Woodwalton Fen (v.c. 31) members are helping the Nature Conservancy Council to monitor the highly managed population of the large copper.

The Cambridgeshire Butterfly Survey launched in 1985 takes the theme of distribution down to a much more local level in that it is attempting to map the range of all species down to the level of 1 km squares on a simple presence or absence basis. Contributors - of which there have been nearly 70 to date - are also encouraged to report particularly attractive sites where there are large numbers of butterflies or a wide range of species. By about 1990, when the initial survey will finish, there will be for the first time a comprehensive base-line from which future changes in status can be measured.

The most recent review of the butterflies of Cambridgeshire was that of Brian Gardiner (1963), but, apart from making it clear that most species were in heavy decline, this did not go into detail. Remarkably little is currently known about the butterflies of particular sites. Virtually none of the Cambridgeshire Wildlife Trust's reserves, for example, have definitive species lists at the time of writing.

Another recording technique that is being used increasingly by amateurs to show up changes in the abundance of species at a particular site is that used in the Butterfly Monitoring Scheme organised by the Institute of Terrestrial Ecology at Monks Wood, funded by the N.C.C. (Pollard, Hall and Bibby, 1986). By making a series of counts along a fixed transect route through an area on a weekly basis between April and September, provided that the weather conditions are suitable, it is possible to calculate an index of abundance for each species. The changes in relative abundance from generation to generation or from one year to the next for a particular site can be compared with the figures obtained at other sites to provide information on national and regional trends and help to determine the effects of habitat change.

Chippenham Fen and Wicken Fen have been contributing to the national scheme for about ten years now and the effects of management at both sites are becoming quite obvious. Grassland species have increased markedly, almost certainly as a result of rigorous cutting regimes which encourage the less vigorous soft grasses and herbs favoured as food-plants by the larvae of such species as the large skipper, common blue and ringlet. The clearing of glades and the widening of rides also provide flowery areas in the sun, which are much favoured by the more mobile species such as the comma and peacock. After completion of the current season's fieldwork at Wicken Fen and its subsequent analysis, the full ten years' data will be used to write up a comprehensive guide to the butterflies to be found on the reserve.

Even before the results of the Cambridgeshire Butterfly Survey are published, the status of some species is already known. Those confined to areas of chalk grassland are not surprisingly at a very low ebb and are unlikely

Comma butterflies *Polygonia c-album* on marsh woundwort *Stachys palustris*

Graham Easy

to be able to recover naturally. The brown argus is one that appears to be quite common, but it occurs at a very limited number of sites, while the small blue is currently known at only one site. Although it is not at risk from any direct threat, it is all too easy for a natural disaster to wipe out a species with such a tenuous foothold as this. It has all but happened already with the white-letter hairstreak, which feeds on elm in the larval stage. We all know about the effects of Dutch elm disease on the landscape of our county, and not surprisingly the butterfly is now rarely reported. The chalkhill blue is one species which has almost certainly been lost altogether within the last two years from its lone site along the Devil's Ditch. Here the lack of sheep-grazing, which has resulted in the establishment of a longer, denser turf, is probably to blame for its demise.

It is not all bad news though, because two species seem to be on the increase. The comma appears to be continuing its long-term trend of spreading eastwards and has been widely reported during the Cambridgeshire

Butterfly Survey. There have been scattered reports of speckled woods, which suggests that the species may be trying to colonise suitable sites. It has certainly taken to the more wooded parts of Chippenham Fen since it first appeared in 1984 and can now be found quite readily during its prolonged and overlapping flight periods.

The whole question of introduction and reintroduction is hotly debated by botanists and zoologists alike, but the prevailing view among those interested in butterflies seems to be in favour, where appropriate. Not many species have the capacity to colonise or indeed recolonise areas without human help. One that it is hoped will be seen again at Wicken Fen in the near future is the swallowtail, which originally became extinct there about 1951. Subsequent attempts to re-establish it have all failed because its food-plant, milk-parsley *Peucedanum palustre*, did not grow in sufficient numbers or with sufficient vigour (Dempster, 1976; Harvey and Meredith, 1981). Changes in management and the recent trend towards wet springs have combined to bring about a promising recovery of the food-plant, making the prospects of a successful reintroduction more likely.

Another reintroduction to Wicken Fen which is under consideration is that of the marsh fritillary, which has not been seen there for some 40 years. Totally absent from East Anglia until its recent establishment at Strumpshaw Fen in Norfolk, this highly sedentary species needs prominent stands of devil's-bit scabious *Succisa pratensis* to lay its eggs on.

Hayley Wood has long been noted as being likely to be suitable for white admirals, the caterpillars of which feed on honeysuckle *Lonicera periclymenum*. Although the species is a strong flyer, it does not readily venture far from its colonies, so again the likelihood of its colonising on its own is very remote. What a nice, harmless addition to the wood's faunal list it would make!

The recent interest in using selected wild flower seed-mixes when landscaping the edges of major new roads and creating areas of amenity grassland may well, with some help, lead to the reappearance in time of flowery verges alive with butterflies. On a smaller scale, for those of you with larger, less formal gardens, there is quite a lot of scope for establishing breeding colonies of some commoner species. Even those of you with only a small plot can attract some of the more spectacular species such as small tortoiseshells and red admirals by planting nectar-bearing plants such as *Buddleja davidii* and *Sedum spectabile*.

Because of the dominance of intensive agriculture, Cambridgeshire is never likely to be a paradise for the butterfly-watcher, but at least there is now enough interest to ensure that it should not be further denuded of its already limited butterfly fauna.

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Footnote

Enquiries about the activities and membership of the Cambridgeshire and Essex Branch of the British Butterfly Conservation Society should be addressed to P. Smout, 10 Hawkins Close, Perry, Huntingdon, Cambs, PE18 ODQ (Tel. Huntingdon 810928). Anyone requiring further details about the Cambridgeshire Butterfly Survey should contact me at The Warden's House, Lode Lane, Wicken, Ely, Cambs, CB7 5XP (Tel. Ely 720274).

A census of the small mammals in Fulbourn Educational Nature Reserve

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Introduction

The study was undertaken to investigate, by means of live trapping, the species of small mammals, their distribution and population density in four habitats in the Educational Nature Reserve at Fulbourn. Comparisons of these findings could then be made with those from other similar areas. The four areas within which the study was undertaken were dry meadowland (Moat Meadow), wet meadowland (East Fen Pasture), wet woodland (west end of Widow's Wood) and dry woodland (north end of Ansett's Wood).

Although the reserve has been under Cambridgeshire Wildlife Trust (previously CAMBIENT) management since 1967, there has been no previous detailed census or report on its small mammal populations. I hope that the information obtained will contribute to records of small mammal species in 10 km squares of the British Isles (Arnold, 1984) and add to the knowledge of community structure of small mammals in different habitats.

Methods

The census was made with the use of 40 Longworth small mammal traps. Intensive trapping was carried out within each area successively, over a period of five days in each, during the months of August and September 1987. Within each area the traps were set 3 m apart in a grid, 30 m long and 9 m wide; the trapping grid therefore occupied 270 square metres. The traps were set in the way recommended by Gurnell and Flowerdew (1982). When the traps were laid in the meadowland areas or in woods where the immediate ground was vegetated, they were placed in the grass on the ground surface. Frequently the runs of small mammals were observed crossing the point at which the trap was placed or in the immediate vicinity of this point; in these instances the trap was laid in the run, with its entrance facing in the direction of the run. Bedding (meadow hay) and food (minced meat, 'casters' (fly puparia) and porridge oats) were placed in the traps' nesting boxes, and the traps were checked early in the morning and late during the evening.

Traps that were found to be sprung were opened in the confines of a plastic bag, where the captured individual could be identified to species level. The animal was then removed from the bag and its sex identified, after which a small amount of fur, approximately 1 cm x 1 cm, was removed from its rump with the use of a small pair of clippers. This was to allow identification of recaptured individuals. The other, somewhat cruel, process of toe-clipping, as a means of marking individuals, was not necessary since the trapping was only occurring over a period of five days and during that time the clipped fur would not have had time to grow back fully. When an individual was recaptured, it was noted as such, but no further fur was removed. Recognition of particular individuals amongst the recaptured animals was not possible with this method of marking.

In the following text, the phrase "total catch" refers to the number of animals caught within a given area, including those individuals which were marked, indicating at least one previous capture. The word "recapture" refers to catches of such marked animals.

Vegetational profile for each of the areas in the study

Dry meadowland (Moat Meadow)

This area is dry chalk grassland, which has beeen ungrazed for 20 years. Now it is a climax of false oat-grass *Arrhenatherum elatius*, which has inhibited colonisation by scrub. The tall grass has a tangled understorey of lady's bedstraw *Galium verum* and salad burnet *Sanguisorba minor*. The soil, which is dry and light, has a high fertility relative to the grazed meadow nearby, and large colonies of black ants *Lasius niger* occur throughout the area.

Wet meadowland (East Fen Pasture)

This area was formerly fen. It has more than half a metre depth of black peat interspersed with chalk. The pasture is tussocky and tangled, with sedges and large clumps of meadowsweet *Filipendula ulmaria* and dewberry *Rubus caesius*, which are separated by short grass areas with silverweed *Potentilla anserina* and water mint *Mentha aquatica*. This area of the reserve is rich in marsh- and spotted-orchids *Dactylorhiza* species.

Wet woodland (west end of Widow's Wood)

This is a mature wet fen woodland, predominantly of alders and ashes, with a few large oaks. The understorey is very sparse, with thinly distributed elder and stinging nettles *Urtica dioica*; it is always shaded. There is much dewberry, enchanter's-nightshade *Circaea lutetiana* and moss.

Dry woodland (north end of Ansett's Wood)

This is a planted woodland area of less than 150 years' standing, in part of which colonisation of a former meadow has probably taken place. There are a few young oaks, but the predominant trees are sycamore and ash, with an understorey of hazel, elder, some hawthorn and a few spindle. The ground flora is varied including ivy *Hedera helix*, ground-ivy *Glechoma hederacea*, lords-and-ladies *Arum maculatum*, primrose *Primula vulgaris* and herb-Robert *Geranium robertianum*.

Results

Dry meadowland (Moat Meadow)

During the five days that trapping took place and in the nine times that the traps were checked, 56 catches were recorded. On average 15% of the traps were sprung at each census. Four species of small mammal were recorded in this area - common shrew *Sorex araneus*, pygmy shrew *Sorex minutus*, short-tailed vole *Microtus agrestis* and water shrew *Neomys fodiens*. When the recaptures were included, the short-tailed voles accounted for 45% of the total catch. Common shrews contributed 38% of the catch and pygmy shrews 12%, while the water shrews made up only 5% of the catch. 52% of the total catch of short-tailed voles consisted of recaptures. Only 29% of the common shrews were recaptures. None of the pygmy shrews trapped had been caught before. One of the three catches of a water shrew was a recapture. The number of captures of short-tailed voles in traps situated near a patch of stinging nettles was higher than in other areas within the dry meadowland. Short-tailed voles also had a tendency to be captured in certain traps, while never being caught in others. In one trap two immature short-tailed voles were caught together.

Water shrew (left) and pygmy shrew (right) Graham Easy

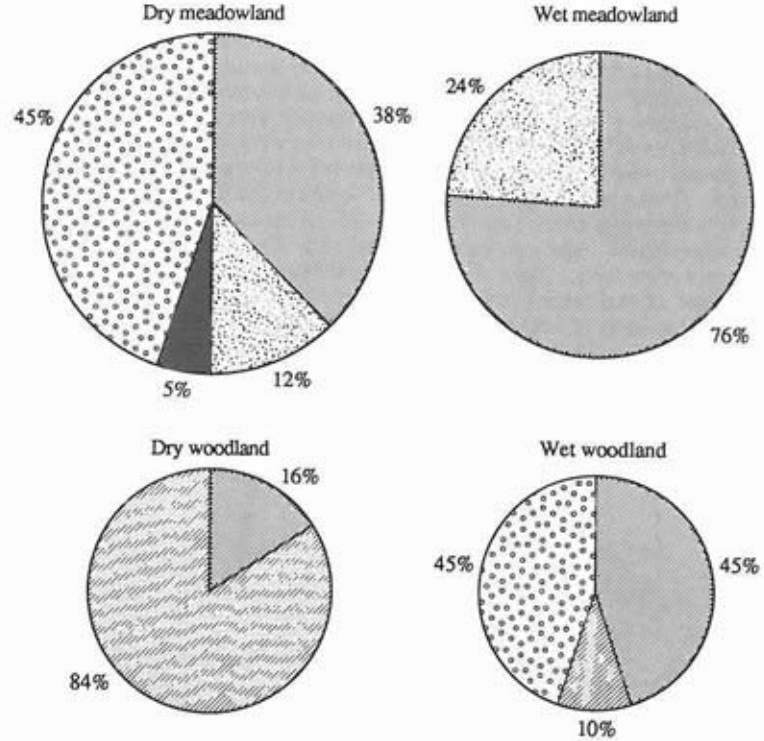

Figure 1 : Relative sizes of total catches in the four areas and percentages of each species

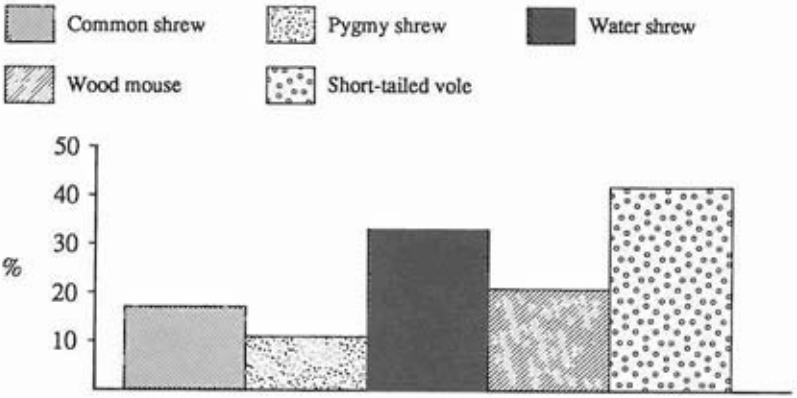

Figure 2 : Mean percentages of recaptures of each species

Wet meadowland (East Fen Pasture)

A total of 44 captures were recorded in this area. The average catch was five individuals at each checking of the traps. The average percentage of traps found sprung at each check was 12%. In this area only two species were recorded - common shrew and pygmy shrew, the common shrews making up 76% of the total catch. 12% of the common shrews captured and 18% of the pygmy shrews were marked.

Wet woodland (west end of Widow's Wood)

A total of 29 captures were recorded in this area; the average percentage of traps found sprung at each check was 8%. In this area three different species were recorded - short-tailed vole, common shrew and wood mouse *Apodemus sylvaticus*. The common shrews and short-tailed voles were codominant in the area, each making up 45% of the total catch. Of the short-tailed voles, 23% were recaptured individuals. Of the common shrews, 14% had been caught before. One of the three wood mice caught had been captured before.

Dry woodland (north end of Ansett's Wood)

A total of 26 captures were recorded in this area; hence on average 7% of the traps were found to have been sprung at each check. Two species were recorded - wood mouse and common shrew. The wood mouse was the more abundant species, accounting for 84% of the total catch. Of the wood mice that I captured, 19% had been captured before, but no common shrews were recaptured.

Discussion

These findings indicate that the dry meadowland provided the highest total catch of small mammals, followed by the wet meadowland, then the wet woodland, with the lowest density in the dry woodland. The data collected at Fulbourn thus suggest that the meadowland, be it dry or wet, supports a higher population density than that of the surrounding woodland. This higher population density could be accounted for by the relatively high fertility of the soil in both the dry meadowland (Moat Meadow), which has dry, light soil, and the wet meadowland (East Fen Pasture), which has half a metre of black peat. A fertile soil would support more vegetation, which would in turn support a higher number of small mammals. The black ants present in Moat Meadow would certainly attract shrews, which are insectivores.

In the dry woodland, one might have expected to encounter the bank vole *Clethrionomys glareolus*, distinguishable from the short-tailed vole by its lighter weight, rich reddish-brown upper surface and longer tail (Corbet and Southern, 1977). The bank vole is a frequent inhabitant of woodland in southern Britain, but its absence from this dry woodland may perhaps be accounted for by the lack of living vegetation on the floor of the wood. This is largely covered by litter, which would greatly reduce or prevent any bank voles inhabiting the wood. The lack of a wide variety of species in the dry woodland may also be due to this fact, as short-tailed voles in particular do inhabit woodland where there is ground vegetation. In the wet woodland there is more ground vegetation cover, and three species were found.

Another absent species which might have been present is the yellow-necked field mouse *Apodemus flavicollis*. This species is restricted to small localised areas (Arnold, 1984). It has been recorded in woodlands in Cambridgeshire, but its distribution is not widespread.

The harvest mouse *Micromys minutus* is a species one might expect to find in the meadowland. However, as harvest mice live in nests above the ground most of the year and since I was trapping during August and September, at that particular time one could not expect to trap this species. From October through to January the species spends more time on the ground and can then be caught in traps (Flowerdew, Hall and Brown, 1977).

The wet meadowland had only half the species of the dry meadowland. The shrews, which commonly inhabit wetter areas, were the only species to thrive there. However, the hypothesis that wetness restricts the number of species is somewhat contradicted by the data from the wet woodland, where three different species were recorded as opposed to only two in the dry woodland.

Short-tailed voles, where present, were the species most often recaught. Two hypotheses can be advanced in explanation. Short-tailed voles may be territorial, having a comparatively small foraging area and remaining within that same area for most of their lives. This would mean that they would come into contact with the traps each time they foraged for food. The other species may either have a larger foraging range or constantly move on to different areas and not exhibit territiorial behaviour, with the result that they move away from the traps and therefore become less likely to be recaptured. Alternatively, the short-tailed voles may be 'trap-happy'; that is to say, because the traps provide food and shelter, they may voluntarily enter them because of the benefits of doing so (Chitty and Kempson, 1949). Shrews and other species may not be so 'trap-happy' and, after entering a trap once, on subsequent encounters may perhaps avoid entering one.

The occasion when two immature short-tailed voles were trapped together strongly suggests that the two voles entered the trap together. As they were both very young, this could suggest that they left the nest and remained together. This phenomenon has been observed before during other studies of short-tailed voles (J. R. Flowerdew, personal communication).

A complicating factor in determining the population distribution of species was the fact that some species exhibited a greater tendency towards being recaptured than others. For instance, in the dry meadowland 45% of the total catch were short-tailed voles and 38% were common shrews. However, as 52% of the total catch of short-tailed voles consisted of recaptures, compared with 29% of the common shrews, it is highly probable that in fact the common shrew population is higher than that of the short-tailed vole. Thus the 12 short-tailed voles caught one or more times made up only 33% of the individual animals trapped, while the 15 common shrews caught one or more times constituted 42%. On the same basis, the seven pygmy shrews accounted for 19% instead of 12%.

The two water shrews captured were both in the dry meadowland. Although water shrews are found predominantly in the vicinity of slow streams, they do occur away from water. This, together with the fact that there was a shallow, water-filled drainage ditch in close proximity to the trapping area, suggests that these captures were not particularly unusual.

Acknowledgements

Profound thanks go to John Flowerdew of the Department of Applied Biology, Cambridge University, for his invaluable help and advice in producing this article and for providing me with the traps in the first instance. Sincere thanks also go to both Michael Reiss and Stephen Tomkins for their vital help and advice. Stuart Wallace kindly drew the figures. I am also grateful to Cambridge Research Biochemicals for their sponsorship of Hills Road Sixth Form College biology projects.

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Fifty years of the Cambridge Bryological Excursions

P.W. Richards and H.L.K. Whitehouse

1938-1949

The Cambridge Bryological Excursions were first organised by P.W.R. and were originally intended for undergraduate and research students in the University Botany School. In 1938, when they began, he had begun to give an annual course of five lectures on bryophytes to students taking botany in Part 2 of the Natural Sciences Tripos and it seemed appropriate to give them an opportunity of learning to recognise the commoner mosses and liverworts in the field and of knowing something of their ecology. Brief typed notes on the distinguishing characters of the chief species were provided. From the beginning, the excursions were well attended and they have been held every year since 1938 without interruption even during the war. In recent years, as mentioned later, many of the participants have been interested people not connected with the university. Very regrettably, attendance by undergraduates has now ceased.

The first excursion was in the afternoon of 5 February 1938, a fine mild day. The party went by coach to Little Widgham Wood south of Newmarket. Those present, in addition to ourselves, included David Valentine (later Professor of Botany at Manchester), John Turner (later Professor at Melbourne University), Tom Tutin (later Professor at Leicester), Kathleen Jones (afterwards Mrs Turner) and other students, as well as Humphrey

Gilbert-Carter and Alex Watt of the Botany School staff. The excursion was bryologically rewarding (see inside back cover) and also enjoyable: H.L.K.W.'s diary even speaks of "frivolity", no doubt provoked by Humphrey's inimitable (and somewhat bizarre) sense of humour.

The second excursion took place a fortnight later. The weather was again fine but with a cold wind. Over fifteen of us cycled to Fleam Dyke. There was a third excursion on 5 March by coach to Icklingham in Suffolk. The party, which numbered twelve, walked over Temple Bridge to Cavenham Heath and the weather was once more fine. Among those present were the Professor of Botany, F.T. Brooks, and Jack Crosby.

These first excursions set the pattern for future years, with outings on Saturday afternoons to Little Widgham Wood, Icklingham or Tuddenham, and Fleam Dyke. The excursion to Little Widgham Wood on 18 February 1939 was very popular; the party of 24 included "Heff" (Dr E.F. Warburg, who had recently taken up a Lectureship at Bedford College, London), Val Chapman (later Professor at Auckland University, New Zealand), Kenneth Sporne, Jack Crosby, David Greenham, Peter Hume, "Tom" Riches and Ernest Hainsworth, as well as Humphrey Gilbert-Carter. For the Fleam Dyke excursion on 11 March the weather turned cold and wet, but ten of us were willing to cycle there. A newcomer in this party was Ben, Humphrey's huge sheep-dog. The Fleam Dyke excursion of the following year (1940) on 2 March was in bright sunshine. We took tea, which Humphrey always favoured, and during it he made one of his characteristic remarks: "I would like to drift to Denmark and sit and eat fish."

The wartime excursion to Widgham Wood on 1 March 1941 was one of the most memorable of the whole fifty years. Owing to snow, it had been postponed from 22 February. There was a party of 26, including "Heff", Humphrey and "Uncle Bill" (Dr W.B. Gourlay, an old friend of Humphrey's), "Rosy" (Dr Mariella Rosenberg) and Catherine Richards (aged three). The coach failed to appear for the return journey. It had also done that the previous year and we had had to walk a mile to catch it. This time we could not telephone because, as we discovered, the lines had been cut during a German air raid on Newmarket. Near Dullingham, after a three-mile walk during which young Catherine was carried on the shoulders of an undergraduate, we eventually met the coach, but it soon broke down and we had to wait for the 8.22 train at Dullingham station, delivering Catherine to her nearly frantic mother after 9 p.m. For Catherine, who had never before been in the country on a starlit night, it was an unforgettable adventure which afterwards had to be endlessly recounted as a bedtime story.

Probably the best-attended excursion of all was that to Widgham Wood in 1946 (23 February), when between thirty and forty people came, including Helen Doyle, C.E. Harrold and John Fincham (now Professor of Genetics at Cambridge). The coach again showed the effects of the war: it did not actually break down, but it vomited sparks on the return journey. That year it had snowed on 2 March and the Fleam Dyke excursion was postponed until a week later. It was still very cold, and the party, which included "Tom" Riches, Alan Burges (later Professor of Botany at Liverpool) and Max Walters, passed two-foot snowdrifts as they cycled from Fulbourn.

In some years, instead of visiting Widgham Wood, the need for a coach

was avoided by going to Kingston Wood (1943) or to Home Wood at Longstowe Hall (1944 and 1948), which were in those days accessible by train. Thus on 7 February 1948 we caught the 2.05 train, arriving at Old North Road station at 2.23, and assembled at the Fox Inn at Longstowe to meet Humphrey and others who had come by an earlier train. The return train left at 5.33.

1950-1988

In 1949 P.W.R. left Cambridge for Bangor and H.L.K.W. took over the running of the excursions. Outings were held to various sites within cycling distance of Cambridge towards the end of the Michaelmas Term and during the early part of the Lent Term, when the weather permitted. Coach excursions to more distant places were held, as in earlier years, in late February and early March. As many as ten excursions in a season were sometimes held, but of course very few in severe winters such as that of 1962/63, when the ground was frozen throughout January and February. In 1965 Jim Dickson helped with organising the excursions; he, Jeff Duckett, John Dransfield, Paul Adam, Brian Huntley, Oliver Rackham and Alan Outen all helped at various times. Co-organisers for many years have been John Birks, who assisted from 1968 to 1982, and Chris Preston, from 1978 to the present day. Bicycles and coaches as means of transport were abandoned about 1969 in favour of the departmental minibus and private cars.

From the 1970s the excursion notices were circulated to members of the British Bryological Society living in the neighbourhood of Cambridge, and gradually the address list has been enlarged to include B.B.S. members from as far away as Diss, King's Lynn, Stamford, Oxford, London and Maidstone, and also anyone with an interest in bryology, for instance in the Nature Conservancy Council at Peterborough, Norwich and Colchester and in the Institute of Terrestrial Ecology at Monks Wood. P.W.R. rejoined the excursions after his retirement to Cambridge. There were 25 of us at Buff Wood, East Hatley, on 29 October 1977, the first excursion to which he came.

After some forty years of good attendances by students, the number showing an interest in bryophytes declined to zero by the mid-1980s. This is presumably in part a reflection of the changes that have occurred in the content of biology courses. As a result the character of the excursions has changed. We now devote our time to recording rather than teaching. Also, since 1986, we have met on Saturday mornings at the site to be visited. This gives us longer in the field and has extended our radius. Previously, we could visit places within about 50 km of Cambridge, but now we can range to 70 km or more, visiting for example Ketton Quarry, Rutland, and Totternhoe Knolls, Bedfordshire. Among those who joined the excursions regularly as students were Peter Chamberlain, Donald Pigott, Michael Proctor, Geoffrey Halliday, Peter Grubb, Malcolm McFarlane, H.A.P. Ingram, Kay Luck, Catherine Richards (who as a child had taken part in the famous Widgham Wood excursion in 1941), Nan Anderson, Philip Lloyd, Sheila Megaw, Oliver Rackham, Jim Dickson, Stephen Waters, Mike Lock, Frances Bell, Jeff Duckett, Mark Hill, Michael Keith-Lucas, Hilary Lees, John Birks, John Dransfield, Andrew Malloch, Jacqui Paice, Leslie Rymer, Rachel Wood, Paul

Adam, Julia Robinson, Honor Gautby, Brian Huntley, Colin Prentice, Michael Fenner, Allan Hall, Alan Leslie, Chris Preston, Iain Robertson, Jon Watson, Alastair MacDougall, Caroline Pannell, Bill Peace, James Salmon, Keith Bennett, Laurence Clemons, Paul Kerslake, Andrew Lack, Quentin Cronk, Mary Edwards, Henry Lamb, Jonathan Sleath, Adrian Newton and Ian Turner. Anyone knowing those on this list might conclude, with some justification, that the excursions were something of a matchmaking establishment!

B.B.S. members and others who have joined the excursions at various times have included Ken Adams, George Bloom, Philip Bourne, Agneta Burton (Mariella Rosenberg's daughter), David Coombe, Paul Driver, Bill Fiddian, Bob Finch, Jack Gardiner, Mark Hill, Nick Hodgetts, Philip Jackson, Nick Jardine, Richard Libbey, Monica Milnes-Smith, Angela Newton, Alan Outen, Richard Pankhurst, Ron Porley, George Scott, Alex Smith, Phil Stanley, Robin Stevenson, Cliff Townsend and Sarah Webster.

Results

In the course of the fifty years some 300 excursions have been held, the majority being in 'old' Cambridgeshire (vice-county 29), but about 32 in Suffolk, 19 in Huntingdonshire, 17 in Bedfordshire, 10 in Essex, four each in Hertfordshire and Northamptonshire and one each in Norfolk and Rutland. Over a hundred sites have been visited, of which nearly 70 were in 'old' Cambridgeshire. Those most often visited have been Madingley Wood (16 excursions), Fleam Dyke (15 or more), Cherry Hinton chalk-pit (14), the beechwood on the Gog Magog Hills (13) and the Devil's Ditch (13). Sites visited regularly outside Cambridgeshire (vice-county 29), besides Icklingham and Tuddenham in Suffolk, have included Monks Wood and Woodwalton Fen in Huntingdonshire, Flitwick Moor and Sandy Warren in Bedfordshire, Therfield Heath, Hertfordshire, and Chalkney Wood, Essex.

As already mentioned, the primary objective of the excursions, until recently, was to teach students how to recognise the common bryophytes. For the organisers there was little opportunity to search for uncommon species. Nevertheless, 37 new vice-county records for Cambridgeshire (including first records for a century or more) have been made on the excursions; these are listed in Table 1. Many new records have also been made for neighbouring vice-counties. An outstanding find made on one of the Suffolk excursions was the discovery by Reg Parker on 7 March 1953 of the rare liverwort *Riccia beyrichiana* Hampe ex Lehm. on Roper's Heath, between Tuddenham and Cavenham Heaths. It is not known within 250 km of this site. It has been refound on subsequent bryological excursions to the same locality by David Coombe (7 March 1959) and Alan Leslie (1 March 1975). Another exciting discovery was the subterranean saprophytic liverwort *Cryptothallus mirabilis* Malmb., found at Flitwick Moor by John Dransfield on 11 March 1967.

In addition to new vice-county records, many other interesting finds have been made. Some of those in 'old' Cambridgeshire are listed in Table 2. Sometimes, three or more exciting finds have been made on a single excursion, for example on 5 November 1966 and 23 February 1985, as the tables show.

Some of the sites that we have visited regularly over the fifty years have been much altered during that time. This has sometimes been by direct human interference; for example, an airfield was built on Cavenham Heath during the war and destroyed some of the most interesting areas including a small *Sphagnum* bog. There have also been changes for other reasons. With the decline in the number of rabbits as a result of myxomatosis, scrub growth has overgrown much of the chalk grassland on Fleam Dyke, on the Devil's Ditch and along the Roman Road on the Gogs. This has led to much increased rarity of many chalk grassland species. Some compensation has been the discovery on elders in the Devil's Ditch of several rare epiphytes that need both light and shelter (see Tables 1 and 2).

There has been a marked decline in the abundance of *Seligeria calcarea* (Hedw.) B., S. & G. and *Pterygoneurum ovatum* (Hedw.) Dix., once frequently found on excursions to Cherry Hinton chalk-pit and other calcareous sites. The much rarer *P. lamellatum* has also declined. The earliest records of *P. ovatum* in the county, dating from more than 150 years ago, are from mud walls, for example in Parker's Piece Lane, Cambridge. Could these *Pterygoneurum* species require nitrogen-rich calcareous soil and have declined with the metalling of roads and the loss of horse-drawn vehicles?

Some species have increased in frequency, for example *Lepidozia reptans* (see Table 2), which was first found in the county in 1965 (by S.J.P. Waters on stumps in Hayley Wood). The increase may relate to a greater prevalence of decaying wood. Two mosses probably introduced to Britain from the Southern Hemisphere have spread rapidly in Britain: *Orthodontium lineare* Schwaegr. was first recorded in Cambridgeshire in 1947 (by P.W.R. on a pine stump in South Lodge Plantation, Croxton) and now occurs on tree bases, stumps and logs in nearly all the woods, and *Campylopus introflexus*, first found in 1965 (by J.M. Lock on an old *Molinia* tussock in carr in Verrall's Fen, Wicken Fen), is likewise spreading in non-calcareous habitats (see Table 2).

All who have come regularly on the excursions have been enthusiastic about them. It is hoped that the outings may long continue.

We thank Mrs G. Crompton and Mr C.D. Preston for their helpful criticisms of the manuscript of this paper.

Postcript

On 6 February 1988 an excursion was held in bright sunshine to Little and Great Widgham Woods by permission of the owner, Mr W.J. Gredley, to commemorate the first excursion fifty years ago, which had been to this locality. Unlike that occasion, transport was by cars rather than by coach. A dozen people came, including Peter Wanstall (President of the British Bryological Society), David Coombe, Oliver Rackham, Mark Hill, Chris Preston and both authors. Greetings for this special occasion had been received from Jean Paton, Alex Smith and Agneta Burton.

Both woods had been planted with conifers, Little Widgham Wood in 1957-60 and Great Widgham Wood in 1954-58, but nevertheless most of the bryophytes recorded on the first excursion were refound. Interestingly, the mosses *Orthodontium lineare* and *Campylopus introflexus*, which are believed to be introductions to Britain (see above), were found on stumps as soon as

we entered Little Widgham Wood. They had not reached this part of England fifty years ago (first Cambridgeshire records being in 1947 and 1965 respectively). The outstanding find was *Ulota crispa* var. *norvegica*, discovered by Mike Lock about 1 m from the ground on a coppiced ash trunk in Great Widgham Wood (52/665552). This was only the second record (see Table 1) in the vice-county this century of this pollution-sensitive species. During lunch Robin Stevenson produced a large iced cake made by his wife. It was suitably inscribed for the occasion and bore a fruiting *Bryum*(?) in icing in one corner. P.W.R. was photographed in the act of cutting it (see inside front cover). Robin also distributed champagne and Peter proposed toasts to us on achieving a half century of excursions.

Table 1: New vice-county records for 'old' Cambridgeshire made on the excursions, with some renewed finds, after an interval of a century or more, also included

Polytrichum formosum Hedw. Little Widgham Wood, P.W.R., 5.2.1938: first record since Henslow found it at Gamlingay in 1829.

Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dum. On damp soil in ride, Little Widgham Wood, P.W.R., 18.2.1939.

Weissia sterilis Nicholson In chalk grassland, Fleam Dyke, H.L.K.W., 2.3.1940.

Leucobryum glaucum (Hedw.) Ångstr. In old coppiced stump, Little Widgham Wood, H.L.K.W., 1.3.1941.

Eurhynchium pumilum (Wils.) Schimp. On shady clay bank on edge of Kingston Wood, D.G. Catcheside, T.G. Tutin & P.W.R., 20.2.1943.

Eurhynchium swartzii (Turn.) Curn. var. *rigidum* (Boul.) Thér. In chalk grassland, Fleam Dyke, P.W.R., 23.2.1946.

Pleuridium subulatum (Hedw.) Lindb. Abundant on bare clay in Little Widgham Wood, P.W.R., 9.3.1946.

Fissidens pusillus (Wils.) Milde var. *tenuifolius* (Boul.) A.J.E. Smith On bricks in old railway cutting at Babraham, D.E. Coombe & M.C.F. Proctor, 10.2.1951.

Rhynchostegiella tenella (Dicks.) Limpr. With last: first record since Henslow, 1829.

Cirriphyllum crassinervium (Tayl.) Loeske & Fleisch. On tree stump by Fishpond, Madingley Park, 52/395605, H.L.K.W., 24.2.1951.

Thuidium philibertii Limpr. In old lawn on chalk, Hildersham Hall, 52/542483, C.D. Pigott & M.C.F. Proctor, 3.3.1951; refound by C.D. Preston *et al.*, 9.2.1980.

Cephaloziella hampeana (Nees) Schiffn. In turf on sandy soil, Hildersham Furze Hills, M.C.F. Proctor, 1.3.1952.

Hypnum jutlandicum Holmen & Warncke On Hildersham Furze Hills, H.L.K.W., 1.3.1952.

Scleropodium tourettii (Brid.) L. Koch Under beech, Hildersham Hall, a student & M.C.F. Proctor, 7.2.1953.

Bryum klinggraeffii Schimp. In arable field, Trumpington, 52/439557, H.L.K.W., 1.12.1956.

Barbula acuta (Brid.) Brid. In Cherry Hinton chalk-pit, 52/485559, K. Stroude & H.L.K.W., 9.2.1957.

Weissia controversa Hedw. With *Fissidens cristatus* Wils. ex Mitt., north-east of coprolite pit, Stow cum Quy Fen, D.E. Coombe, 16.2.1957: first record since Henslow found it at Gamlingay in 1830.

Brachythecium salebrosum (Web. & Mohr) B., S. & G. On fallen oak trunk, grounds of Hildersham Hall, G. Halliday, 1.3.1958.

Brachythecium populeum (Hedw.) B., S. & G. In chalk grassland, Devil's Ditch, 52/619615, J. Harding, 5.3.1960.

Racomitrium heterostichum (Hedw.) Brid. Damp clinker on side of sewage bed, Madingley Park, 52/391605, S.J.P. Waters, 11.2.1961.

Racomitrium lanuginosum (Hedw.) Brid. With last.

Racromitrium ericoides (Brid.) Brid. With last two: determined by M.O. Hill: see *Rep. Br. Bryol. Soc.*, 43 (1984): 24.

Cephalozia connivens (Dicks.) Lindb. On stump, Hayley Wood, M.O. Hill, 19.2.1966.

Aloina brevirostris (Hook. & Grev.) Kindb. In Cherry Hinton chalk-pit, 52/485559, H.J.B. Birks & J.G. Duckett, 5.11.1966.

Leiocolea badensis (Gott.) Jorg. Wet chalk in Cherry Hinton chalk-pit, 52/485559, H.J.B. Birks, 5.11.1966.

Lophozia perssonii Buch & S. Arn. With last.

Lophozia excisa (Dicks.) Dum. On clinker of railway, Hayley Wood, J.G. Duckett & H.L.K.W., 10.2.1968.

Calypogeia muellerana (Schiffn.) K. Mull. On base of royal fern *Osmunda regalis* tussocks, 'water garden', Cambridge Botanic Garden, 52/453571, H.J.B. Birks, 3.2.1973.

Isopterygium elegans (Brid.) Lindb. On sandy bank, White Wood, Gamlingay, H.L.K.W., 10.11.1973.

Sphagnum recurvum P. Beauv. var. *mucronatum* (Russ.) Warnst. At Wicken Fen, H.J.B. Birks, 8.2.1975.

Hylocomium brevirostre (Brid.) B., S. & G. Under birch trees, Wicken Fen, 52/551702, P. Adam, 8.2.1975. Later, it was found to have been collected in the same area by A.C. Leslie in 1974.

Campylopus fragilis (Brid.) B., S. & G. On rotting log, Chippenham Fen, 52/648695, P. Adam, 5.2.1977.

Pseudephemerum nitidum (Hedw.) Reim. Wet slope in rough meadow, Mill Hill, south of Gamlingay, 52/233513, P. Adam *et al.*, 20.10.1977.

Nardia scalaris S. Gray With last, S.D. Atkins *et al.*

Hygrohypnum luridum (Hedw.) Jenn. On gravel path in woodland, Longstowe Hall, 52/309556, G. Bloom, 28.10.1978.

Ulota crispa (Hedw.) Brid. var. *norvegica* (Groenvall) Smith & Hill On *Salix* stems near ground level in fen carr near brick-pits, Wicken Fen, 52/560707, C.D. Preston, 18.2.1984.

Ulota phyllantha Brid. On bark of old elder in Devil's Ditch 52/613619, P.W.R., 8.3.1986.

Table 2: Interesting finds made on the excursions in 'old' Cambridgeshire, additional to the new vice-county records

Fissidens exilis Hedw. On bare clayey soil, Little Widgham Wood, P.W.R., 9.3.1940: third record for the vice-county.

Lejeunea cavifolia (Ehrh.) Lindb. On stumps, Little Widgham Wood, P.W.R., 23.2.1946: third record for the vice-county.

Aloina aloides (Schultz) Kindb. var. *aloides* On chalk on floor of eastern chalk-pit, Cherry Hinton, 52/485559, H.L.K.W., 25.11.1950: first record for the vice-county since

Rhodes, 1911.

Entodon concinnus (De Not.) Paris In lawn, Hildersham Hall, 52/542483, C.D. Pigott & M.C.F. Proctor, 3.3.1951. In lawn, Wandlebury, 52/494534, D. Kingston, 2.2.1957: not far from where the plant was discovered along the Roman road by P.W.R. in 1932.

Cinclidotus mucronatus (Brid.) Mach. At base of tree by ditch, Hildersham Hall, M.C.F. Proctor, 7.2.1953: second record for the vice-county, the first being by P.W.R. in 1941 on trees by the River Kennett near Red Lodge.

Cryphaea heteromalla (Hedw.) Mohr On branch of elder, Hildersham Hall, R.E. Parker, 7.2.1953: second record for the vice-county this century, the first being near Babraham by P.W.R. in 1942. On old elder, Chippenham Fen, 52/651692, H.L.K.W., 25.2.1961. On elder in scrub, Devil's Ditch, 52/626606, C.R. Stevenson, 5.2.1983: first record for 22 years of this pollution-sensitive species.

Climacium dendroides (Hedw.) Web. & Mohr At eastern end of Madingley Wood, 52/402596, Mrs J.G. Hughes, 10.3.1956: first record from Madingley Wood since Relhan, 1820, but not seen since 19.1.1957. In carr, Verrall's Fen, Wicken Fen, 52/552702, L. Clemons, 24.2.1979: 49 years after it was last found (by P.W.R.) at Wicken Fen.

Herzogiella seligeri (Brid.) Iwats. On rotten wood, Chippenham Fen, 52/648695, H.L.K.W., 25.2.1961: second record for the vice-county, the first being by P.W.R. in 1946 in a plantation near Madingley.

Scorpiurium circinatum (Brid.) Fleisch. & Loeske On rockery stones introduced from Killarney to the grounds of Hildersham Hall, 52/542483, J.M. Lock, 4.3.1961.

Ephemerum recurvifolium (Dicks.) Boul. In arable field, Madingley Hall, 52/408596, O. Rackham, 27.1.1962.

Brachythecium populeum (Hedw.) B., S. & G. In lawn, Wandlebury, 52/494534, M.O. Hill, 30.1.1965: second record for the vice-county.

Cephaloziella hampeana (Nees) Schiffn. On decaying wood, Gamlingay Wood, H.J.B. Birks, 6.11.1965. On clinker of railway near Hayley Wood, J.G. Duckett, 19.2.1966: second and third records for the vice-county.

Tortula papillosa Wils. On elder in lower chalk-pit, Cherry Hinton, 52/483557, H.J.B. Birks, 5.11.1966. Refound after 23 years on elders in Underwood Hall chalk-pit, Westley Waterless, 52/613569, C.D. Preston, 5.2.1983.

Lophozia perssonii Buch & S. Arn. On crumbling chalk soil in old railway cutting, Fleam Dyke, 52/544546, J. Dransfield, 11.2.1967: second locality in the vice-county.

Barbula acuta (Brid.) Brid. At Stow cum Quy Fen, J.G. Duckett, 17.2.1968.

Pterygoneurum lamellatum (Lindb.) Jur. In Cherry Hinton chalk-pit, H.J.B. Birks, 28.11.1970.

Lepidozia raptans (L.) Dum. On decaying wood, Papworth Wood, D.E. Coombe, 31.10.1971. On rotten wood, Fulbourn Nature Reserve, D.E. Coombe, 5.2.1972. On decayed log, Jerusalem Wood, Chippenham Fen, 52/650690, G.A.M. Scott, 14.2.1976: second, third and fourth records for the vice-county.

Tortula latifolia Bruch ex Hartm. On asphalt path near bird sanctuary, Adams Road, Cambridge, 52/437585, H.L.K.W., 27.1.1973. This species usually occurs in the flood zone of rivers, but has been found on asphalt away from water in several places in England and Wales.

Orthotrichum lyellii Hook. & Tayl. On beech, Wandlebury, 52/495530, H.J.B. Birks, 10.2.1973: first record since Rhodes, 1911.

Tortula vahliana (Schultz) Mont. On chalk slope under bushes, Harlton clunch-pit, 52/390520, H.J.B. Birks, 17.2.1973. On chalk bank of earthwork, Wandlebury,

52/492534, H.J.B. Birks, 8.11.1975. On chalk bank in old chalk-pit, Bassingbourn, 52/329428, P.W.R., H.L.K.W. *et al.*, 2.2.1985.

Trichostomum brachydontium Bruch In chalk grassland, Fleam Dyke, H.J.B. Birks, 3.11.1973: second locality in the vice-county.

Leiocolea badensis (Gott.) Jorg. On damp chalk soil, Fleam Dyke, 52/543545, J.C. Gardiner, 3.11.1973. Near chalk spring, Nine Wells, Great Shelford, 52/461541, C.M. Pannell, 5.11.1977: second and third records for the vice-county.

Campylopus brevipilus B., S. & G. In carr south of Cross Dyke, Wicken Fen, 52/551702, H.J.B. Birks *et al.*, 8.2.1975: second record for the vice-county.

Campylopus introflexus (Hedw.) Brid. On clinker of railway, Hayley Wood, B. Huntley, 15.2.1975. On log in woodland, Hildersham Hall, J.D. Sleath, 9.2.1980. On decayed stump in woodland, Sawston Hall, 52/492488, N. Hodgetts, 27.10.1984.

Nowellia curvifolia (Dicks.) Mitt. On decaying log, Forty Acre Wood, Chippenham Fen, 52/653694, B. Huntley & H.L.K.W., 22.2.1975: second locality in the vice-county.

Metzgeria fruticulosa (Dicks.) Evans On elder in scrub in Devil's Ditch, 52/58-64-, P. Adam, 27.2.1977: second record for the vice-county.

Brachythecium salebrosum (Web. & Mohr) B., S. & G. In carr, Verrall's Fen, Wicken Fen, 52/552702, J.C. Gardiner, 24.2.1979. On much-decayed fallen tree trunk, Forty Acre Wood, Chippenham Fen, 52/652696, M.O. Hill, 6.12.1986: third and fourth records for the vice-county.

Riccia rhenana Lorbeer Refound at Madingley brick-pits after an interval of 18 years, 52/404615, P.W.R., 10.11.1979.

Tortella inflexa (Bruch) Broth. On chalk stones on the Fleam Dyke, C.D. Preston, 2.2.1980: second locality in the vice-county.

Ptilidium pulcherrimum (G. Web.) Vainio On bark of ash, Knapwell Wood, 52/330606, C.D. Preston, 16.2.1980: fourth record for the vice-county and the first for 14 years.

Pleurozium schreberi (Brid.) Mitt. On decaying blackthorn log, Elsworth Wood, 52/312617, J.A. Hawkings, 6.2.1982: second record for a boulder clay wood in the vice-county.

Pottia caespitosa (Bruch ex Brid.) C. Müll. In chalk grassland, Fleam Dyke, 52/544545, R.A. Finch, 11.2.1984: second record for the vice-county.

Grimmia trichophylla Grev. On horizontal concrete surface near ground level on north side of Sawston Hall, 52/488491, I.M. Turner, 27.10.1984: first record in the vice-county for 24 years.

Trichostomopsis umbrosa (C. Müll.) Robins. On steep bank beside chalk spring, Nine Wells, Great Shelford, 52/462542, H.L.K.W., 3.11.1984. With *Tortula vahliana* on chalk bank in old chalk-pit, Bassingbourn, 52/329428, P.W.R. & H.L.K.W., 2.2.1985: first records of *Trichostomopsis umbrosa* in semi-natural habitats in the vice-county.

Orthotrichum cupulatum Brid. On horizontal tombstone, Croxton churchyard, 52/252592, A.E. Newton, 23.2.1985: second localised record for the vice-county and the first for 30 years.

Leucodon sciuroides (Hedw.) Schwaegr. Refound in Croxton churchyard after an interval of 51 years, 52/252592, C.D. Preston, 23.2.1985: first find of this pollution-sensitive species in the vice-county for 32 years.

Platygyrium repens (Brid.) B., S. & G. With *Metzgeria fruticulosa* on horizontal willow trunk above swampy ground, Croxton Park, 52/255592, C.D. Preston, 23.2.1985: second record for *P. repens* in the vice-county.

Aloina brevirostris (Hook. & Grev.) Kindb. Refound in Cherry Hinton chalk-pit, R.A. Finch, 16.3.1985: this is its only Cambridgeshire locality.

Utricularia vulgaris, an aquatic carnivore at Wicken Fen

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The four British species of bladderwort *Utricularia* represent an interesting variation on the theme of carnivorous plants. Like the more familiar sundews and butterworts, *Utricularia* species are generally found in nutrient-poor habitats and supplement their nutrient income by trapping small animals. However, our native bladderworts are entirely aquatic, floating just below the surface in ponds, lakes and ditches. Greater bladderwort *Utricularia vulgaris* is more catholic in habitat than the other British species, often occurring in base-rich waters, such as the brick-pits at Wicken Fen. Once widespread in lowland Britain, *U. vulgaris* is now declining (Perring and Walters, 1976).

Utricularia vulgaris is rootless and free-floating, dying back at the hind end while growing at the tip and fragmenting as the zone of senescence reaches the bases of side shoots. It traps its prey in tiny purse-like structures borne in large numbers on the stems and on the highly dissected leaves (Figure 1). These traps were originally thought to be buoyancy aids since, in plants removed from the water, they were observed to contain a large air bubble. They were consequently called "bladders", a term which is still used and has given the plant its common name. Bladders vary in size from about 1 mm to about 5 mm long depending on their position on the leaf.

Each bladder has a semi-circular trap door which bears four trigger bristles on its outer face and is surrounded by filamentous structures ("antennae") which are known to guide some types of crustacean prey in towards the trap (Meyers and Strickler, 1979). With the trap door tightly shut, the cells of the bladder wall pump out up to 40% of the water inside, causing the sides of the trap to bow inwards. The inside of the bladder is thus held at a hydrostatic pressure considerably lower than that of the water outside. The trap door sits on a flexible shelf which forms a perfect seal. If, however, an animal disturbs a trigger bristle and the seal is broken, the trap door flies inwards and water rushes in to equalise the pressure, sucking the prey in with it. The trapping process to too rapid for the human eye to discern: the door opens and shuts in only 10-15 milliseconds and this is one of the fastest plant movements known (Sydenham and Findlay, 1973). The resetting process begins almost immediately and the trap is ready to fire again in about 20 minutes.

Although the carnivorous habits of *Utricularia* species have fascinated biologists for more than a century, surprisingly little is known about the details of prey capture. Charles Darwin and his son Francis carried out numerous experiments on the very similar species *U. neglecta*, but failed to elucidate the trapping process (Darwin, 1875). Many fundamental questions remain unresolved. How dependent on animal food are plants in nutrient-rich waters? Do mucilaginous secretions lure prey to the traps? How does the prey die? Does the trap secrete digestive enzymes (as is the case in other genera of carnivorous plants) or is the breakdown of prey principally microbial? How cost-effective is its trapping strategy? What is the plant's

impact on prey populations?

The possible impact on populations of aquatic invertebrates is of considerable interest, since it has been proposed that *Utricularia* species might be used in the biological control of mosquitoes in the subtropics. Shoots of *U. vulgaris* have been shown to be effective at catching early instar mosquito larvae in dense cultures, but there is no information about its efficacy under natural conditions. Indeed this is true for other categories of prey such as cladocerans and copepods. The question arises: how many prey items can a single plant account for at natural prey densities? Hegner (1926) attempted to estimate the number of crustacean prey present in the traps of a single plant with four side shoots. By multiplying the estimated number of traps present by a conservative figure for the number of prey per trap (10), he arrived at a

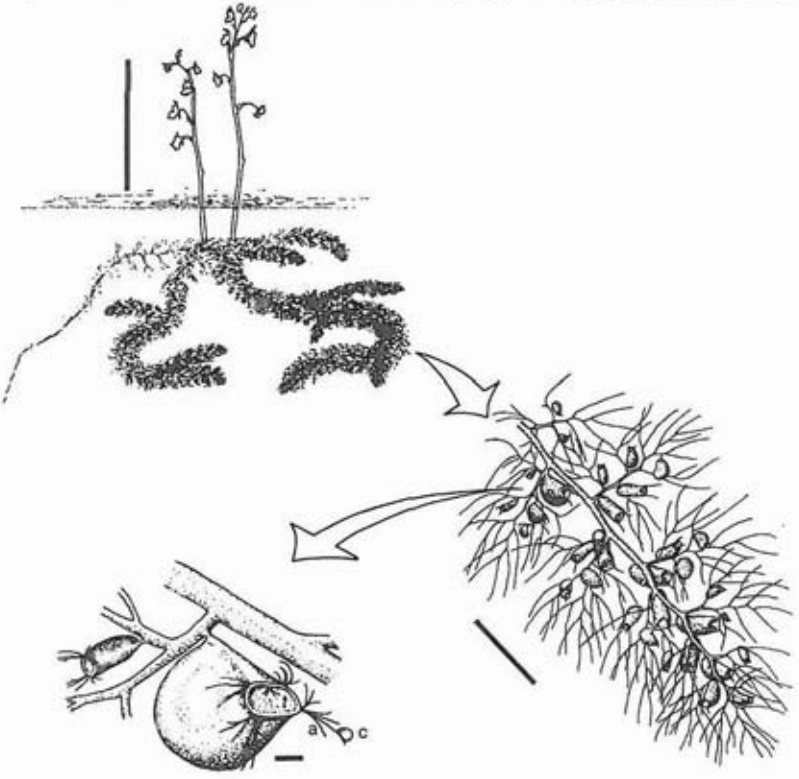

Figure 1: *Utricularia vulgaris*
Top: a plant as it appears in late July, bearing yellow flowers above the water surface
Middle: a large leaf bearing large and small traps (seven days old)
Bottom: a large bladder showing trigger hairs (t) and antennae (a) with a typical prey animal, the cladoceran *Chydorus sphaericus* (c)
Scale bars represent 10 cm, 1 cm and 1 mm respectively.

number of about 150,000 animals in the traps. He noted, however, that since the plant continues to make new traps throughout the summer, the total number of animals captured in a season "must be enormous".

This paper describes a field experiment carried out on a population of *Utricularia vulgaris* in brick-pit 76b at Wicken Fen. The experiment was designed to assess the trapping rate and to relate the number and type of prey captured to availability of prey. Much of the laboratory work required to complete the study remains to be done, but some of the preliminary results are relevant to the question: how many prey items might a single plant take during its growing season?

The experiment

Twenty plants of *U. vulgaris* were placed in floating plastic mesh boxes in early April 1987 and left in their natural position at the edge of the reed fringe in the brick-pit. Each plant was marked with a plastic ring on the internode immediately in front of the youngest leaf with fully-formed traps at fortnightly intervals from April to September. At each visit, the number of new leaves and the number of bladders per leaf were noted, some leaves were taken and preserved for analysis of prey, and the number and lengths of side shoots were noted.

The prey available at each period was sampled by taking plankton samples from the water surrounding the plants and by washing animals from the surface of neighbouring plants. Since it was not intended to study the impact of the plants on prey populations, the productivity and turnover of prey were not assessed. Water temperatures were monitored hourly and water samples were taken at irregular intervals throughout the summer and analysed for phosphate and nitrate.

Figure 2 shows the variations in water temperature, the mean number of leaves produced on the main axis of a plant in each fortnight (including only the two large leaves at each node and excluding the one or two much smaller leaves which accompany them) and the mean number of bladders on new large leaves. The high rate of production of new leaves by each plant each fortnight (about 40) is most striking, especially since a plant will normally bear less than 200 leaves on its main axis at any time. The die-back rate is therefore also very high. There is also seasonal variation in the number of bladders per leaf, with considerable differences between individual plants.

If the mean number of new leaves and the mean number of bladders per leaf are multiplied together for each period and a grand total taken, a figure of about 13,500 bladders produced on the main axis during the season is obtained. To this should be added at least 1,500 to account for the bladders on the small leaves and stem at each node, that is a total of 15,000 bladders.

Less information is currently available about the number of prey items per trap. A trap accumulates prey remains over its trapping life of about 17 days, so analysis of its contents at this age will reveal its entire catch. All the bladders from four 17-day leaves sampled in early May were analysed; each had caught between one and 18 small crustaceans, midge larvae and oligochaete worms, with a mean of 5.1 animals. Analysis of four mid-August leaves gave a range of zero to 16, with a mean of 6.8 animals. Taking six prey per trap as a tentative estimate of the mean for the summer gives an estimate of

the total number of animals caught on the main axis over the entire season of 90,000 per plant.

How many animals do the side shoots account for? Here calculations are more conjectural because side shoots were not specifically studied in this experiment. On average, each plant produced one side shoot each fortnight and these produced leaves at a rate only very slightly below that of the main axes. However, leaves of side branches were generally smaller and bore approximately 50% fewer bladders than main axis leaves of the same age. There is no reason to suppose that these bladders were any less effective at catching prey than those on the main axis. Assuming six prey per trap and working out the number of traps produced pro rata for each of ten side shoots gives an estimate of 140,000 animals accounted for by the side shoots of a single plant.

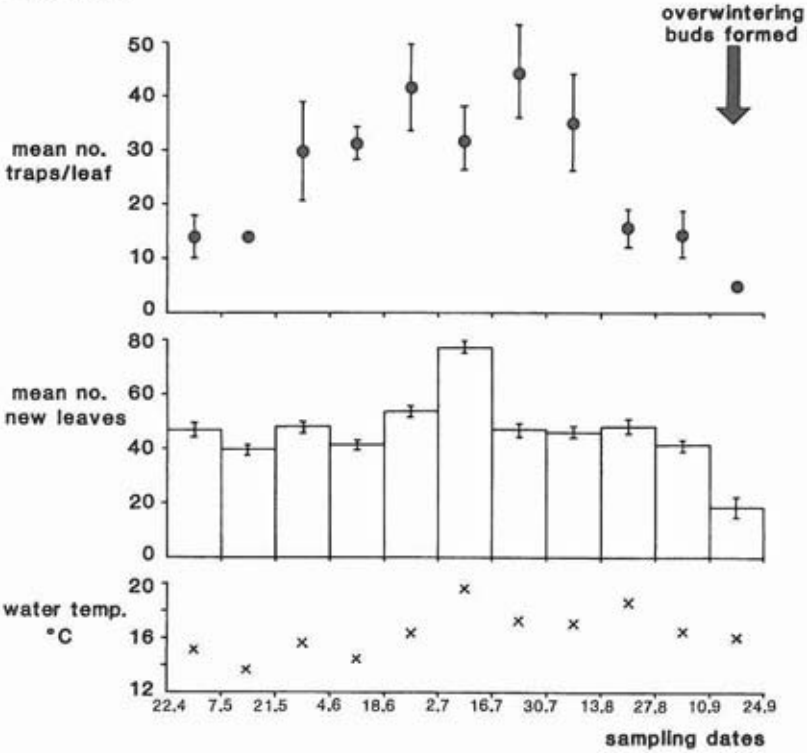

Figure 2: Seasonal variations in trap production at Wicken Fen
Top: mean number of traps per leaf (one leaf per plant maturing at the mid-point of the fortnight)
Middle: mean number of new large leaves produced each fortnight
Bottom: water temperature (mean of the hourly readings over the fortnight)
The variation between plants is expressed as two standard errors either side of the mean.

Thus it may be concluded that around 230,000 animals would have been caught by each of the plants in the brick-pit during the summer of 1987. This figure is only 50% greater than Hegner's estimate for a plant (based on no more than eight weeks' growth), in spite of the fast turnover of traps observed during this 22-week study. Why is this total not very much higher than Hegner's? First, the density of bladders reported by Hegner corresponds to that on the Wicken plants at the height of bladder production; the low number of traps early and late in the season reduces drastically the potential total catch. Secondly, Hegner dissected ten "mature" bladders, which would undoubtedly have been of the large type found along the leaf axis; this study includes the catch from the tiny peripheral bladders, since these constitute the majority of traps present. Thirdly, the total number of prey for a Wicken plant may need to be adjusted (probably upward) when details of seasonal changes in prey abundance become available. Finally, it appears that the availability of prey in the brick-pit at Wicken is much lower than in many other *Utricularia vulgaris* habitats; the zooplankton is sparse throughout the year and the majority of the catch consists of minute crustaceans which live on the plant surface. The maximum number of prey which can be trapped and accommodated in each bladder is apparently only very rarely attained in this brick-pit. By comparison, in a small, plankton-rich pond in Cambridge, many bladders less than 3 mm long were each found to contain more than 40 prey items.

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The B.S.B.I. Monitoring Scheme in TL 45

Graham Easy

Since the B.S.B.I.'s instruction pamphlet had suggested its plant survey work ought to be fun to do, I embarked on the society's 1987-1988 Monitoring Scheme in a somewhat light-hearted manner. Luckily, I was asked to cover that 10 km square (TL 45) which includes the Gogs, much of Cambridge city and the Cherry Hinton chalk-pits and cement workings, an area I had investigated fairly thoroughly over the last decade.

As an incentive to maintain my enthusiasm throughout the campaign, I checked back to the previous survey in 1950-1954, mainly the work, I supposed, of those stalwarts Sell, Perring and Walters, and decided that their tally of almost 770 plants had to be beaten. Furthermore, I determined that

my personal 'life list' for that square, then a mere 780 or so, had to exceed a thousand by the end of the year. The National Organiser of the scheme, Dr Tim Rich, had enthusiastically rushed out at the stroke of midnight on New Year's Day to make the earliest of records for 'his' square. In less foolhardy fashion I descended on that plant haven where the St Neots and the Royston lines formerly met near Long Road to 'twitch off' my first 200 during the first week of January, just before the onset of cold weather. A surprising number of plants were in flower; for instance there was a new tetrad record of moth mullein *Verbascum blattaria*, and it was pleasing to see the only patch of wild celery *Apium graveolens* I know in the city in good heart.

Almost half the area to be surveyed was of urban spread; thus a decision had to be made on the criteria to be used to record garden escapes, planted trees, etc. After referring to past inclusions in the Cambridgeshire and other Floras, I took a fairly straightforward approach - to list only those garden escapes that were wall-invaders, pavement-colonisers or established on waste ground or rubbish-tips. Botanic Garden escapees had to be invasive weeds or unwanted colonisers of nearby waste ground, while trees and shrubs had to be self-sown saplings or at least growing where it seemed unlikely they had been planted - although exceptions were made for species found in more remote or ancient hedgerows. It was covering Cambridge city that I found to be especially amusing. While there is no reason why one should not search every basement grating, wander around nooks and crannies of old buildings and churches and study wall-tops and factory-site waste ground through binoculars, to do so in the midst of the bustle of city centre activity needs a steady nerve! Over the years I have found it best to do this work when many people are on the streets; early morning surveys can be misinterpreted!

It is surprising just how many species were found in this environment; indeed a great many had previously gone unrecorded. The selection of *Cotoneaster*, *Berberis* and other berry-bearing shrubs on show was often the result of distribution by birds. Blackbirds seemed mainly responsible, for it was where these birds gathered to roost that some of the major concentrations of these shrubs were established. It is just possible that pokeweed *Phytolacca acinosa* on waste ground near the river opposite the Fort St George arrived in similar manner. Shaggy soldier *Galinsoga ciliata* and wall lettuce *Mycelis muralis* have invaded the streets by means of parachute seed dispersal, but why is wall lettuce so common here, yet so rare elsewhere in the county. How did *Aethionema grandiflorum* get on top of Sidney Sussex College's wall facing Sidney Street? Was the selection of garden species on the wall overlooking Silver Street planted there? How has the impressive colony of *Hieracium scotostrictum* remained undetected on the garden walls of Pembroke College? The more streets I examined, the more the interesting aspects of plant distrubution unfolded.

In the countryside, square TL 45 has not been so rewarding. Plants of the chalkland arable seem to have suffered especially from herbicide sprays and changing farming methods; for instance, I found none of the interesting fumitories on the headland sites that I remembered in the past. I often resorted to searching waste ground to find familiar arable weed species! A possible addition to the list of weeds is *Solanum luteum* at Coton, especially as it seemed to be vying successfully with black nightshade *S. nigrum* as a pest. It

is this category of late-germinating invaders, of which the *Galinsoga* is another example, that is unaffected by early spraying programmes and still makes a show in both field and garden late in the year.

Sadly, the majority of the rare plants formerly listed for Dernford Fen have been lost to the plough or the changing state of the remaining fen, now mostly being swamped by maturing hawthorn thickets. Even the marsh-orchids were in poor numbers. At least brookweed *Samolus valerandi* was in vast quantity, and, another mystery of dispersal, one plant of the alien *Oenothera stricta* showed proudly in one of the open grass/sedge areas left.

The typical plants of boulder clay woodland were found at Madingley, even though many were rather sparsely distributed and a few that were expected, such as yellow archangel *Lamiastrum galeobdolon*, were not encountered. More insidious was the vast expansion of small balsam *Impatiens parviflora* completely carpeting some of the rides. This seems especially worrying in the wake of the Indian balsam *Impatiens glandulifera* explosion along most river valleys of South Cambs. There, most of the indigenous waterside plants have become endangered by its merciless onslaught; for example Byron's Pool is now flanked by seven-foot high forests of this coloniser. At least it has not yet invaded the remnant wetland nearer the city. Here, in the shelter of Coe Fen, Sheep's Green, Owlstone and Granchester Meadows, can be found a very similar plant population to that of earlier times - *Catabrosa aquatica*, *Epipactis phyllanthes*, *Triglochin palustris*, *Juncus compressus* and the rare *Polygonum mite* to mention but a few. One conspicuous plant along the waterways is the great water dock *Rumex hydrolapathum*, which has strangely been overlooked previously in square TL 45.

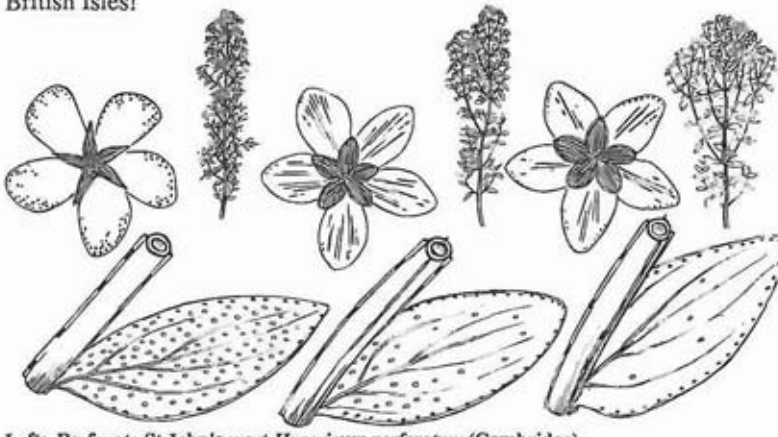
When about halfway through the year and with over 500 species to my credit, I reassessed my progress. A major setback was the lack of alien species on the only rubbish-tip at Coldham's Lane - in marked contrast to the fifty logged at Newmarket Road tip in the 1950s survey. When I checked through the Cambs list, it became clear that a considerable number of the alien species included were only found in the Botanic Garden. Luckily for this count the appalling weather of 1987 meant that the workers there had been overtaken by weed growth and had allowed a large number of invasive species to flourish. Most of the previously recorded plants were still abundant, while many equally well-established aliens had not been reported previously. Thus this new area of search more than compensated for the loss of a flourishing rubbish-tip flora. One area of the gardens flooded, and a range of wetland species appeared, including various sedges, rare grasses, monkey flowers and an impressive colony of grass-poly *Lythrum hyssopifolia*. As the area dried out, a selection of aliens was allowed to flower before spraying and mowing operations were employed against them late in the season.

By the end of July, the 1950s total was equalled, but to increase the tally required delving further into the past work of field botanists. Many of the sites they had listed had obviously gone completely, and others were so changed that they were no longer suitable for the species formerly recorded there. A few remained, however. French crane's-bill *Geranium endressii* is still on the roadside field edge at Wilberforce Road, but it has been augmented by a range of garden species more obviously planted; only red bistort

Polygonum amplexicaule and bear's-breech *Acanthus mollis* seemed to be spreading. Birthwort *Aristolochia clematitis* grows untidily in the hedge behind the office at the University Farm. Most of the derelict land that once provided botanists with large tracts of ruderal situations to explore has now been built upon. Formerly there were large areas of waste ground bordering the railway system which supported a wide range of plant species; only that between Hills Road and Long Road now remains, but this patch was truly magnificent this year, with twiggy mullein *Verbascum virgatum*, perforate St John's-wort *Hypericum perforatum*, dittander *Lepidium latifolium* and large-flowered evening-primrose *Oenothera erythrosepala* providing the backcloth of colour to a wide range of interesting colonists including up to four different *Hieracium* species.

I cannot but mention those well-trodden botanical sites on the chalk; indeed I spent many hours searching among the rarities at Wandlebury, the Cherry Hinton chalk-pits and the Gogs golf course and beech woods. Two other areas provided unexpected gems; the soil heap by the Long Road approach to Addenbrooke's Hospital produced corn parsley *Petroselinum segetum*, now rare away from Fenland river-banks, and the alien bastard cabbage *Rapistrum rugosum*, while the corn silo at Shelford Station sheltered such treasures as the grass *Apera spica-venti*, *Consolida orientale* and *Myagrum perfoliatum*, a plant apparently not seen wild in Britain for 20 years or more. All these had been introduced with imported grain.

Not until mid-September was my personal life tally of a thousand species for the square realised, and not until the end of the season did the year's total pass 900. With the work on tetrads within this 10 km square by Chris Preston, Martin O'Leary, Philip Oswald and Mrs Kathleen Tucker with Miss Leila Brown, a grand total of 918 is claimed, which may uphold past claims that a more varied flora exists in this 10 km square than in any other in the British Isles!



Left: Perforate St John's-wort *Hypericum perforatum* (Cambridge)
Right: Imperforate St John's-wort *H. maculatum* (Ditton Park Wood)
Centre: Plant growing in Newnham College car park, perhaps *H.* x *desetangsii*, which is probably a hybrid between these two species Graham Easy

Recording in Tetrad W of Grid Square TL 45 in 1987

C.D. Preston

Tetrad W, on the south side of the Gog Magog Hills, is in Cambridgeshire terms a highland area.* It lies on the chalk uplands, 30-70 m above sea level. My first view of it in 1987 was on a wintry January day, as I passed through on the main Cambridge--Haverhill road. The large arable fields separated by vestigial hedges and narrow shelter-belts which sloped down from the road towards the valley of the Cam appeared to offer little of interest to the botanist. Fortunately first impressions were misleading: so far I have recorded some 280 species and I am sure there are more to be added in 1988.

I found much of interest in the arable fields which I had dismissed in January. Although the weed flora in the bulk of the crops is exceedingly poor, many rarer species still hang on around field edges. These include *Fumaria densiflora, F. officinalis* subsp. *wirtgenii, Legousia hybrida, Lithospermum arvense, Papaver hybridum, Polygonum rurivagum* and *Valerianella dentata.* Although I found *Papaver hybridum* in several places, I never counted more than four plants in a population. By contrast, there was at least one healthy colony of *Lithospermum arvense*, exceeding 100 plants. Some native plants survive on the narrow grassy sides of tracks running between the fields, including *Bromus erectus, Clinopodium vulgare, Nepeta cataria, Origanum vulgare* and *Orobanche elatior.* Other species in this habitat, including *Onobrychis viciifolia* and *Sanguisorba minor* subsp. *muricata*, are presumably relics of former cultivation.

The best semi-natural vegetation is found in the north-west corner of the tetrad, on the Gog Magog Golf Course. Here the regularly mown grass sward contains many calcicoles. Its most remarkable feature is the large population of *Linum perenne* subsp. *anglicum*, surely the most elegant of the rare plants of Cambridgeshire and impressive when flowering *en masse* in the rough and semi-rough. I was surprised to find a single bush of the hybrid hawthorn *Crataegus* x *media* in a hedge on the course, as one of its parents, *C. laevigata*, appears to be absent from the tetrad.

Although the woods of the Wandlebury estate next to the golf course are of planted origin, they contain some of the species characteristic of woodland on chalk. *Daphne laureola* occurs in quantity, there are a few plants of *Helleborus foetidus*, and *Eranthis hyemalis* is extensively naturalised. Woodland grasses here include *Festuca gigantea* and *Poa nemoralis*. There are also a few fragments of chalk grassland at Wandlebury, where *Cirsium acaule* and *Helianthemum nummularium* grow.

One of the most remarkable features of the tetrad is its dryness. I have found no true ferns and only one rush, *Juncus inflexus*, one sedge, *Carex flacca*, and two willows. One of the willows, *Salix viminalis*, is represented

* The oft-repeated assertion that there is no higher ground to the east of the Gogs until one reaches the Urals turns out on investigation to be totally erroneous. The chalk ridge called (in my atlas) the East Anglian Highlands is higher near the Suffolk border, some 10 km east of the Gogs.

by a single bush which has apparently arrived in the chalk-pit south of the golf course since this was surveyed in the 1970s, presumably as a wind-blown seed. Aquatic plants are apparently totally absent. The only water I have found is a small, heavily shaded and unvegetated artificial pond. Whatever remains to be found in 1988, it is unlikely to include a rich variety of wetland plants.

Vascular plant records

G. Crompton

The B.S.B.I. Monitoring Scheme has been well supported and, despite the bad weather, a substantial number of records have been made; it is hoped that the remaining areas within the tetrads and 10 km squares which have to be recorded will be visited and the records completed in this, the last year of the scheme. Graham Easy and Chris Preston have written accounts of their recording year in this issue, which may prove to be an inspiration to others; however, nobody is expected to reach the total of over 900 species recorded in one 10 km square in one year. This number is a record for Cambridgeshire, and possibly for Britain!

This scheme has also been useful as a start towards updating the records for the proposed Historical Flora of the vice-county. Anyone who would like to help with recording for the new Flora, by 'adopting' a 10 km square, searching for locally rare species (for which lists of pre-1980 localities will be supplied) or specialising in recording common species across the vice-county, will, I hope, get in touch with one of the four authors, Chris Preston, Harold Whitehouse, Philip Oswald or myself, c/o The Herbarium, Botany School, Downing Street, Cambridge.

Myagrum perfoliatum L. Great Shelford, one plant on waste ground by corn silo, 52/465524, G.M.S. Easy in herb. G.M.S.E., 22.7.1987, NCR. This is the first record in Britain since 1963 for this European crucifer, and only the fourth post-1930 record. An interesting note on this plant has been published (with a full-page illustration) in *B.S.B.I. News*, No. 47: 34 (Dec. 1987).

Potentilla tabernaemontani Ascherson Burwell Heath, a large patch *c.* 8 x 10 paces, with *Thalictrum minus* and *Astragalus danicus*, in area of shortly-mown turf on stripes and polygons, 52/617621, D.E. Coombe, 10.5.1987. Though it has long been known on the southern end of the Beacon Course and on the Round Course, this is the first record on "Newmarket Heath" since W.H. Coleman's record in Babington's (1860) Flora.

Oenothera stricta Ledeb. ex Link Dernford Fen, one plant amongst tall sedges and grasses, 52/473505, G.M.S. Easy in herb. G.M.S.E., 27.8.1987, NCR. A native of Chile, in Britain this species is usually found near the sea, and only rarely inland.

Polygonum mite Schrank Coe Fen, on the edge of a cattle-trampled ditch, with *P. hydropiper*, 52/446578, G.M.S. Easy in herb. G.M.S.E., 5.9.1987, conf. P.D. Sell. Although only a few stone's-throws away from the Botany School, it was last recorded here in 1958, and it has long been thought lost!

Primula elatior (L.) Hill x *P. veris* L. = *P.* x *media* Petermann Carlton Lane, 52/633532, J.C. Faulkner, 1967, 2nd CR; J.C. Faulkner, M. Keith-Lucas, N. Marchant, P.D. Sell (No. 68/1E & G) and S. Woodell in CGE, 19.4.1968; still there, 1.5.1987, J.C. Faulkner and G. Crompton. The plants occur, with both parents (Sell No. 68/1A & B), on the verges of an open trackway. This site is our only example of a rare outlying non-woodland locality for oxlips and has apparently never previously been published.

Lysimachia nemorum L. Ditton Park Wood, S.E.-N.W. rides, 52/668569, R. Payne and G. Crompton, 1.6.1987; 52/668571, A.C. Leslie and G. Crompton, 26.6.1987. Leys Wood, West Wickham, three patches on rutted rides, 52/62-49-, B. Jackson and G. Crompton in CGE, 2.6.1987. These are the only clearly native sites in the vice-county; last recorded at Ditton Park Wood (before the Forestry Commission started replanting) by F.H. Perring and L.C. Frost in 1956 and at West Wickham by C.D. Pigott and R.G. West in 1950!

Symphytum tuberosum L. subsp. *tuberosum* Harston, on edge of ditch under trees by wooded lane, good colony, 52/431501, G.M.S. Easy in herb. G.M.S.E., 10.5.1987, NCR. Native in damp woodlands in Scotland; local and probably not native in England and Wales.

Veronica officinalis L. Steeplechase Course, abundant in mown turf, *c.* 52/623612, A.C. Leslie, 27.6.1981. Round Course, in flower by hedge, 52/596122, and Beacon Course, forming a very conspicuous pale lilac band in long stripes, 52/590624, 20.6.1987, and Long Hill, 52/661641, 24.8.1986 and 17.6.1987, D.E. Coombe. A very local species in Cambs, it has not been recorded on "Newmarket Heath" since Babington's (1860) Flora.

Adoxa moschatellina L. Carlton Lane, on bank of ditch by copse with ash, hawthorn and hazel, for *c.* 10 yards, 52/633532, J.C. Faulkner and G. Crompton, 1.5.1987. Known here since 1957, it has spread since last seen by J.C.F. in 1972. Likewise, it has spread along *c.* 35 yards at White Wood, Gamlingay, 52/212520 (its only other locality in v.c. 29, where it had probably been introduced before 1956), G. Crompton, R. Payne and J. Plumridge, 27.4.1987.

Senecio integrifolius (L.) Clairv. subsp. *integrifolius* Beacon Course, scantily, 52/59-62-, J.W. Clarke, 2.6.1957; two plants, G. Crompton, 23.5.1987. Near junction of Round Course and July Course, in abundance, 52/60-62-, J.W. Clarke, 31.5.1959; seven flowering plants in closely mown turf, D.E. Coombe, 27.5.1987. July Course, at least 20 plants, 52/614618, D.E. Coombe, 25.5.1987. These appear to be the only records for "Newmarket Heath" since the war, although it has continued to be locally frequent on the adjacent Devil's Ditch.

Hypochoeris maculata L. Beacon Course, Newmarket Heath, large rosette, 30 cm across, of 25 well-spotted leaves, consisting of probably three plants, G. Crompton with E.M. Hyde and J. Hyde, 21.4.1987; subsequently six flowering stems (three of them branched) were produced, suggesting that the plants are long-established here. After John Ray's

(1663) record "on the Banks of the Devil's Ditch near Reche, not far from Newmarket", this species was recorded on Newmarket Heath, or Newmarket "On the Heath", by both John Martyn (1727) and Thomas Martyn (1763) and in Richard Relhan's *Flora Cantabrigiensis* (all editions, 1785, 1802, 1820). There do not appear to be any other definite records for the Heath, though it remains well-established on the Devil's Ditch at a considerable distance away.

Potamogeton pusillus L. Edge of flooded chalk-pit, Brookfields, 52/477573, K. Hand and C.D. Preston in **CGE**, 6.8.1987. Except for G.S. Gibson's record from Sawston in 1843 (in **CGE**, det. Dandy and Taylor), this is the first Cambs record outside the fens for this locally rare species.

Eriophorum vaginatum L. Ninewells, Thriplow Moor, *c.* 52/452473, G.N. Maynard and N. Maynard, 1842, det. D.E. Coombe, 20.10.1986, NCR. The specimen is labelled *E. angustifolium*. G.N. Maynard wrote on p. 309 of Vol. 13 of the Maynard Manuscript in the Cambridgeshire County Record Office: "This species of cotton grass - which I have by error named *E. angustifolium* - formerly grew on the spot called Ninewells . . . nearby is Triplow Heath, a district that formerly abounded with low, damp and undrained places well suited for the growth of this plant (and where in former days when this specimen was gathered) it was very plentiful, and where my father [Nathan Maynard] used to gather it with many other now rare plants in the district. About the time when these specimens were gathered, viz. 1842, this Heath was ploughed and pared up, the land drained and most of the water and bog loving plants made their disappearance. But the low part called Ninewells was left undisturbed, and I have found the plant sparingly from time to time in that locality." The new vice-county record for *E. vaginatum* was published (apparently without anyone recognising its significance) in my paper entitled "The Peat Holes of Triplow", in *N. in C.*, No. 2 (1959): 25-34, as D.E. Coombe has pointed out to me. Chippenham Fen, A. Shrubbs in **CGE**, undated specimen (*c.* 1890), 2nd CR.

Carex viridula subsp. *oedocarpa* (N.J. Andersson) B. Schmid (*C. demissa* Hornem.) Welches Dam, 52/46-85-, A. Fryer in **OXF**, 10.6.1880, det. R.W. David. Wimblington Fire Lots, 52/43-93-, A. Fryer in **OXF**, 20.6.1881, det. R.W. David. Witcham Turf Fen, by Old Lynn Drove, 52/46-83-, A. Fryer in **OXF**, 17.6.1883, det. R.W. David. These records of a calcifuge species very rare in Cambs and last recorded in 1959 (though common in Britain) have been communicated by C.D. Preston and pre-date our first record for this species by nearly thirty years.

Bryophyte records

C.D. Preston and H.L.K. Whitehouse

During 1987 the bryophytes have been listed in 14 churchyards north of Cambridge. The mean number of species recorded was 24. Most (33) were found at Cottenham, 52/455686; the lowest total (15) was at Benwick, 52/340906, but here the church itself has been demolished. *Brachythecium rutabulum*, *Grimmia pulvinata*, *Orthotrichum diaphanum* and *Tortula muralis*

were found in all the churchyards and *Bryum argenteum, B. capillare, Eurhynchium praelongum* and *Homalothecium sericeum* in all but one. Churchyards provide good habitats for some mosses which grow on stonework or old walls: these include *Bryum radiculosum* (found in 10 churchyards), *Orthotrichum anomalum* (7), *Rhynchostegiella tenella* (7), *Schistidium apocarpum* (8) and *Tortula intermedia* (10). Only three liverworts were found in the survey. Some of the more interesting records made are included in the list below.

MUSCI (Mosses)

Brachythecium glareosum (Spruce) B., S. & G. Under hawthorn scrub on base-rich ground, Bassenhally Pit, 52/286984, M.O. Hill, 24.10.1987.

Ephemerum recurvifolium (Dicks.) Boul. In small quantity in stubble field near Eversden, 52/382536, C.D.P. and H.L.K.W., 8.2.1987.

Gyroweisia tenuis (Hedw.) Schimp. At base of buttress on north side of Haddenham church, 52/464756, H.L.K.W., 31.1.1987. On mortar of north wall of Fen Drayton church 0.5 m from the ground, where splashed by water dripping from a roof gutter, 52/339681, D. Newman, 21.11.1987.

Leskea polycarpa Hedw. On elder at roadside south of Brandon Creek, 52/605915, C.R. Stevenson, 31.10.1987. It is unusual to find this plant away from the flood zone of rivers.

Pottia caespitosa (Bruch ex Brid.) C. Müll. In chalk grassland, Fleam Dyke, 52/544545, R.A. Finch, 11.2.1984. This plant was previously known in the vice-county only from the Devil's Ditch. Through an oversight, the record was omitted from earlier reports.

Tortula ruraliformis (Besch.) Grout On stone surround and chippings on a grave in Swavesey churchyard, 52/362693, P.W. Richards *et al.*, CGE, 21.11.1987.

Trichostomopsis umbrosa (C. Müll.) Robins. In crevices in wall near bottom of stone steps to basement, east side of Wimblington church, 52/415920, H.L.K.W., 7.3.1987. At base of wall on west side of porch, Rampton church, 52/428681, H.L.K.W., 21.11.1987. Near ground level on north wall of Cottenham church, 52/455686, H.L.K.W., 28.11.1987. At the time, the Wimblington find was the most northerly known, but the plant has since been found in Nottinghamshire and Yorkshire.

HEPATICAE (Liverworts)

Lophozia perssonii Buch & S. Arn. This rare plant was refound on bare chalk soil at Cherry Hinton chalk-pit, 52/485557, C.D.P., 18.12.1987, and we found larger patches at 484556 on 2 and 10.1.1988.

Riccia fluitans L. In the pond on the south-west side of the flyover where the Oakington–Dry Drayton road crosses the A604, forming a thick spongy mass continuously around the edges among *Typha* stems and extending out towards the centre, 52/396629, E. Swale and H. Belcher, 13.7.1987.

Ricciocarpos natans (L.) Corda In small quantity amongst *Lemna trisulca* in dyke on east side of Second Bridge Drove, The Galls, Haddenham, 52/433764, Mrs J.M. Croft and C.D.P., 1.7.1987. One frond seen amongst *Potamogeton coloratus* in water *c.* 35 cm deep in small fen dyke at north end of Sedge Fen Drove, Wicken Fen, 52/561705, Mrs J.M. Croft and C.D.P., 1.7.1987, but abundant in the same area (Windpump Ditch) later in the summer, J.M. Lock, 19.9.1987. Abundant in Commissioners' Drain at south-west end of Rothschild's Lapwing, Adventurers' Fen, 52/554693, J.M. Lock, 5.10.1987.

Weather notes for Cambridgeshire 1987

J.W. Clarke

January: The changeable weather of December 1986 continued until 7th, when an anticyclone became established and persisted almost without a break until the end of the month. A severe spell began on 10th and lasted until 20th. Day temperatures did not rise above freezing point, and the night minimum fell as low as 10°F on 11th-12th. Snow fell on 13th and drifted in a strong east wind on 14th, blocking some roads locally. Drifted snow remained lying in places at the end of the month. From 21st to 27th milder air gave a thaw and very dull, misty conditions. After 28th frosty weather returned, with brilliant sunshine by day. A very dry month, with only 0.43 ins of rain, on 7 days, mainly falling as snow. 7 days with snow lying.

February: Frosty weather on 1st gave way on 2nd to changeable weather, with the temperature reaching 55°F on 6th. On 15th an anticylone brought a return to sharp night frosts. Fronts coming down from the north in the circulation of the high pressure area produced a little snow on a few days. On 27th milder weather became established, with 55°F being reached on 28th. A dry month, with 1.04 ins of rain falling on 9 days. Snow lying on 1 day.

March: Changeable mild weather at the end of February continued until 3rd, when an anticyclone brought a return to cold weather with night frosts. After 16th changeable and very wet weather set in and continued to the end of the month. A great gale on 27th brought down trees and damaged buildings. 2.04 ins of rain fell, on 17 days.

April: The changeable, wet weather continued until 14th, when more settled weather became established. The second half of the month was mainly sunny and warm, with above-normal temperatures and very little rain. On 25th a temperature of 71°F was reached. Rain fell on 8 days (1.49 ins). Thunder on 1 day. 3 days over 70°F.

May: First days of the month were unsettled and wet. An anticylone after 5th brought fine weather, but also much cumulus cloud from the North Sea. Changeable wet weather on 11th-25th; then mainly fine to the end of the month. Rainfall above average (2.24 ins), on 15 days. Thunder on 1 day.

June: Excessively wet, sunless and cool until 27th, when an anticyclone became established, giving a few days of fine, warm weather until the end of the month. Rainfall much above average (4.14 ins), on 20 days. Thunder on 6 days.

July: Fine and very warm, with no rain until the middle of the month. Changeable, wet weather then returned and continued for the rest of the month. Rain fell on 13 days (2.26 ins). No thunder.

August: Changeable and wet in the first fortnight. An anticyclone brought a week of sunny, warm weather on 14th-22nd, with temperatures exceeding 80°F on three days. Wet,

unsettled weather returned in the last week, with the temperature only reaching 54°F on 27th. Above-average rainfall (3.20 ins), on 11 days. Thunder on 2 days.

September: Changeable, unsettled weather continued almost throughout the month, but with occasional ridges of high pressure bringing a number of fine days. The last days of the month were fine but rather cool, with northerly winds round an anticyclone to the west. Rainfall (1.01 ins), on 13 days. No days with thunder.

October: First two days fine and sunny; then changeable and very wet until 23rd. Fine and settled to 31st. In the early hours of 16th a gale of almost hurricane force struck the region. Trees were blown down and uprooted in hundreds. Above-average rainfall (3.65 ins), on 12 days.

November: An anticyclone gave fine, mild weather in the first week. Changeable weather then returned and persisted throughout the rest of the month, bringing much rain. Very mild, with only one air frost. Rainfall much above average (3.05 ins), on 12 days.

December: The weather became more settled at the beginning of December. From 7th to 14th an anticyclone brought frost at night, and on 9th the temperature remained below 32°F all day. The rest of the month was changeable and mild, with the temperature reaching 57°F on 29th. Rainfall below average (0.79 ins), on 8 days.

Weather records at Swaffham Prior 1987

Temperature °F

Month	*Mean max.*	*Mean min.*	*Highest*	*Lowest*	*Rainfall (ins)*
January	34.3	27.8	48 on 4th	10 on 12th & 13th	0.43
February	40.9	31.0	55 on 6th & 28th	21 on 1st	1.04
March	43.5	33.2	52 on 17th	23 on 12th	2.04
April	59.3	43.6	71 on 25th	37 on 3rd	1.49
May	58.7	42.0	71 on 26th	33 on 4th	2.24
June	63.8	51.3	77 on 29th	42 on 15th	4.14
July	70.5	55.5	80 on 6th	47 on 26th	2.26
August	69.6	55.0	83 on 21st	44 on 6th	3.20
September	65.2	51.7	72 on 20th & 21st	38 on 27th	1.01
October	56.8	43.4	68 on 5th	28 on 29th	3.65
November	51.0	40.0	55 on 16th	25 on 29th	3.05
December	45.0	37.8	57 on 29th	23 on 8th & 9th	0.79
Annual means	54.9°	42.7°		Total	25.34

Number of days over 80°F	4
Number of days over 70°F	42
Number of days with a maximum under 32°F	11
Number of days with a minimum under 32°F	58
Last air frost of the spring	29th March
First air frost of the autumn	26th Oct.
Days with snow lying	8
Days with thunder	10

Above: P.W. Richards' original list of bryophytes seen in Little Widgham Wood on 5 February 1938 (see p. 42)

Below: Bryologists on the jubilee excursion in Little Widgham Wood on 6 February 1988 (see pp. 45-46): left to right, Ron Porley, David Coombe, Robin Stevenson, Mark Hill, Paul Richards, Peter Wanstall, Harold Whitehouse, Chris Preston, Oliver Rackham, John Akeroyd

M.O. Hill

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