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Contents

Cover photograph: Oxlips *Primula elatior* in Hayley Wood Peter Wakely

Copies of *Nature in Cambridgeshire* may be obtained from the Herbarium, Botany School, Downing Street, Cambridge, CB2 3EA (price £3.00 by post). Articles for consideration for No. 36 should be submitted to the Editor, Mr P.H. Oswald, at 33 Panton Street, Cambridge, CB2 1HL, by 31 December 1993.

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Editorial

As in 1990, this is an extra large issue, this time to accommodate a 32-page paper by Chris Preston on the distribution of Oxlips in Cambridgeshire. We are grateful to English Nature, which has provided a grant to enable this important study of a nationally scarce species to be published.

The Wildlife Trust (formerly CAMBIENT) has been managing a section of the Devil's Ditch since the early 1970s, aiming to maintain the botanical interest by preventing scrub encroachment. We are delighted to publish an account by Margaret Stanier of some of the management experiments carried out during this period under the supervision of Dr Peter Grubb. Margaret Stanier has been a member of the Trust's Management Committee since its inception and is currently its Secretary and Honorary Warden for the Devil's Ditch.

Please note two corrections to *Nature in Cambridgeshire* No. 34. In Table 2 on p. 37 *Sanguisorba officinalis* is an error for *Sanguisorba minor*, and in the entry for *Potamogeton* x *nitens* on p. 72 of 'Vascular plant records' the 10-km square for Whittlesey should be 52/29.

This year's issue is once more weighted heavily on the botanical side, with several accounts of species or genera of vascular plants and only one essentially zoological paper, Steve Boreham's third study of the macro-invertebrates of a Cambridgeshire stream system. However, several zoological contributions have been more or less promised for next year's issue, which we hope will redress the balance to some extent.

We again thank Dr Ken Joysey for the use of the Macintosh LaserWriter at the University of Cambridge Museum of Zoology.

Philip Oswald

Cambridge City's first Local Nature Reserve

Lime Kiln Close, Cherry Hinton, was formally declared a Local Nature Reserve by Cambridge City Council in May 1992, and a delightful opening ceremony was performed by the Mayor, Councillor Barry Gardiner, on Saturday, 26th September. It was one of those sparkling sunny mornings after an early mist had dispersed, and we could hardly have chosen a better day. This old chalk-pit, known affectionately by generations of Cherry Hinton children as "The Spinney", has associations with Cambridge botanists that take us back to the days of John Ray.

After the Mayor had cut the tape, the assembled representatives of the Wildlife Trust, English Nature, the Cambridge Building Society and other supporting organisations, together with local residents, enjoyed a conducted tour of the reserve, when the interesting flora and the current management practices were demonstrated by Dave Seeley, the warden of the reserve, and Dr Max Walters, Vice-President and former Secretary of the Trust.

It is the declared intention of the City Council, as explained in *A Nature Conservation Strategy for Cambridge*, published in 1991, that Lime Kiln Close should be followed by seven other declarations of Local Nature Reserves.

S.M. Walters

Macro-invertebrates as water quality indicators in the Quy Water stream system

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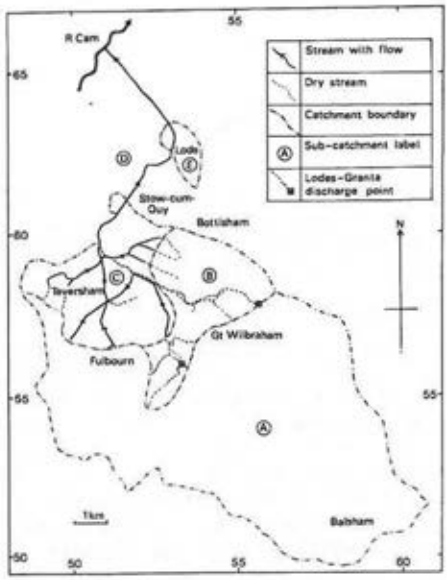
Introduction

The Quy Water stream system drains an area of about 78 km^2 to the east of Cambridge, stretching from Balsham in the south, through Fulbourn, to Lode in the north (see Figure 1). The catchment between Balsham and Great Wilbraham has rolling valleys underlain by Upper and Middle Chalk capped by Boulder Clay and various gravel deposits. The Totternhoe Stone in the Lower Chalk outcrops between Fulbourn and Great Wilbraham, giving rise to a spring-line which runs roughly east to west across the catchment. A ridge of Lower Chalk capped by gravels sharply confines the catchment south-west of Stow-cum-Quy, and the resulting impeded drainage has allowed the accumulation of peat in a saucer-shaped depression. Lower Chalk underlies Quy Water as far as Lode village, and further north a broad plain of Gault Clay covered by peat and gravels extends towards the River Cam.

Although there are ephemeral streams north-west of Balsham up to 80 m O.D., the Quy Water stream system proper began in the past at four main springs around the 15-metre contour at Wilbraham Temple (TL557577), Shardelow's Well (TL536559), Caudle Ditch (TL497566) and Poor Well (TL514566). Groundwater abstraction, combined with three successive dry winters, has caused the springs at Wilbraham Temple and Shardelow's Well to stop flowing, leading to general desiccation of their associated watercourses and wetland habitats. The National Rivers Authority's 'Lodes–Granta Scheme' has attempted to support artificially the flow of streams in south-east Cambridgeshire that are suffering drought stress. Water pumped from the Chalk is piped overland and discharged at strategic points along the streams to be supported. Outfalls at Wilbraham Temple and Fulbourn Fen, near Shardelow's Well, (see Figure 1) began operating in September 1991, but the success of these discharges is the subject of continuing research and has not been investigated here. The principal sources of natural water in the present Quy Water system are the springs at Caudle Ditch and Poor Well (which feeds Ryde Water). Both streams flow about 1.5 km before joining to form the Mill Ditch at a confluence known as the Bull's Eye. The Mill Ditch, a steep-sided artificial cut, flows northwards and receives treated domestic effluent from Teversham sewage treatment works. Further downstream, the Mill Ditch is joined by minor streams draining Cambridge Airport and Wilbraham Fen. Beyond this point the stream is known as Quy Water, a 4-km stretch of slow-moving water held back by a weir at Lode Mill. This artificial watercourse has embankments over 2 m above the surrounding land, and drainage from Bottisham village has to be piped beneath it. The village of Lode is on a small knoll of Lower Chalk, across which the stream flows before turning north-west. The course of Bottisham Lode runs for a further 4 km in an artificial raised channel to the River Cam near Waterbeach.



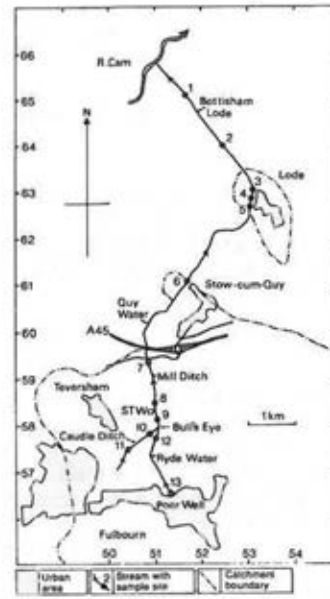


Figure 1: Map of Quy Water drainage area, showing catchment boundaries
Figure 2: Map of the area studied in detail, showing sampling sites
The location of Teversham sewage treatment works is indicated by STW.

Historical background

The history of the Quy Water stream system has been described in detail by T.D. Hawkins (1990). Originally drainage from the springs at Fulbourn and Wilbraham flowed into a mere south of Stow-cum-Quy. From there a stream flowed north across broad low-lying flood-plains towards the River Cam. Two further streams also drained north from what are today the villages of Bottisham and Lode. The Romans are thought to have canalised the stream flowing from Lode village to the River Cam to create the watercourse known today as Bottisham Lode. Some time before 1604, a group of rich 'Adventurers' diverted the stream draining Wilbraham and Fulbourn into the headwaters of Bottisham Lode, creating Quy Water, and also enclosed parts of Stow-cum-Quy Fen.

The Mill Ditch was also cut before 1604, but originally it carried Ryde Water beneath Caudle Ditch. By the mid 19th century the tunnel had been breached and many new drains had been dug, so that the Bull's Eye confluence was similar to its present arrangement. In addition, before 1797 a tunnel was constructed beneath the Little Wilbraham River so that water draining from the mere south of Stow-cum-Quy was diverted from the Little Wilbraham River to the Mill Ditch. The mere persisted until the early 19th century (Penning & Jukes-Brown, 1881), when this area became known as Little Wilbraham Fen.

A great many other modifications to this complex artificial drainage system occurred, although neglect often led to flooding of low-lying land (Vancouver, 1794).

Catchment studies

By using the Ordnance Survey Pathfinder 1:25,000 maps of Cambridge & Balsham (TL45/55) and of Cambridge (North) & Burwell (TL46/56), supplemented by field observations, catchment boundaries for the Quy Water system and for a number of sub-catchments were established (see Figure 1). Sub-catchment A is a 57-km^2 area of north-west-facing slopes on the Chalk escarpment with ephemeral streams. Water from this sub-catchment rarely enters the drainage system directly as surface flow, but usually percolates through the Chalk to recharge the aquifer. An exception to this is the run-off from built-up areas such as Fulbourn, which may reach the stream system rapidly after rainfall. Sub-catchment B is susceptible to drought and includes the springs at Wilbraham Temple and Shardelow's Well, which are now artificially supported by the 'Lodes–Granta Scheme'. Sub-catchment C is the main area of drainage which was active during this study. The principal springs feeding this area are those at Poor Well and Caudle Ditch, with minor contributions from run-off and seepage lines in Fulbourn, Teversham and Little Wilbraham Fen. The land in area D is more than 2 m below Quy Water, raised in its artificial channel. Sub-catchment E is an outlier on the small knoll of Lower Chalk on which Lode village is built. It represents part of the original catchment of the stream which was canalised to form Bottisham Lode.

Fieldwork

This study, conducted between May and October 1991, describes the macro-invertebrates of the Quy Water system in relation to water quality. Figure 2 shows a map of the area studied in detail. Thirteen sampling sites were established on the Quy Water system – one at Poor Well and one on Ryde Water (Sites 13 and 12), two on Caudle Ditch (Sites 11 and 10), on the Mill Ditch one below the Bull's Eye confluence (Site 9), another immediately downstream of the sewage works (Site 8) and a third near Quy Water Bridge (Site 7), one on Quy Water at Stone Bridge (Site 6), three immediately downstream of Lode Mill (Sites 5, 4 and 3), and two on Bottisham Lode (Sites 2 and 1).

In two previous studies reported in *Nature in Cambridgeshire* (Boreham, 1990, 1991) 'kick' sampling was used to monitor streams' benthic macro-invertebrates over a period of time. However, owing to the variety of substrates encountered in this study, three different sampling techniques were employed. An *accurate* sampling method gives a true representation of the macro-invertebrate fauna, but a *precise* one will provide repeatable results (Lee & Corbet, 1989). A colonisation sampler is unlikely to be accurate, since it offers a specific micro-habitat which will be suitable only for certain taxa. It may, however, be precise, attracting the same taxa in similar numbers each time it is used. Such a device is ideal for long-term pollution monitoring. By contrast, a grab sampler merely captures whatever creatures are in its path and, because of their patchy distributions, it has poor precision. However, if many

samples are taken, a grab sampler may be quite accurate. Kick sampling falls between these extremes and is widely used for pollution monitoring.

On stable riffles (Sites 13–9 and 5–2), three 30-second kick samples were collected with the use of a 25 x 25 cm Freshwater Biological Association hand-net (Macan, 1958). In areas with medium to fine sediment (Sites 11, 8–6, 2 and 1), a grab sampler was used to collect approximately three litres of sediment, which was washed through a 1-mm sieve to reveal the animals. Adapted seven-chambered Standard Aufwuchs Unit (SAufU) colonisation samplers (Hellawell, 1978; Lee & Corbet, 1989) were also placed at Sites 11, 9–5 and 3–1 and retrieved after two-week periods to supply additional information. At other sites theft of the samplers prevented these data from being obtained. Thus, two or more sampling methods were employed at some sites. In all cases macro-invertebrates were sorted in the field and the species were identified where possible. A hydrobiological index of water quality, the BMWP score (National Water Council, 1981), was also applied to the data.

Stream description, flora and fauna

Ryde Water and Caudle Ditch

The spring-head at Poor Well (Site 13) lies at the north-west corner of low-lying marshy land which within the last 20 years was flooded and formed a pond known as Poor Well Water. Abstraction from the nearby Fulbourn Pumping Station (which ceased in July 1987: B. Elliot, pers. comm.), deliberate drainage and, more recently, drought have reduced the pond to a wet meadow. The present spring-head has a base of chalky rubble and in 1991 was fringed by water-cress *Nasturtium* (*Rorippa*) sp. and the alga *Cladophora*. The wetland flora was dominated by Common Reed *Phragmites australis* (which is cut annually), with Water Mint *Mentha aquatica* and Bittersweet *Solanum dulcamara*. Where Ryde Water flows from Poor Well spring-head, it receives some urban run-off and is also joined by drainage ditches fed by the same spring-line. At this point the mean summer discharge was 30 litres per second (l/s). Ryde Water flows north in a heavily shaded section and then through arable fields in a steep-sided channel 2 m deep. At Site 12, upstream of the Bull's Eye confluence, Ryde Water is a fast-running, chalky gravel-bedded stream, with a mean flow of 35 l/s. It is fringed by *Cladophora*, water-starworts *Callitriche* spp. and water-cress, with Water Figwort *Scrophularia auriculata* and Wild Teasel *Dipsacus fullonum* subsp. *sylvestris* on the steep banks. The Three-spined Stickleback *Gasterosteus aculeatus* was present here and upstream as far as Poor Well.

Caudle Ditch receives run-off from Fulbourn Hospital and part of Cherry Hinton, but also collects water from spring-lines in the chalk. The stream flows north-east, following partly shaded field boundaries, and receives highway run-off and field drainage from the area between Fulbourn and Teversham. At Site 11 Caudle Ditch flows relatively fast over chalky gravel, with a mean discharge of 25 l/s, and in 1991 was fringed by water-starworts, water-cress, Brooklime *Veronica beccabunga* and rushes *Juncus* spp. Great Willowherb *Epilobium hirsutum* and Water Figwort also grow on the steep sides of the narrow channel. Downstream the flow is generally sluggish, with several faster runs, and the channel is rather broad and open in aspect. Charles Turner kindly surveyed the relatively rich flora of this stretch. In addition to the plants named

above, his list included Canadian Waterweed *Elodea canadensis*, Fool's Water-cress *Apium nodiflorum*, Lesser Water-parsnip *Berula erecta*, Branched Bur-reed *Sparganium erectum*, Hoary Willowherb *Epilobium parviflorum*, Hemp-agrimony *Eupatorium cannabinum*, Bulrush (or Great Reedmace) *Typha latifolia*, Water-plantain *Alisma plantago-aquatica*, Pink Water-speedwell *Veronica catenata* and Brookweed *Samolus valerandi*. Some, at least, of the water-cress was Narrow-fruited Water-cress *Nasturtium microphyllum*. Site 10 was located on a fast gravel run in this area, with a mean flow of 35 l/s, and supported many Three-spined Sticklebacks. At the Bull's Eye confluence, Caudle Ditch and Ryde Water join, and they are then joined by two further ditches to form the Mill Ditch. One of the dry ditches once carried water from Shardelow's Well. The still water in the mouths of these channels had many *Gyrinus* (whirligig beetles) and was choked by *Cladophora*, water-starworts, water-cress, Brooklime, Water Mint, Great Willowherb, Water-plantain, Common Reed, Reed Sweet-grass *Glyceria maxima* and rushes.

Mill Ditch and Quy Water

The Mill Ditch is cut against the gradient of the slope and the steep-sided channel reaches 3 m in depth. Site 9 was upstream of Teversham sewage works on a fast-flowing chalky gravel-based riffle, with water-cress, rushes and Brooklime. The mean summer flow was 70 l/s. Below Teversham sewage works, at Site 8, the flow had increased to 150 l/s and the stream was broader (2 m) and deeper (>0.4 m). Algae, including *Enteromorpha* and *Cladophora*, were abundant, and a carpet of Canadian Waterweed was fringed by water-starworts and water-cress. Stone Loach *Neomachilus barbatulus* and Roach *Rutilus rutilus* were also captured, and a shoal of Roach with 10–15 individuals up to 25 cm long was observed. Below Site 8 the stream becomes slower as it flows between raised banks through low-lying arable fields south of the A45. A ditch choked by water-cress and Meadowsweet *Filipendula ulmaria* which drains Teversham village and Cambridge Airport contributed less than 5 l/s, and a channel draining Wilbraham Fen enters from the east.

At Site 7 the stream was broad but shallow, with a bed of soft muddy sand from which Bullhead *Cottus gobio* were captured. North of the A45, near Quy Mill, the stream had much *Cladophora*, with Great Willowherb and sedges. Adjacent to the stream were disused stream channels which supported Common Reed, Teasel, Bulrush and Water Forget-me-not *Myosotis scorpioides*. Below Quy Mill the stream is joined by the dry course of the Little Wilbraham River (also known as Quy Water) and then turns north-west in artificial embankments. At this point an overflow channel leads to the Black Ditch, which drains the low-lying land to the north-east. Reed Sweet-grass grew thickly across the whole stream, and further downstream *Cladophora*, Brooklime, Water Forget-me-not, Great Willowherb, Water Figwort, Amphibious Bistort *Polygonum amphibium*, Indian Balsam *Impatiens glandulifera*, Reed Canary-grass *Phalaris arundinacea* and Yellow Iris *Iris pseudacorus* were all recorded. Grey Herons *Ardea cinerea* were also observed on this section of Quy Water. Near Quy Hall the stream has been enlarged to form an ornamental lake, on which Mute Swan *Cygnus olor*, Moorhen *Gallinula chloropus* and Mallard *Anas platyrhynchos* were observed. The level is maintained by a small weir at Stone Bridge (Site 6). Deep silt had

accumulated at this site and, in addition to many of the other plants mentioned above, Water-plantain, Meadowsweet and Common Duckweed *Lemna minor* were recorded.

Downstream of Stone Bridge, *Cladophora* and other algae choked Quy Water, which is some 3 m wide, slow-moving and, in the vicinity of Anglesey Abbey, more than 2 m above the surrounding fields. Near Lode Mill the partly shaded channel supported Rigid Hornwort *Ceratophyllum demersum*, Canadian Waterweed, Yellow Water-lily *Nuphar lutea*, Yellow Iris, Common Reed and Reed Sweet-grass. A weir creates a head of water more than 1.5 m deep, and inspection of anglers' keep-nets revealed Pike *Esox lucius*, Perch *Perca fluviatilis*, Roach and Eels *Anguilla anguillla*.

Lode Mill to Bottisham Lode

Below Lode Mill the stream flows swiftly over gravel riffles (Site 5) and was fringed by Water-cress, Brooklime, Water Forget-me-not and Water Figwort. Figure 3 shows the National Rivers Authority's flow data (G. Hyett, pers. comm.) from the gauging station situated between Sites 4 and 5 near Lode Village. The mean monthly discharge for 1986 in Figure 3 (a) shows the seasonal variation, with peak flows in the spring and low flows in the autumn. Figure 3 (b) shows a flow duration curve calculated from data accumulated over a 21-year period. It indicates that spates where discharge exceeds 1,000 l/s are infrequent events and that the flow very rarely falls below 10 l/s.

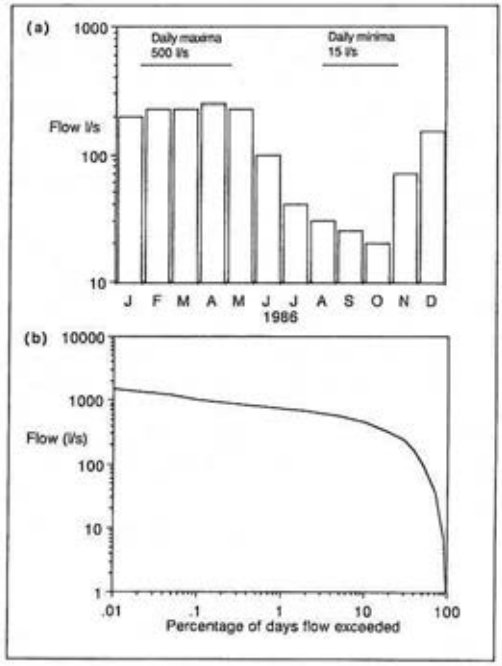


Figure 3: (a) The mean monthly discharge for 1986 and (b) a flow curve calculated from 21 years' data (1965–1985) at the gauging station between Sites 4 and 5 in Lode village

Near the flow gauging station, the stream was heavily shaded and the broad gravel riffle at Site 4 supported only algae. At Site 3 the stream runs some 2 m below the surrounding land and turns north-west towards the River Cam. The sand and gravel riffles at Site 3 were 2.5 m wide and had a base of Lower Chalk; they supported Common Reed, Great Willowherb, Water Forget-me-not, water-cress, *Cladophora* and a water-milfoil *Myriophyllum* sp. Stone Loach and Bullhead were also captured at Sites 5–3.

Bottisham Lode continues in an artificial channel, and the surrounding fields become lower until the stream flows above them. Site 2, at Jack of Clubs Farm, had a swiftly flowing riffle based on silty sand. The flora was similar to that at Site 3, but with Rigid Hornwort, Reed Canary-grass, Reed Sweet-grass, Teasel and Common Comfrey *Symphytum officinale*. Small shoals of Chub *Leuciscus cephalus* and Dace *L. leuciscus* were observed, and Bullhead were also captured. Downstream, at Site 1, the flow was rather sluggish, and Pike were seen basking beneath overhanging vegetation. Many of the plants recorded at Sites 2 and 3 were recorded again between Site 1 and the River Cam.

Macro-invertebrates

Ryde Water and Caudle Ditch

The spring-head at Poor Well (Site 13) supported *Gammarus pulex* (a freshwater shrimp), *Potamopyrgus jenkinsi* (a freshwater snail), *Glossiphonia* sp. (a leech), *Limnephilus* sp. (a cased caddisfly) and Chironomidae (non-biting midge larvae). Downstream, at Site 12, all the above taxa were present except *Limnephilus*, and in addition Tipulidae (cranefly larvae), *Limnaea peregra* (a freshwater snail) and abundant *Baetis* spp. (mayfly nymphs) were collected. On Caudle Ditch, at Site 11, *Dugesia* sp. (a flatworm), Tubificidae (sludge worms), *Hemiclepsis marginata* (a fish leech), *Erpobdella octoculata* (a leech), *Haliplus* sp. and *Elmis aenea* (water beetles), *Ceratopogon* sp. (a biting midge larva) and Hydracarina (water mites) were collected in addition to most other taxa previously mentioned. Downstream, at Site 10, the assemblage was rather similar, although *Caenis* sp. (a mayfly) was present and *Dugesia*, Tubificidae and several other taxa of less significance were absent.

Mill Ditch and Quy Water

Downstream of the Bull's Eye confluence, Site 9 had a fauna rather similar to that of Sites 10 and 11. However, below the sewage works at Site 8 only tubificids, chironomids, leeches, Culicidae (mosquitoes and gnats) and *Ceratopogon* sp. were abundant, with infrequent mayflies and beetles. At Site 7 a similar assemblage occurred, but with *Bithynia tentaculata* (a freshwater snail), *Gammarus pulex* and *Crangonyx pseudogracilis* (a freshwater shrimp). Species richness increased downstream, and at Site 6 *Planorbis* sp. (a ramshorn snail), *Limnaea peregra*, copepods (waterfleas), ostracods (seed shrimps), Corixidae (lesser water-boatmen), *Hydrometra* sp. (a water-measurer), *Dugesia* sp., *Asellus aquaticus* (a hoglouse) and Piscicolidae (fish leeches) were present. Chironomids and tubificids were less abundant than at Sites 8 and 7.

Lode Mill to Bottisham Lode

The three sites directly downstream of Lode Mill (Sites 5–3) all had a similar fauna, with *Dugesia* sp., tubificids, *Gammarus pulex* and *Crangonyx pseudogracilis*, *Asellus aquaticus*, *Caenis* sp. and *Baetis* spp., *Limnephilus* sp., Coleoptera, Tipulidae, Simuliidae (blackflies), Chironomidae, *Sphaerium corneum* and *Pisidium* sp. (a pea cockle), *Potamopyrgus jenkinsi*, *Bithynia tentaculata*, *Planorbis* sp. and abundant copepods. However, *Hydropsyche* sp. (a caseless caddisfly) was present only at Site 3. Site 2 had a similar fauna, but with *Lumbriculus* sp. (an oligochaete worm), *Limnaea peregra* and *Ancylus fluviatilis* (a freshwater limpet). The assemblage at Site 1 had rather fewer molluscs and beetles but included *Pleus* sp. (a lesser backswimmer), *Valvata* sp. (a freshwater snail) and Collembola (springtails).

Comparison of sampling methods

Each of the three sampling techniques employed in this study collected a different subset of the macro-invertebrate fauna. In general, colonisation samplers collected most taxa and kick sampling was also successful, but grab sampling consistently captured fewer macro-invertebrate groups. Tubificids, leeches, freshwater shrimps, beetles and flatworms all appeared to favour the colonisation samplers. However, sessile or slow-moving taxa such as pea cockles were under-represented, as were Chironomidae and *Potamopyrgus jenkinsi*. Taxa captured by the grab sampler were often not collected by the colonisation sampler at the same site. Kick sampling remained the most useful method where fine sediment did not preclude it.

Water quality

The BMWP score assigns a value to the presence of each macro-invertebrate taxon, proportional to its known or assumed pollution sensitivity. Pollution-tolerant taxa get low scores, while pollution-sensitive taxa score more highly. Murphy (1978) calculated the mean BMWP score for each assemblage (the average score per taxon or ASPT) because he observed that such an index was less affected by variations in factors such as stream size, season and micro-habitat diversity than the BMWP itself. Critical assessment of water quality relies on indices such as these to simplify the interpretation of invertebrate data. Figure 4 shows the mean BMWP score and ASPT for each sampling method at each site over the study period. This figure appears complex because data from each of the three sampling methods has been shown, but only the highest values at each site have been linked by a line. In general there is a broad similarity in the pattern shown by the two indices. Sites upstream of Teversham sewage works have medium to high scores. Below the sewage works, however, water quality is at first depressed but then steadily recovers downstream.

Although Poor Well (Site 13) had a relatively low BMWP score, the ASPT indicates that the macro-invertebrates present were relatively pollution-sensitive. Other chalk springs also show this phenomenon, with a restricted but pollution-sensitive specialist fauna (Boreham, 1990). Ryde Water (Site 12) and Caudle Ditch (Site 11) both receive urban run-off, which may have detrimental effects. However, Site 10 on Caudle Ditch upstream of the Bull's Eye and Site 9 on Mill Ditch above the sewage works both had high water quality. Teversham sewage treatment works treat domestic effluent from approximately 6,000

people in Fulbourn, Teversham, Wilbraham and Stow-cum-Quy, using biological filters, settling tanks and tertiary clarifiers. In dry weather the works discharge a maximum of 1,400 m^3/day of treated sewage effluent. The consent limits for composition of this effluent stipulate that most samples should not exceed 30 milligrams per litre (mg/l) suspended solids, 15 mg/l biological oxygen demand and 5 mg/l ammonia (J. Barker, pers. comm.). Teversham sewage works operate well within these constraints, since the tertiary treatment produces high-quality effluent. In September 1991, new inlet works and humus and storm tanks came into operation to meet a new and tighter suspended solids limit of 20 mg/l. Below the sewage works (Site 8) both indices were depressed, and this was more pronounced at Site 7, which had the lowest water quality scores recorded. The delay between release and microbial breakdown of organic matter, causing unfavourable conditions in a stream, is well documented (Mason, 1981). However, the 4-km, slow-moving section of Quy Water between Sites 7 and 5 apparently allows much of the suspended solid load to settle out.

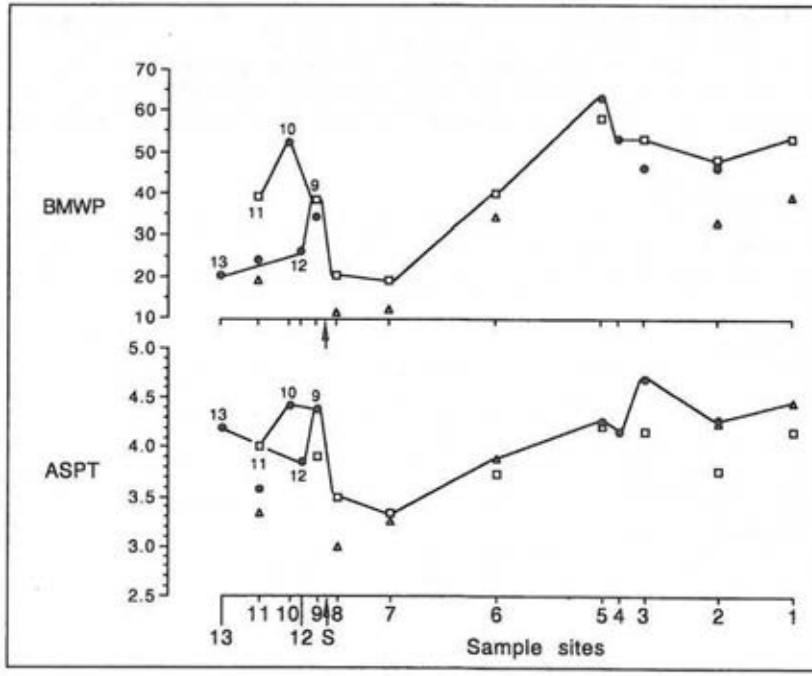


Figure 4: The mean BMWP and ASPT scores for each sampling method at each site over the study period
Kick samples: ● Grab samples: △ Colonisation samples: □
Outfall from Teversham sewage treatment work: S

Sites 6 to 1 showed a general improvement in water quality with distance downstream, and index values were similar to those upstream of the outfall. Although a small amount of urban run-off from Lode village enters Bottisham Lode, Site 3 had the highest ASPT recorded, suggesting that this is of little consequence.

Discussion and conclusions

The Quy Water system provides water and wetland habitats which form linear 'islands' of floral and faunal diversity in an area of intensive agriculture. However, owing to drought and abstraction, the present system is merely a fragment of a previously more extensive network of artificial watercourses, some of which may be reinstated by the 'Lodes–Granta Scheme'. Water quality was found to be generally high, with urban run-off having only a minor effect in this predominantly rural catchment. Although species richness and water quality were lowest below Teversham sewage works, the high-quality effluent was rapidly dealt with by the stream. Colonisation and grab sampling proved to be useful adjuncts to kick sampling and were invaluable where the latter was impractical. Colonisation samplers usually gave the highest BMWP scores and grab sampling always yielded the lowest. However, colonisation samplers gave the highest ASPT values only at sites known to receive pollutants. At other sites grab samplers often attained the highest ASPT. This may be because, although colonisation samplers offer refuge in a polluted stream, the substrate is too restricted to attract the full macro-invertebrate community in unpolluted conditions.

Acknowledgements

Many thanks go to Glyn Hyett and David Tester of the National Rivers Authority, John Barker of Anglian Water, Brian Elliot of the Cambridge Water Company and Charles Turner of the Department of Plant Sciences, University of Cambridge, for their help during this project.

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The restoration of grassland on the Devil's Ditch, Cambridgeshire

Margaret Stanier

The background

During the 1950s and 1960s naturalists became aware that much chalk grassland, an important natural habitat of southern Britain, was being lost. The chalk downs had been managed for decades as permanent pasture, sometimes grazed by cattle but especially by sheep. The numbers of stock animals and the areas grazed had varied according to current economic conditions, and certain areas had even been ploughed up from time to time and converted to arable land. Now, however, much of the pasture was becoming overgrown by bushes, with corresponding reduction of 'typical chalk grassland', a phrase which brings to the mind's eye a picture of floristic richness and diversity, attractive to both the professional botanist and the field naturalist.

This change was due mainly to alterations in agricultural practice. Since the beginning of the century the number of sheep kept on upland pasture had gradually declined and areas of bushes, mainly Hawthorn *Crataegus monogyna* and Wild Privet *Ligustrum vulgare*, had increased. The great reduction in the Rabbit population caused by myxomatosis in the 1950s permitted a sudden rapid increase in bush growth as grazing and bark-gnawing by Rabbits were greatly lessened. Bushes shaded out the ground flora and eventually formed areas of dense scrub. The loss of ground flora not only reduced the floristically rich sward but also limited the numbers of insect species such as butterflies and hoverflies which used these plants as food sources or overwintering shelter. Ground-nesting birds such as Skylarks were also affected, as the possible areas for nest-sites were reduced. This lack of grazing, besides permitting scrub development, also altered the character of the remaining grassy areas. There had formerly been large stretches of short turf with much Sheep's-fescue *Festuca ovina* and Quaking-grass *Briza media*, accompanied by small or low-growing plants, for example Common Milkwort *Polygala vulgaris*, Fairy Flax *Linum catharticum*, Eyebright *Euphrasia* species, Horseshoe Vetch *Hippocrepis comosa* and Wild Thyme *Thymus praecox* subsp. *arcticus* (*T. polytrichus* subsp. *britannicus*). This type of sward was being replaced by long tussocky grasses such as Upright Brome *Bromus erectus* (*Bromopsis erecta*), with tall perennials such as Wild Carrot *Daucus carota* subsp. *carota* and Greater Knapweed *Centaurea scabiosa*. At about this time the southern chalkland was also invaded by patches of the yellowish-green Tor-grass *Brachypodium pinnatum*, an undesirable addition to the ground flora as its dead leaf litter forms a dense soil cover permitting no intermingling of other species.

This pattern of change occurred throughout south-east England – on the North and South Downs of Kent, Surrey and Sussex, on Salisbury Plain and elsewhere in Wiltshire and Dorset, on the Hampshire/Berkshire Downs and on the Chiltern Hills, extending north-east to the Dunstable Downs and Therfield Heath in Hertfordshire. Such familiar and much-loved landmarks as Box Hill in Surrey, Ivinghoe Beacon in Bedfordshire and St Catherine's Hill in Hampshire began to lose their former outlines and colour, as a rather dull scrubland or coarse grassland dominated by one or two species replaced the species-rich sward.

The problem

It was therefore desirable both for variety of wildlife interest and for the beauty of the landscape to turn the tide of the advancing scrubland and to try to reinstate grassy turf. In the 1970s the spread of Hawthorn was slowed down to some extent by voluntary efforts. Volunteers, either singly or in groups organised by County Wildlife Trusts and similar bodies, took saws, secateurs and slashers and cut down the Hawthorn bushes appearing in the grass; and certainly the spread of bushes would have been more extensive without these efforts. The reinstatement of grassland is not much of a problem when single Hawthorns or small groups of bushes are cut; if the bare patch left after bush removal is not too large or too old and is surrounded by extensive grassland, natural spread of the grass can soon obliterate it, particularly if the Hawthorn stump is removed or destroyed.

The situation is quite different, however, if a large area (say 100 square metres or more) of dense scrub which has been present for years or decades is cut and removed down to the bare soil beneath it, particularly if this newly cleared land is itself surrounded by more dense scrub or by arable land. Within a year the bare soil is covered, not by grass and the associated forbs, but by a luxuriant growth of 'weeds', the seeds of which are either windborne, derived from the seed bank in the soil or brought in by Rabbits. This rank growth is likely to include Cleavers *Galium aparine*, Wild Mignonette *Reseda lutea* and Weld *R. luteola*, Prickly Sow-thistle *Sonchus asper*, Black-bindweed *Fallopia convolvulus* and perhaps Ivy *Hedera helix* and Common Nettle *Urtica dioica*, in fact typical hedgerow or scrambling plants, certainly not the species of chalk grassland.

This is the nub of the problem. How can grassland be restored after removal of dense scrub? Why do the species of the original grassland fail to return after scrub removal? Is it ever possible to reinstate grasses on land after clearance of Hawthorn? These are the questions which Dr Peter Grubb and his group at the Botany School, in conjunction with Cambridge Conservation Volunteers, have been studying for nearly twenty years on the Devil's Ditch near Burwell. Much of the work to be described was carried out by Dr Barbara Key while a research student at the Botany School from 1973 to 1976.

The action

The lushness of the weed growth appearing after scrub removal suggested a high fertility in the soil below the Hawthorn. The first stage of the work on the Devil's Ditch was therefore a careful comparison of the chemistry of soil samples taken from under the Hawthorn with those taken from under the

existing ancient chalk grassland nearby. The pH of these two types of soil was about the same (pH 7.8), but the scrub soil was slightly lower in calcium carbonate. The most important differences were in the levels of phosphorus (P) and nitrogen (N): the scrub soil was nearly twice as rich as the grassland soil in inorganic P; it also had more nitrate and a far greater capacity to release available N. It was certainly the abundance and availability of these elements that produced the vigorous weed growth after scrub removal. Evidence of the source of the additional P was found by hanging muslin bags in the scrub on the Devil's Ditch and collecting fallen leaves, twigs and fruits of several species of bushes. In general it was found that much additional P reaches the ground in leaf litter under bushes and that the annual P load on scrub soil is about four times that on grassland soil. Another factor may be the capacity of the deeper-rooting scrub plants to transfer P from the subsoil to the topsoil.

In the spring of 1974 the first attempt at reinstating grassland was made on the south-west-facing slope of the Devil's Ditch, by sowing seed of Upright Brome which had been collected the previous summer from the old well-established grassland of the Galley Hill area of the Devil's Ditch. The grass seed was sown under rabbit-proof frames of wire netting near the bottom of the slope on ground which had been cleared in 1971. This attempt was unsuccessful, as the germinating grass was overwhelmed by a huge number of seedlings of self-sown Prickly Sow-thistle germinating from the seed bank in the soil. A second attempt at sowing grass was made in spring 1975 – also a failure as the grass seedlings withered in the dry summer of that year.

In early September 1975, a large area on the south-west slope, 30 metres long and eight metres wide, was cleared of dense scrub, mainly Hawthorn and Wild Privet. The stumps of the Hawthorn were treated with ammonium sulphamate to promote rotting. The scrub on the opposite slope was also felled to minimise the danger of overheating in the clearing. Frames and wire netting were used to mark out 40 plots on this newly cleared land, each plot being 100 x 70 cm. The bare soil was raked to give a good tilth. Upright Brome seed collected that summer was raked into the topsoil at about 1 cm depth. The seeding rate was about 2,000 seeds per plot (that is about 3,000 seeds per square metre). Seeds of six species of forbs, also collected from plants on the Ditch, were sown into each plot along with the brome – Common Rock-rose *Helianthemum nummularium* (500 seeds per plot), Horseshoe Vetch (20 seeds per plot) and also Kidney Vetch *Anthyllis vulneraria*, Small Scabious *Scabiosa columbaria*, Greater Knapweed and Wild Thyme at intermediate seeding rates. Various coverings were used on different plots – wire netting alone, a cloth covering, a mulch of cut brome (intended to limit washing of the seedbed down the slope) and clear plastic sheeting (intended to create a warm, moist atmosphere for the seedlings). A sward of brome began to form on all plots within a month (i.e. by October); the forbs also germinated and were established within two months. Very few 'weeds' became established, except on the control plots which were deliberately left unseeded. The differences between the various covering treatments were only slight. During the winter the grass growth was slow, but in the following spring (1976) the brome grew well. The forb seedlings all disappeared in the dry summer of 1976, but the brome survived and made good growth in the wet autumn of that year.

Thereafter, every September the process was repeated on a newly cleared section of the south-west slope of the Devil's Ditch, by sowing Upright Brome seed into an area of a size determined by the amount of seed collected that summer (July–August). The hard work of grass seed collection and sowing was carried out by the Cambridge Conservation Volunteers, whose members came up to Galley Hill on the Devil's Ditch summer after summer in the evenings to collect the grass seed during the two or three weeks when it was ripe. The only year omitted was 1976; that summer's drought meant that no brome seed was available. The clearance started at the base of the slope and was continued upwards, the last section cleared being that alongside the ridgetop pathway. The last brome seed was sown in 1986. The covering and mulching procedures were not used in later years, as they were found to make little difference to the success of the grass seed germination. Seeds of forbs were not used after 1975, as their seedlings would have been swamped by the tall, vigorously growing brome.

The final set of observations on this south-west slope of the Devil's Ditch was carried out by another member of Dr Grubb's group, Robin Pakeman, in 1985 and 1986. These observations concerned the effect of the brome on the chemistry of the underlying soil. Since the brome had been sown in little by little, it was possible to take samples of soil which had been under it for different periods of time. In general it was found that in the soil under the brome the available nitrogen and phosphorus had both become reduced; furthermore, the longer the soil had been under brome, the greater was the reduction. The soil thus became more similar to the soil under old grassland on the Ditch, and so presumably more appropriate to grassland forbs.

The result

We now know, therefore, how to create grassland on a soil cleared of heavy scrub, giving a sward of which the soil gradually becomes better suited to the grassland flora. Raking in the seed to newly cleared land in the month of September ensures that the grass establishes itself before the weed population builds up; and the grass has put down deep enough roots by the following summer to allow it to survive drought conditions. The outcome of all these summer seed collections and September sowings is that the Devil's Ditch now has two stretches of new Upright Brome sward, one about 120 m long and the other about 80 m. The soil chemistry is known to be appropriate for the chalk-loving species, and a few plants of Salad Burnet *Sanguisorba minor* subsp. *minor*, Common Rockrose and Wild Carrot are now present. Incidentally, plants of certain grassland species (Wild Carrot, Common Rockrose, Field Scabious *Knautia arvensis* and Greater Knapweed) have been grown in horticultural conditions from seed collected on the Ditch and the mature plants then transplanted back into one of the reseeded sites. It should be possible by such a procedure to hasten the development of a species-rich flora in the new brome areas.

The future

These new grasslands are not self-maintaining. There is inevitably a regrowth of bushes, mainly Wild Privet and Dog-rose *Rosa canina* and some Blackthorn *Prunus spinosa*, and also some Ivy near the bottom of the slope.

Some Hawthorn also grows again, but not much since most of the stumps were successfully killed at the time of clearance. The new grasslands have been kept more or less open by constant efforts on the part of volunteers (and in one year by paid workers), who have cut back regrowth and raked it down the slope to the Ditch bottom. Sheep have grazed the old grassland of Galley Hill in the autumn, winter and early spring of 1991/92. Currently the absence of fencing means that sheep cannot be put onto the new grasslands; but there is a plan to graze these areas eventually, and it is to be hoped that stocking level and period of grazing will be carefully controlled so as to avoid over-grazing. It will be interesting to find out whether grazing keeps down the regrowth of privet and rose and maintains the sward without human intervention. The discovery of a method of making new grassland on a site of scrub, though scientifically interesting, will have done little in the long term for the landscape if the maintenance of such grassland is costly in money or labour.

Acknowledgement

The help and advice of Dr Peter Grubb in the preparation of this article are gratefully acknowledged.

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The search for Moor Barns Bath

Erica Swale & Hilary Belcher

The preparation of a Historical Flora of Cambridgeshire perforce includes the re-examination of sites from which plants have been recorded in the past. Many of these sites still exist unchanged, but others have been lost by subsequent development of buildings or by changes in land-use or physical conditions. In other cases again, it is necessary to refind sites 'lost' by name changes in recent times.

One of these is the cold bath and grove at Moor Barns, near Madingley, also known as Moor Barns Thickets or Coton Gate Copse, where several 18th- and 19th-century botanists recorded finds. Thus John Martyn (*c.* 1730?) wrote of fungi ("*Peziza parva* and *coccinea*") on "rotten sticks just by the cold bath at Moor Barns in January and February", and in the Lowe Herbarium in Warwick

Museum is a reference of 1837 to the "Bath Grove above the well". In a copy of his *Flora of Cambridgeshire* (1860), C.C. Babington made the annotation: "Moor Barns thicket is now grubbed up. It was by the right hand side of the road to Madingley (from Cambridge) just past the separation of that road from the St Neots road. A wild piece of woodland with a strong spring in it."

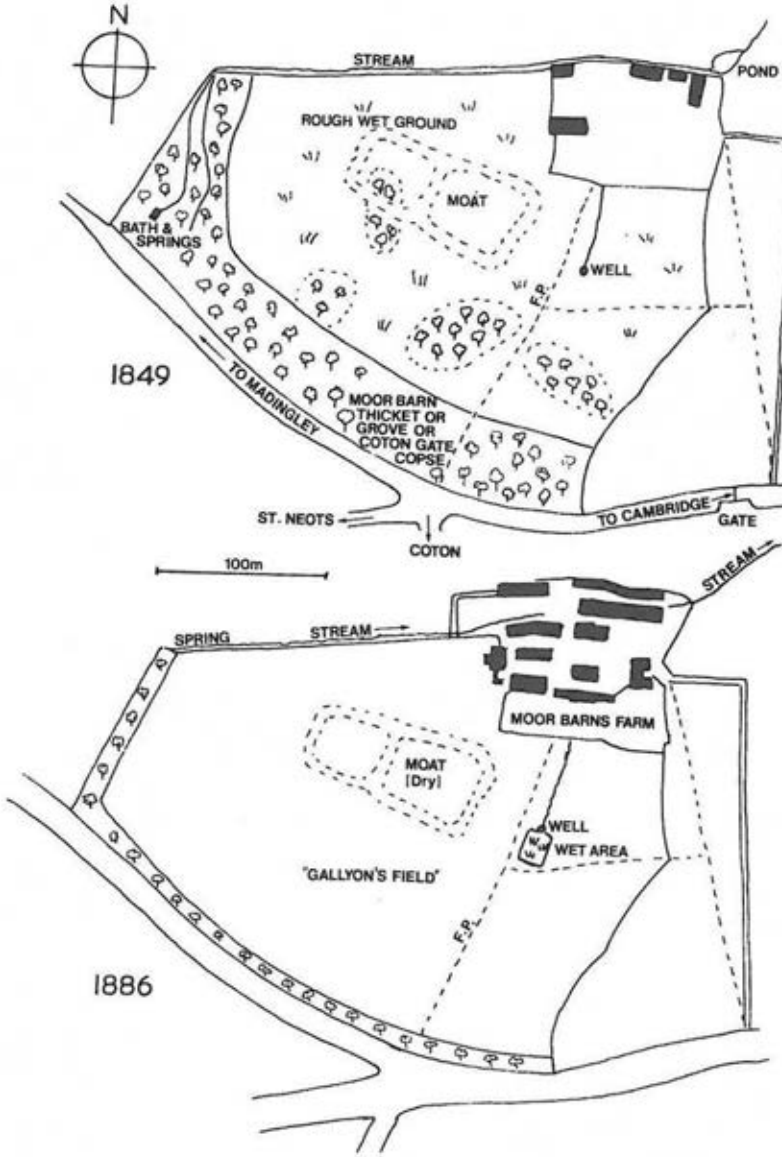
Maps published before 1860 (see Figure 1) show the thicket to have been a band of woodland about 40–55 m in depth widening to 120 m north to south at the western end, lining the north side of the St Neots road (now A1303) and the road from it to Madingley, from 52/410595 to 413594, with further patches in the adjoining field today known as Gallyon's (see Figure 2) lying between it and Moor Barns Farm (52/413596), previously occupied by Gallyon's Shooting School and now privately let for shooting.

We made a search for references to the bath in local topographical literature, starting with that in the Cambridge Collection. The Royal Commission on Historical Monuments (1968) has this to say regarding Madingley (p. 176): "There is a plentiful water supply. A powerful spring at N.G. TL 41135965, some 300 yds. W. of Moor Barns Farm . . . , doubtless supplied the 'famous Bath . . . thought to be one of the coldest in England' described by Cole"; and there follows a reference to the Cole (1781) manuscript.

We then examined a photocopy of this manuscript at the County Record Office. On p. 268 of Volume 19 William Cole wrote: "I can't finish this account of Madingley without mentioning the famous Bath in that Parish, about a mile from the Church on the Side nearest Cambridge, it being much frequented by the Students of Cambridge, and others, for their Health; it is generally thought to be one of the coldest in England."

Volume 9 of the Victoria County History (Wright & Lewis, 1989), states under Madingley (p. 166) that "in the 18th century a cold bath near Moor Barns was frequented by people from Cambridge", but the reference given in a footnote seems to be erroneous. Edmund Carter's *The History of the County of Cambridge* (1753, reprinted 1819), referring to Moor Barns, says: "Here is also a very good cold bath, much frequented by Cantabs, the water being very good and the walk thither very agreeable." It should be noted that bathing was very popular in the 17th and 18th centuries, four Cambridge colleges, Peterhouse, Pembroke, Emmanuel and Christ's having their own cold baths. The baths of the last two still exist, that at Christ's in its original state.

Further information was found in *Hobson's Conduit* (Bushell, 1938), which states (p. 98) that a charter dated 1444 granted King's College a piece of land 30 feet square called "Holwelle" at Madingley, belonging to Barnwell Priory, "near the grange called Morebernes belonging to the same convent . . . for the construction of a subterranean aqueduct to bring water to the college". In fact the charter, a copy of which is in the University Library, only gave permission for the transfer, and this never took place. The land remained in the possession of the Priory until the Reformation, when it passed to Trinity, so the aqueduct was never built. Interesting questions arise. Does "Holwelle" mean "holy well"? If so, is it "holy" because of some specific virtue or because it belonged to a priory, whose inhabitants would naturally wish to make the most of their possessions? "Holwelle" could also mean "a well in a hollow" or "a well with hollies", or it could be derived from a personal name. None of these last three meanings seems likely, leaving the first a strong possibility.



Figures 1 and 2: Maps of the Moor Barns area in 1849 and 1886: in the intervening years the farm was enlarged, the grove felled, the bath destroyed, and possibly land drains put in.

On the same page Bushell refers to Bryant (1933), whose *Samuel Pepys – the Man in the Making* (p. 35) tells how Pepys and his fellow undergraduates at Cambridge "walked the fields towards Madingley" and that on a hot summer's day in the year 1653 they "walked out from Cambridge to Aristotle's Well, where they slaked their thirst with great draughts of water from the conduit". Aristotle's Well, says Bushell, might either refer to Moor Barns or to Trinity Conduit Head, much nearer Cambridge. This is a group of shallow springs feeding a conduit, built by Franciscan monks in 1326 to supply their convent near the site of the present Sidney Sussex College, which supply was later taken over by Trinity College. However, this source of water was apparently always jealously guarded and was piped to a nearby tiny locked building still existing. The spring and cold bath at Moor Barns, however, and probably also the well described below, were open to visitors, perhaps even managed commercially, and were therefore a more likely destination for a student excursion. It would even seem possible that "Aristotle's Well" was a name given, possibly by students, to this well after the Reformation, when holy wells would have been out of favour. Moor Barns is about 3 km (just over two miles) from Great St Mary's Church, well within the three-mile limit imposed on undergraduates, and the walk there is up a gentle hill, with far-reaching views. Carter, cited above, called "the walk thither very agreeable".

In William Custance's map of 1811 the bath is shown and labelled as such. It lay in Moor Barns Thicket close to the road from Cambridge to Madingley and to a footpath from that road to Girton, at 52/410595. An estate map of Madingley at the County Record Office, annotated "clearly of pre-1810 and possibly pre-1793", shows a rectangle in the same place and also two streams, one from the bath and another running parallel close to the east, flowing northward through the wood as far as the track running eastwards to Moor Barns Farm. These features are shown in the sketch map in Figure 1. A map of 1833–35, in a notebook of William Coleman entitled *Localities of Plants in Cambridgeshire* in the Department of Plant Sciences library, shows the bath, but it is labelled "spring", with the two streams as before. In a tithe map of 1849 the bath and streams are again shown, unlabelled, and the grove is still standing. After 1860 Babington (as mentioned above) noted that the grove had been grubbed up, and in an Ordnance Survey 25-inch map of 1902, surveyed in 1886, the trees are reduced to a thin belt along the road and a rather thicker one at the western end, beside the footpath to Girton, while the bath and the two streams have vanished (see Figure 2), not reappearing on later maps.

This narrow belt of trees and scrub still exists, about 14 m wide by the footpath and 9 m wide along the road. The trees are mostly young, many having been replanted a few years ago when dead and dying elms were taken out, and none has a diameter of more than about 250 mm. They are mainly Hornbeam, with a few Beech and Field Maple. There is an extensive undergrowth of Snowberry *Symphoricarpus rivularis* and Wild Privet *Ligustrum vulgare*. In spring Bluebells *Hyacinthoides non-scripta* still occur, but they are soon submerged in a sea of Common Nettles *Urtica dioica*. Of the bath, which was situated by the road at the end of the strip beside the footpath, nothing whatever is visible.

At present the spring is at the northern, downhill, end of the north/south strip. In dry periods it emerges under a bramble patch from a pipe laid in about

1988, emptying into a ditch in which it flows past Moor Barns Farm and forms one of the two streams feeding the Washpit Brook. In wetter weather the spring water also breaks out a few feet away by the footpath to Girton, forming a marshy area. This is the spring mentioned by the Royal Commission on Historical Monuments and referred to earlier.

We then set out to find what remained of the well mentioned in the Lowe Herbarium. A letter of enquiry sent to Dr J.R.G. Bradfield, Senior Bursar of Trinity College, which owns Moor Barns Farm and its land, was passed by him to Mr C.E. Comins of Messrs Bidwell, who manage it for them. A letter from Mr Comins directed us to a "substantial underground brick structure" in the field where the grove used to stand, between the farm and A1303, and a stream flowing from it towards the farm. He suggested that we get in touch with Mr D. Harvey, the farm manager, who told us how to find it, at 52/413595.

The "brick structure" is a brick-lined well 1.37 m in diameter, with a dome-shaped upper part surfaced with concrete and capped by an octagonal slab, as shown in Figures 3 and 4. The floor shown in the latter, pierced by an iron pipe, seems to have been inserted during this century or last, to provide a now disused water supply to the farm and farmhouse. At present a trickle of water flows from a break at the base of the dome into a ditch leading down the slight slope towards the farm buildings. The ditch contains a dense growth of Lesser Water-parsnip *Berula erecta*. After several dry summers and the digging of the cutting for the A45 trunk road in 1979–80, the former strong flow from the well

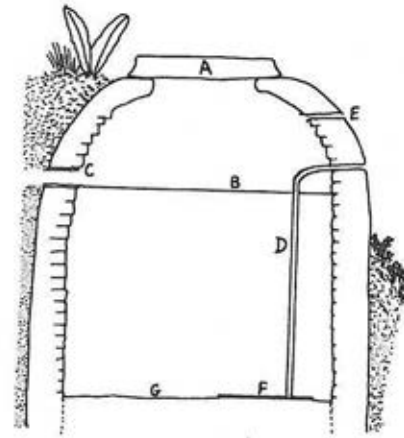


Figure 3: Drawing of the well-head from the ditch (June 1991)
Figure 4: Longitudinal section of the well-head to show the concrete cover (A); the level of water (B); field drains (C); pipe to erstwhile farm water supply (D); overflow pipe (E); iron basal plate (F); floor of unknown material, sounding hollow when tapped (G)

has become much reduced. Mr Harvey told us that he made the hole at the bottom of the dome and deepened the ditch to its present level in 1984. This was to stop the flooding of the field which was a long-standing nuisance after heavy rain.

Can this be the "Holwelle" of the King's College charter and perhaps the "Aristotle's Well" visited by Pepys? It is not marked on any of the maps we have seen, and there is no other well in the vicinity. Mr Harvey told us that the water is very good.

A mysterious rectangular area measuring 17 x 16 m lies immediately south of the well, on the opposite side from the ditch, and is surrounded by a strand of barbed wire. The soil here is very wet, even in dry weather, and bears numerous clumps of tall Soft-rush *Juncus effusus*, Great Willowherb *Epilobium hirsutum*, Tufted Hair-grass *Deschampsia cespitosa*, Blood-veined Dock *Rumex sanguineus* and thistles *Cirsium arvense* and *C. vulgare*.

A spring-line lies just to the south of the two roads adjoining the site of Moor Barns Thicket, where the chalky boulder clay overlies the impervious chalk marl and gault clay. In maps of 1849 and before, the two streams associated with the bath arise very near the road, indicating that the thicket as well as the adjoining field were wetter than at present owing to underground water. The streams disappeared when the greater part of the wood was felled and the bath was destroyed. Possibly drainage operations were also carried out at that time. As already stated, the spring now arises much lower.

Although there were springs in the thicket, the vascular plants recorded between 1727 and 1860 represent only a diverse meadow/woodland flora, and one must look at the records for fungi, algae and bryophytes to find species more directly associated with the springs and bath. The plants observed by John Martyn (all after his *Methodus* of 1727), Thomas Martyn (1763), Relhan (1785, 1786, 1820), Coleman (1833–35a, b) and Babington (1860) are listed in an appendix, for which we are indebted to Gigi Crompton. Of the vascular plants, Hornbeam *Carpinus betulus* and Bluebell *Hyacinthoides non-scripta* can still be found, while Spurge-laurel *Daphne laureola* persists a little way down the slope, in the strip of woodland running down to Wrangling Corner. Margaret Howe has seen Bee Orchids *Ophrys apifera* on a higher part of Gallyon's Field. It is a little surprising to see Gorse *Ulex europaeus* recorded from a presumably wet habitat near the spring. The Oxlips "*Primula elatior*" were probably the hybrid False Oxlip (see p. 34).

Among the old records of bryophytes, "*Sphagnum cauliferum*", listed by John Martyn (*c.* 1730?), has long been a puzzle; but according to Mark Hill, a *Sphagnum* specialist, this is synonymous with *Cryphaea heteromalla*, usually found as an epiphyte on Elders near water, but now very rare in Cambridgeshire. Other records of special interest are of *Leucodon sciuroides* and *Climacium dendroides*, both first noted by Thomas Martyn (1763). *Rhynchostegium riparioides* and *Fontinalis antipyretica* indicate permanent water, but these have vanished with the bath and streams, as have the two or three recorded freshwater algae.

We should welcome any further details which may perhaps be known to readers. The bath and the (holy?) well in particular may be worthy of future investigation by local historians. The bath may be found of interest in the context of the several 17th- and 18th-century baths around Cambridge.

Acknowledgements

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Appendix (compiled by G. Crompton)
Eighteenth- and nineteenth-century records of vascular plants, mosses and liverworts from the Moor Barns area

Note: Latin names used by the authors themselves have been given (in inverted commas) only where this seemed necessary. All Thomas Martyn's (1763) records are listed in his *Herbationes Cantabrigienses* (13 botanical excursions) as "In and near Moor-Barns Thicket".

Allium vineale Moor Barns (Babington, 1860).

Apium graveolens Coton Copse water near the farm, 1834 (Coleman, 1833–35a). Coton-gate Copse water, by the farm-house (Coleman, 1833–35b).

Arctium ?pubens ("*A. tomentosum* Pers.") Moor Barns (Babington, 1860).

Athyrium filix-femina Near the water in Moor Barns Thicket; W.H. Coleman (Babington, 1860).

Carex sylvatica Coton Gate copse (Coleman, 1833–35b). Moor Barns Thicket (Babington, 1860).

Carpinus betulus Moor-Barns (T. Martyn, 1763). Moor-barns-Thicket (Relhan, 1820). Moor Barns Thicket; R. Relhan (Babington, 1860).

Conopodium majus ("*Bunium flexuosum* Wither.") Field by Moor Barns (Babington, 1860).

Cruciata laevipes Moor-Barns (T. Martyn, 1763). Moor-barns (Relhan, 1820). Moor Barns (Babington, 1860).

Dactylorhiza fuchsii ("*Orchis maculata* Linn.") Coton-Gate Copse (Coleman, 1833–35a, b). Moor Barns (Babington, 1860).

Daphne laureola Copses extending from Coton-gate Copse towards the Huntingdon Road, 1834 (Coleman, 1833–35a, b). Between Moor Barns and Huntingdon road; W.H. Coleman (Babington, 1860).

Dryopteris filix-mas Farther end of Coton-gate copse, beyond the water, 1835 (Coleman, 1833–35a, b). Near the water in Moor Barns Thicket; W.H. Coleman (Babington, 1860).

Festuca gigantea Moor Barns Thicket (Babington, 1860).

Filipendula vulgaris Moor-Barns (T. Martyn, 1763). Moor-Barns (Relhan, 1820). Moor Barns; J. Martyn [error for T. Martyn?] (Babington, 1860).

Geranium pratense Moor-Barns (T. Martyn, 1763). Moorbarns Thicket; J. Martyn [error for T. Martyn?] (Babington, 1860).

Hyacinthoides non-scripta Moor-Barns (T. Martyn, 1763). Moor-barns Thicket (Relhan, 1820). Copse at Coton Gate, 1834 (Coleman, 1833–35a, b). Moor Barns (Babington, 1860).

Hypericum hirsutum Coton Gate Copse (Coleman, 1833–35b). Moorbarns Thicket (Babington, 1860).

Inula helenium Moor Barns (Relhan, 1820). Moor Barns; R. Relhan (Babington, 1860).

Listera ovata Coton Gate Copse, 1833 (Coleman, 1833–35a, b).

Lithospermum officinale Moor Barns (Babington,1860).

Mentha x *piperita* (*M. aquatica* x *M. spicata*) Coton Copse, in the hollow by the water, 1834 (Coleman, 1833–35a, b). Wet hollow in Moor Barns Thicket (Babington, 1860).

Ophrys apifera Moor Barns (Relhan, 1820). Copse at further end of Moor Barns Thicket (Babington, 1860).

Orchis morio Flore albo [With white flower] at Moor barns (J. Martyn, annotation in his copy of Ray, 1660). Flore albo, Moor-Barns (T. Martyn, 1763). Moor Barns (Babington, 1860).

Primula ?x *tommasinii* (*P.* x *polyantha*, *P. veris* x *P. vulgaris*) ("*P. elatior*") Coton-gate Copse, 1834 (Coleman, 1833–35a, b).

Ranunculus auricomus Moor-Barns (T. Martyn, 1763). Moor-Barns Thicket (Relhan, 1820). Coton-gate Copse, 1835 (Coleman, 1833–35a). Moorbarns Thicket (Babington, 1860).

Rhamnus catharticus Green lane by farm-house at Coton copse, 1834 (Coleman, 1833–35a). Green lane by the farm house behind Coton-gate Copse (Coleman, 1833–35b). Moor Barns; W.H. Coleman (Babington, 1860).

Rosa arvensis By Madingley Wood and Moor Barns (Babington, 1860).

Sanicula europaea Moor Barns Thicket (Relhan, 1820). Coton gate copse, 1834 (Coleman, 1833–35a, b). Moor Barns Thicket (Babington, 1860).

Smyrnium olusatrum In a copse in the angle between the Coton-gate copse Water & the 2nd road to Girton (viz. that leaving the Huntingdon Road at 2.5 miles), 1835 (Coleman, 1833–35a). Girton, in a copse in the angle between the Rd. and the Coton-gate Copse water (Coleman, 1833–35b).

Trifolium ochroleucon Moor barns Closes (J. Martyn, annotation in his copy of Ray, 1660).

Ulex europaeus Near the spring in Moor Barns Thicket (Babington, 1860).

Viola hirta Moor Barns (Relhan, 1820). Moor Barns; R. Relhan (Babington, 1860).

Amblystegium serpens Moor-Barns (T. Martyn, 1763).

Climacium dendroides Moor-Barns (T. Martyn, 1763). Moor-Barns (Relhan, 1785, 1820).

Cryphaea heteromalla ("*Sphagnum cauliferum*") In Moor Barns Grove (J. Martyn, *c.* 1730?). ("*Sphagnum arboreum*") Moor-Barns (T. Martyn, 1763).

Fissidens bryoides or *F. incurvus* ("*Hypnum/Dicranum bryoides*") Moor-Barns (T. Martyn, 1763). Moor-barns Grove (Relhan, 1785). Moor Barns Grove (Relhan, 1820).

Fontinalis antipyretica In the spring-head of the Coton copse water, 1835 (Coleman, 1833–35a).

Homalothecium (*Camptothecium*) *sericeum* Moor-Barns (T. Martyn, 1763).

Leucodon sciuroides Moor-Barns (T. Martyn, 1763: first record for Cambs). Moor-barns (Relhan, 1785).

Phascum cuspidatum var. *cuspidatum* ("*Phascum acaulon*") Moor-Barns (T. Martyn, 1763).

Physcomitrium pyriforme Moor-barns (Relhan, 1786). Moor Barns (Relhan, 1820).

Plagiomnium rostratum (*Mnium longirostrum*) Watery Places. Near Madingley Bath (Relhan, 1820: first record for Cambs).

Rhynchostegium (*Eurhynchium*) *riparioides* ("*Hypnum repens triangularibus minoribus foliis, pediculis & capitulis brevioribus & tumidioribus, majus*") In Moor Barns Grove; Mr Davies (J. Martyn, *c.* 1730?). ("*Hypnum ruscifolium*") On the Planks of Water-Mills, and on Stones in Water. Madingley Bath (Relhan, 1820).

Schistidium apocarpum (*Grimmia apocarpa*) Moor Barns (Relhan, 1820).

Thamnobryum (*Thamnium*) *alopecurum* Moor-Barns (T. Martyn, 1763).

?*Thuidium tamariscinum* ("*Hypnum proliferum*") Moor-Barns (T. Martyn, 1763).

Aneura (*Riccardia*) *pinguis* On the sides of Madingley Bath (Relhan, 1785: first record for Cambs). Near Madingley Bath (Relhan, 1820).

Frullania dilatata Moor-Barns (T. Martyn, 1763: first record for Cambs).

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New water bodies at Wicken Fen

J.M. Lock & T.J. Bennett

During the last five years a number of new water bodies have been created on the National Trust's property at Wicken Fen, and some older ones have been enlarged, deepened or modified. This paper attempts to provide a record of the dates of these works so that future studies of succession in plant and animal communities can be based on firm foundations. The various works are here described in chronological order, and their positions are marked on the map which accompanies this paper.

1. The Educational Area (Compartment 33)

These two ponds were dug in May 1986 in response to concern about possible damage to the various brickpit pools from excessive pond-dipping by schoolchildren, as well as about potential problems arising from unintentional cross-transfers between pools which tend to have distinct faunas. One is about 20 x 1 m and holds water about 1 m deep at its maximum. It has dried out in

the driest summers. It is heavily used for pond-dipping. Nothing was introduced, but it rapidly developed a rich and varied fauna and flora. The other is about 20 m square and was designed to slope from dry land to a depth of 2–3 m at its deepest. Unfortunately the clay, which here lies beneath only 1–1.5 m of peat, began to cave in during the digging, and the deepest areas were back-filled to avoid disaster. The deepest part is thus only about 1 m deep and the intention of the pool, to demonstrate hydrosere zonation, has never been fully achieved. The pool has been dominated for several years by *Chara*. Concerns about a reduction in the diversity of catches during pond-dipping, due to a combination of very low water levels and over-use, led to the excavation of three further ponds in this area during August 1991. All three are approximately 20 x 5 m and about 1.5 m deep. They lie along a line in the same orientation as the 1986 pond. In order to ensure that they too do not dry out, they have been linked to each other, and to a re-excavated ditch which joins Wicken Lode, with pipes of 110 mm diameter.

2. Howe's Bank/Spinney Bank (west end)

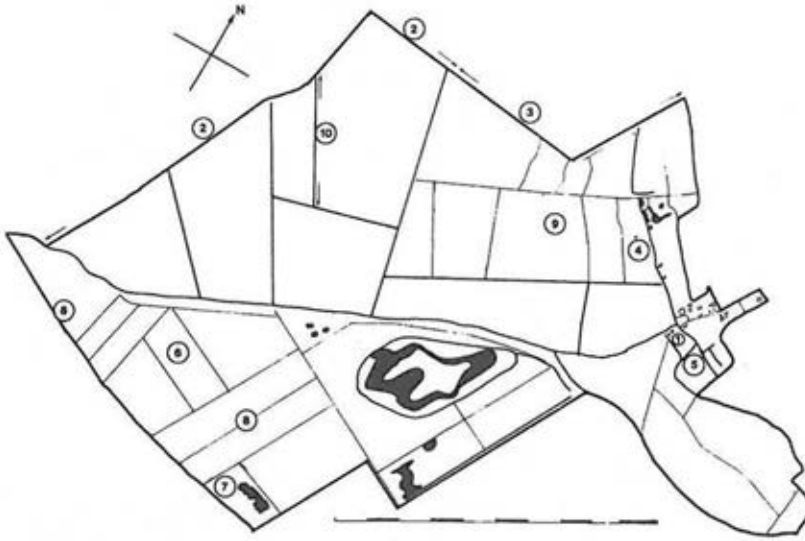
The weakness of this bank was clearly demonstrated in 1982, when work on the deepening of New Dyke led to a rapid rise in water level inside the bank and copious leakage through it. An agreement was reached with Anglian Water (now the National Rivers Authority) to render the bank sound and waterproof. To achieve this, the bank was raised and a polythene membrane inserted. The material for raising the bank was dug from inside the Fen, producing a wider and deeper ditch than the former Howe's Dyke. The new bank partially covered the old ditch line, and the present ditch is thus essentially new. The old ditch had last been dug out, by hand, in 1947–48. The present works began at the western end in October 1986 and were completed in January 1987. They do not connect with Drainers' Dyke.

3. Spinney Bank (east end)

Continuing and completing the waterproofing of the northern side of the Fen, this ditch was dug out and widened, and the bank was strengthened and waterproofed along most of its length with a polythene membrane, between November 1988 and April 1989. In this case the dyke was joined up, as it originally had been, to Drainers' Dyke. Colonisation was rapid, particularly at the eastern end, with *Glyceria maxima* covering the whole width of parts of the ditch by late 1990. In November 1991 the entire length was completely 'slubbed out' and reprofiled by the N.R.A. in an attempt to restore it to its intended specification. A further effect of the work is that the ditch running towards the Fen from Spinney Abbey Farm now flows into the Spinney Bank ditch, so that any enriched run-off that it may carry does not enter the Fen proper.

4. Engineers' Craters

These pools, in front of the hide on the Boardwalk, were made in March 1987 by the Royal Engineers. Three charges, each of 60 lb, were detonated simultaneously at a depth of about 2 m to produce three interlinked craters. These have subsequently been considerably enlarged and tidied up by Fen staff and volunteers and now hold water at all but the very driest times.



Map of Wicken Fen showing locations of works described in this paper

5. Ditches in and around the Education Area (Compartment 33)

These were dug out in August 1988. Most of them already existed but they were deepened and widened. The cross ditch was dug, with the intention of providing a clay-bottomed ditch for comparison with the peaty ones on the Fen itself, but it has held water only in the wetter parts of the year. The bare clay banks are an excellent site for Brookweed *Samolus valerandi* and the moss *Physcomitrium pyriforme*. One of the older ditches produced a dense stand of Fine-leaved Water-dropwort *Oenanthe aquatica*, of which only a single plant has otherwise been seen on the Fen in recent years, also by a recently-dug ditch.

6. The Reed Field ditch system (Compartments 51, 52 & 53)

In March and April 1989, after the reed harvest, the old ditches in the Reed Field were cleared and additional ditches excavated, incorporating a number of short branches (blind spurs). The intention was to create more open-water habitat within the Reed Field for duck and it was also hoped to improve the site as a habitat for Bitterns. Many of the ditches dried out in the dry summers of 1989, 1990 and 1991, but not before developing fine stands of Greater Bladderwort *Utricularia vulgaris*.

7. The Borrow Pit (Compartments 42 & 87)

The National Rivers Authority scheme, outlined by Lock (1991), involved the winning of a large amount of clay (70,000 m^3) for raising and strengthening banks. Originally it had been intended to bring this from Burwell Clay Pit, but, on the suggestion of the Local Management Committee, it was dug from an area

of Adventurers' Fen close to the old 'Sappers' Pond'. This pit was about 7 m deep over much of its area, and in Gault Clay throughout, possibly just penetrating the Upper Greensand at its deepest point. The Gault Clay was rich in fossils of belemnites, ammonites and bivalve molluscs. The digging was carefully planned so as to leave islands, one of which was surfaced with gravel, and the whole area was subsequently landscaped in order to provide a shoreline of varying gradients. The pit was dug between August and November 1989 and was flooded from Commissioners' Drain in December 1989. Fish entered with the inflow.

8. Pools and ditches in the N.R.A. scheme

As part of the N.R.A. scheme, Commissioners' Drain was widened over part of its length, adjacent to Evans' Fen and the Reed Field. Much of the original bed remained. A new ditch was cut between Rothschild's Lapwing and the Conservation Reedbed. This ran through gravel for much of its length, and a portion of an antler of a Red Deer *Cervus elaphus* was recovered from the gravel.

9. Experimental peat-diggings (Compartment 18)

These were made adjacent to the Boardwalk. The first was dug in 1989 and was relatively unsuccessful because it ran at right angles to the old peat-digging ridges. It now holds water only in the winter. That made in 1990 was longer, deeper and generally more successful. Annual diggings to extend the system are planned.

10. North Dyke (Compartment 72)

For many decades the line of this dyke has been marked only by a shallow depression. An essentially new water body was created in November 1991 when the dyke was excavated from both sides. The southern bank was profiled to a traditional steep 'batter', but on the north side a more gentle, stepped slope was made to encourage colonisation by emergent vegetation. The depth is about 1.5 m along most of its length, and the top width is about 4 m. At the northern end, shallow water links the new dyke to the peripheral Howe's Dyke, while at the other end a 110-mm pipe can be used to let in water from Cross Dyke.

Various other ditches, dykes and drains on the Fen were cleared during this period, but this was part of the regular maintenance schedule. The water bodies listed above are the main new works during the period.

Acknowledgements

Few of the works listed would have been possible without the generous support of Anglian Water and its successor, the National Rivers Authority, the Nature Conservancy Council (now English Nature), the World Wide Fund for Nature and the National Trust. The National Trust's staff at the property helped in many ways.

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The distribution of the Oxlip *Primula elatior* (L.) Hill in Cambridgeshire

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Introduction

The Oxlip *Primula elatior* (L.) Hill is one of the best known Cambridgeshire plants. It combines three attributes which lead botanists to take a special interest in a species – aesthetic appeal, rarity value and academic interest. Flowering Oxlips in the spring attract many people who would not even describe themselves as botanists to the county's boulder-clay woods. The very restricted distribution of the plant in Britain means that more committed botanists have to travel to Cambridgeshire or to the adjacent counties to see it. And the fact that in parts of its range the Oxlip completely replaces the Primrose *Primula vulgaris* Hudson, hybridising with that species when it comes into contact with it, has provided great scope both for academic research and for phytogeographical speculation.

Despite the popular and academic interest in the Oxlips of Cambridgeshire, there is no published list of the woods in which they grow. Oxlips have been studied in detail in the western Cambridgeshire woods, but the more numerous eastern woods have been comparatively neglected. The fact that in this area Oxlips grow in almost all woods, in the absence of Primroses, has apparently dissuaded botanists from attempting to compile a complete list of sites. This paper presents the results of a survey of Oxlip sites in the vice-county of Cambridgeshire (v.c. 29) in 1991–92, setting them in the context of earlier records.

The Oxlip in Europe and Asia

The Oxlip is one of the three British and European species in *Primula* subgenus *Primula*, the others being the Cowslip *P. veris* L. and the Primrose *P. vulgaris* Hudson. It is a widespread species, extending from England east through Europe to the Altai mountains of central Asia. The species is a variable one, and Smith & Fletcher (1948) comment that "the literature dealing with the plant is profuse and names have multiplied exceedingly". Populations differ in the shape, hairiness and rugosity of the leaves, the length of the calyx, the shape of the calyx lobes, the number of flowers in the inflorescence, the diameter of the corolla and the shape and size of the capsule. Smith & Fletcher recognise a total of nine subspecies. Some of these sound very different from the British plant: the eastern subsp. *pallasii* (Lehm.) W.W. Sm. & Forrest, for example, has glabrous leaves which gradually narrow into the petiole rather than abruptly contracted, pubescent leaves. Later authors (e.g. Valentine & Lamond, 1978) have included the purple-flowered *P. amoena* Bieb. within *P. elatior*, as subsp. *meyeri* (Rupr.) Valentine & Lamond, thus increasing the range of variation still further. Valentine (1972) distinguishes six subspecies of *P. elatior* in Europe, of which subsp. *elatior* is the most widespread.

In Europe the Oxlip occurs in a range of habitats. In western Europe it is a lowland plant, but further east it ascends into the mountains, reaching 2,645 m

in the Alps and 3,300 m in Turkey. In some areas *P. elatior* is primarily a montane plant; in Poland, for example, the range of the upland Oxlip differs from, but overlaps with, that of the lowland Cowslip (Valentine, 1966) and in Turkey Oxlips are usually found above 1,800 m, only rarely descending to 1,300 m (Lamond, 1978). In Europe Oxlips grow in woods or grassland, usually over damp or wet, at least mildly basic soils. The species occurs in many different plant communities. In central Europe, for example, its habitats include Oak–Hornbeam woods over wet soils in the Upper Rhine; Beech woods over deep neutral loam and over limestone; montane plateau fir woods over rich brown-earth soils where the main trees are *Abies alba* and *Picea abies* with *Acer pseudoplatanus* and *Fagus sylvatica*; subalpine spruce woods over limestone near the tree-line at 1,270–1,500 m; montane and subalpine *Trisetum flavescens* meadows where Oxlips are plentiful and are one of the plants which distinguish these communities from the *Arrhenatherum*-dominated grasslands; and montane *Molinia* meadows where both Oxlips and *Anemone nemorosa* are able to grow because *Molinia* does not come into leaf until late in the spring (Ellenberg, 1988). In Turkey Oxlips grow in marshy alpine meadows, on stream-banks, on rocky slopes and stable scree, on rock ledges, and in turf by melting snow-patches (Lamond, 1978).

The Oxlip in Britain

The first localised records of Oxlips in Britain were made by Ray (1660). He recorded *Primula veris elatior pallido flore* "in Kingston and Madingley woods abundantly and elsewhere". Oxlips are still present in Kingston Wood, and there is no reason to doubt the record from Madingley Wood. None of the taxa with which Ray might have confused the Oxlip would be likely to grow in abundance in a wood.

Subsequent British botanists, living in areas from which *P. elatior* was absent, equated this plant, which was described from continental Europe, with the 'False Oxlip' *P.* x *polyantha* Miller (*P.* x *tommasinii* Gren. & Godron), a similar plant which is actually a hybrid between the Cowslip and the Primrose. Withering (1776) described the Oxlip as a plant of "high barren pastures"; this was based on a plant he had seen in Shropshire and misidentified (cf. Withering, 1787). Although the true *P. elatior* was drawn by Sowerby for *English Botany*[1], Smith's accompanying text dealt with the False Oxlip (Smith, 1799). In this text, Smith suggested that the plant might be a hybrid resulting from the fertilisation of a Primrose with Cowslip pollen. He repeated the possibility that "*P. elatior*" was a hybrid in *The English Flora* (1824), but his readers cannot have been encouraged by the comment that "having often, perhaps, been confounded by the umbellate variety of the Primrose, its history and true nature have become the more obscure". Hooker (1830) summed up the distribution of the Oxlip as "not common: more rare in Scotland. About Dublin . . .".

This confusion was cleared up during the 19th century in three stages. In the 1840s it was established (largely as a result of a protracted correspondence in the *Phytologist*) that the true Oxlip did occur in eastern England, but that most plants hitherto recorded as Oxlips were another taxon, which appeared to be the Cowslip–Primrose hybrid. Charles Darwin (1869) conducted a detailed series of crossing experiments, which left him in no doubt that *P. elatior*, *P. veris* and

P. vulgaris were distinct species and that the False Oxlip was the hybrid *P. veris* x *P. vulgaris*. Finally, the detailed distribution of *P. elatior* was investigated by R. Miller Christy, initially in Essex and later in East Anglia as a whole (Christy, 1884, 1897). Christy's second paper reviewed the taxonomic evidence and presented a detailed map of the British distribution of *P. elatior*. It effectively marked the end of the period of confusion.

Subsequent research has confirmed Christy's conclusion that the Oxlip has a restricted distribution in Britain, consisting of a larger eastern and a smaller western area separated by the valley of the River Cam. Christy himself (1922, 1924a) later reported outlying populations beyond the northern and western edges of the eastern Oxlip area, and Simpson (1982) has shown that the boundary of the eastern area extended further north than Christy realised. In recent years Oxlips have been discovered in several woods in S.E. Buckinghamshire and the adjacent part of Hertfordshire (Mabey & Evans, 1980, 1989). These would represent a major extension of the native range of the Oxlip, but the sites have not been described in any detail in the botanical literature, and there is some doubt whether the populations are native or introduced. The known British distribution of the Oxlip is mapped in Figure 1.

The Oxlip in eastern England is a rather uniform species. It shows little of the variation found in its wider European range, and all the British plants are referable to subsp. *elatior*. However, a degree of cryptic polymorphism has been demonstrated in the Cambridgeshire populations by Valentine (1970). Populations in different woods appear to show consistent differences in such variables as the size and shape of their leaves and the time of flowering, which would merit investigation (Dr Oliver Rackham, *in litt.*, 31.12.1991).

The ecology of Oxlip was first studied in detail by Adamson (1910, 1912) in his classic study of Gamlingay Wood. Subsequent contributions which have developed and extended Adamson's work include those of Abeywickrama (1948), Martin (1965, 1968), Rackham (1980) and Whale (1983a, b; 1984), many of them based on studies in the western Cambridgeshire woods. In East Anglia Oxlips are usually found in woods over calcareous boulder clay, growing (often with *Filipendula ulmaria*) in the wettest areas which are subject to seasonal flooding. Oxlips are able to grow in these waterlogged areas because the vigour of the flood-sensitive *Mercurialis perennis*, which forms dense swards in the drier areas, is reduced. Although it is flood-tolerant, Whale (1983a, 1984) suggests that the Oxlip is more drought-sensitive than related *Primula* species.

It is one of the most paradoxical features of the Oxlip that, although it is usually found in woods in Britain, it is ill-adapted to life in the dense shade of undisturbed woodland and only flowers in profusion when felling leads to an increase in light levels. The boulder-clay woods have traditionally been managed as coppiced woods with scattered standards, and the massed flowering of Oxlips in the second year after coppicing has been one of their best known features. Although the traditional management has fallen into disuse almost everywhere, many Oxlip woods have been acquired by conservation bodies and coppicing has been revived, often with volunteer labour. However, the spectacular display of flowering Oxlips often fails to develop, being nipped in the bud by the depredations of grazing deer.

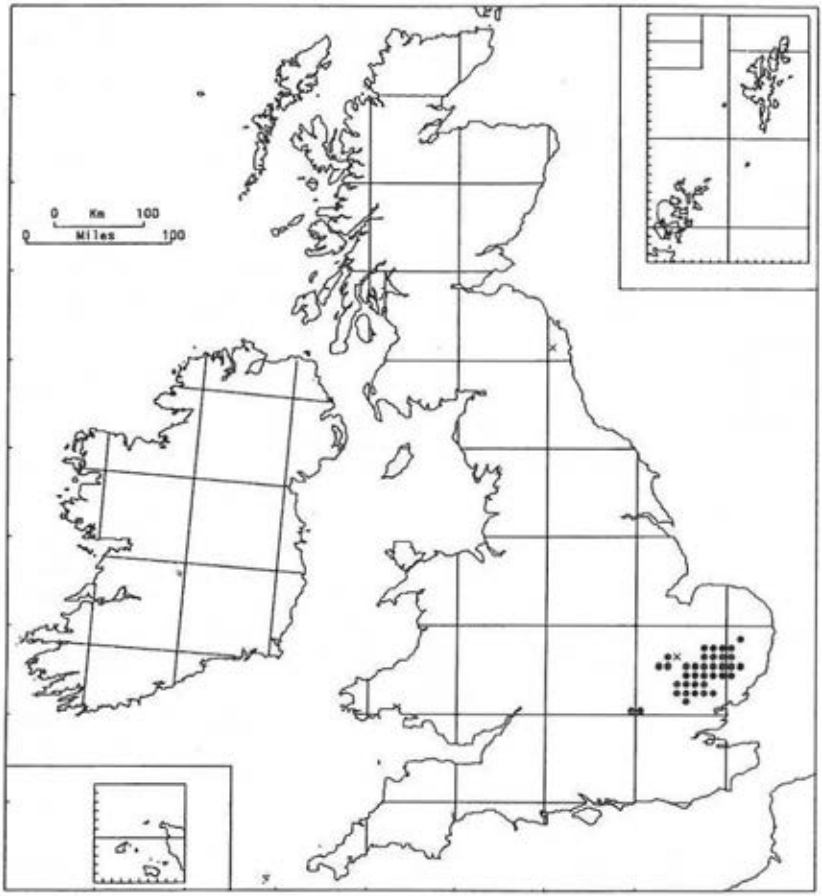


Figure 1: The distribution of the Oxlip in the British Isles. Records are plotted in the 10-km squares of the national grid. Dots denote squares in which plants have been recorded as apparently native since 1950; crosses denote squares in which only introduced plants have been recorded. There are no squares for which there are records made before but not after 1950.

The woods in which Oxlips grow have featured prominently in the growing body of literature on the historical ecology of British woodland, and detailed descriptions of West Cambridgeshire sites are given in the works of Rackham (1969, 1975, 1976, 1980, 1990, 1992) and Peterken (1980). Christy (1897) pointed out that the Oxlip "seldom, if ever, extends to new plantations", and more recent authors have produced a wealth of evidence to show that the Oxlip is one of the most reliable indicators of ancient woodland. It grows in sites

which are apparently primary woodland and in some ancient secondary woods. However, it is rarely found in hedges even in the vicinity of large woodland populations, and it only spreads very slowly into recent woods even when they are adjacent to ancient woods. The nature of the Cambridgeshire sites is discussed in more detail later in this paper.

The Oxlip is often thought of as an exclusively woodland plant in Britain. Clapham *et al.* (1962) describe its habitat as "woods on chalky boulder clay" and Stace (1992) says simply "woods on clay". Woods are certainly the main British habitat, but there is no doubt that at one time there were also significant Oxlip populations in damp meadows. At Great Bardfield in Essex, where the true Oxlip was rediscovered by 19th-century British botanists, Oxlips were described as growing "by thousands in the meadows . . . in one instance a meadow of about two acres is entirely covered by them, being a very mass of yellow bloom" (Doubleday, 1842). Botanists who went to Bardfield to see Oxlips in the next few years confirmed this habitat. William Borrer and Edward Forster found the plant in even greater abundance in a "wet hilly pasture" (Forster, 1844), and Bromfield (1849) found "some acres of meadow covered with it in full flower". Christy (1884) noted that almost all the sites in which Oxlips grew in the open in Essex were "low, moist and often swampy meadows composed of blackish, alluvial soil lying in a narrow strip along the banks of various streams and rivers"; most of these meadows were in the south-east part of the Oxlip's range in Essex. In Suffolk too, Oxlips have been recorded from damp meadows by streams and rivers; four such sites were described by Christy (1922, 1924a) and in the Rat valley near Stowmarket "up to about 1940 . . . the old pastures were often yellow with thousands of Oxlips" (Simpson, 1982). At a well-documented outlying locality at Dickleburgh in Norfolk, Oxlips grew amongst *Epilobium hirsutum*, *Filipendula ulmaria* and *Phragmites australis* over peat (Woodell, 1965). These open habitats have suffered greatly from agricultural improvement, and, as they have been drained and ploughed, Oxlips have become increasingly confined to woods.

The relationship of the Oxlip to the Primrose has been the subject of much study. Primroses are absent from much of the British range of the Oxlip, but when the two species meet they hybridise freely. Christy (1897) suggested that the "modest and retiring Oxlip is . . . being gradually hybridized out of existence by the more aggressive Primrose". Later botanists have been unable to find any evidence to support this hypothesis, but, if the value of a hypothesis is judged by the extent to which it stimulates further work, then this part of Christy's paper was certainly as valuable as those which have proved to be factually correct. Most field studies of hybridisation between Oxlips and Primroses have taken place in the West Cambridgeshire woods, many of which contain both species. When both Oxlips and Primroses grow in a wood they usually have different small-scale distributions, with Primroses growing on patches of more acid soil, on slopes, around the margin of the wood or in areas of secondary woodland (Rackham, 1980) and hybrids occurring where the two species meet. Detailed accounts of the relationship between the two species are given by Valentine (1947, 1948) and Woodell (1969). Cowslips and Oxlips rarely hybridise, and when hybrids do occur they are usually found only as one or two plants rather than in swarms. These hybrids have also been investigated by Valentine (1952, 1975).

Sources of Cambridgeshire Oxlip records

Sources of records, 1660–1990

The first localised records of Oxlips from Cambridgeshire are those of Ray (1660), which are also the first British records. Relhan (1785, 1802, 1820) does not give any localities for the Oxlip in his *Flora Cantabrigiensis*, simply regarding it as a plant of "Woods, and Hedges". There is no indication that Relhan realised that the Cambridgeshire Oxlip differed from that reported from the rest of the country, and Babington was surely right to conclude that he included both the true plant and related taxa in this entry. Similarly, the record from Bottisham in Leonard Jenyns's annotated copy of Relhan is almost certainly erroneous. The manuscript records of W.H. Coleman[2], made between 1833 and 1835, are also suspect. Webb & Coleman's *Flora Hertfordiensis* (1849) suggests that the authors were not happy about the identity of the true Oxlip even after the discussions published in the *Phytologist*: its treatment of the plant was described by Christy (1884) as very unsatisfactory. In the records below I have decided to accept Coleman's records from the known sites of Kingston Wood and Eversden Wood and that from Westoe Park. Although there are no other certain records from Westoe, a specimen of Henslow's from Bartlow confirms that it was present in this area. However, I do not think that it is safe to accept Coleman's records from Madingley Wood (the only record other than Ray's) and the nearby copses at Coton Gate (Moor Barns Thicket) and Whitwell. Significantly, Babington (1860) does not publish these records, citing Madingley Wood in italics as one of those localities "which rest solely upon the authority of the older botanists".

Records of Oxlips were included in Babington's (1860) *Flora of Cambridgeshire*, the first localised records for the county to be published for 200 years. Babington received Oxlip records from other botanists (particularly W.W. Newbould) while he was preparing this work; these are preserved in his manuscript in the Department of Plant Sciences, Cambridge, but he later saw Oxlips himself at most of the localities and the published book therefore reports them on his own authority. Records are also available in the copies of this Flora annotated by H.N. Dixon, W.H. Mills, C.E. Moss, W.M. Palmer and W. West, all now held in the library of the Department of Plant Sciences.

Christy (1897) first defined the British distribution of the Oxlip with precision. He carried out much fieldwork in tracing the boundary of its distribution "mile by mile, at no inconsiderable expenditure of time and trouble", but he only mentioned a few specific localities in his paper. Christy's herbarium is in the Passmore Edwards Museum, but the *Primula* specimens have apparently been mislaid and Dr C.W. Plant (pers. comm.) cannot trace any relevant manuscripts there.

The presence of Oxlips in individual sites was first systematically examined in Cambridgeshire in the 1930s. This was a period when a young generation of botanists was actively recording plants and noting records on the Cambridge Natural History Society's card index (now held in CGE). Many Oxlip localities were placed on record by J.L. Crosby, W.T. Stearn, T.G. Tutin, D.H. Valentine, E.F. Warburg and others. Valentine retained a life-long interest in the genus (cf. Valentine, 1974). The distribution of the Oxlip in Cambridgeshire was summarised by Evans (1939).

The brother and sister team of Doris and Harry Meyer undertook a detailed

survey of Oxlips and Primroses in the western boulder-clay woods from 1934 to 1938, apparently quite independently of the botanists recording for the C.N.H.S. Their results were exhibited at a B.S.B.I. conference in 1950, and a summary map published in the Conference proceedings (Meyer & Meyer, 1951). By 1950 they had begun a similar study of the larger eastern Oxlip area, but the results of this study were not published.

Botanical recording continued in Cambridgeshire in the 1950s, when the species in many 1-km squares were listed. Surprisingly few new Oxlip sites were located during this survey, but the continued presence of the plant in many of its known localities was confirmed by F.H. Perring and his collaborators. The results of this survey were summarised at a 10-km square scale in the resulting Flora (Perring *et al.*, 1964) and in the *Atlas of the British Flora* (Perring & Walters, 1962). The next systematic survey of the county, the B.S.B.I. Monitoring Scheme of 1987–88, was based on sample squares which, by chance, failed to include any of the main concentrations of Oxlips in the county.

Dr Oliver Rackham has been investigating the woods of Cambridgeshire since the mid 1960s, and in the course of his work he has recorded Oxlips in many woods. He has kindly extracted relevant records from his files. I have also incorporated into the text several of his comments on a draft of this paper (*in litt.*, 31.12.1991): these are followed by "(O.R.)".

Oxlip specimens from Cambridgeshire are held in many herbaria, and I have extracted records from **BM**, **CGE** and **LTR**. Herbaria are not very rewarding as a source of records, as almost all the specimens from the county have been collected at the well-known sites in West Cambridgeshire. None of the experts who have studied Oxlips have revised the material held by the major national herbaria, perhaps deterred by the fact that the distinguishing characters of the plants are "largely obliterated in the process of drying" (Christy, 1897). In some herbaria Oxlips and False Oxlips are still indiscriminately mixed in the *P. elatior* folder in a graphic demonstration of the confusion which once surrounded these taxa.

Only a fraction of Oxlip records will have found their way into the sources outlined above. Most observers who have seen Oxlips in the county will have been unaware of the existence of botanical recording schemes. Even those botanists who were themselves contributing to such schemes must often have concluded that it was not worth sending in Oxlip records, either because they knew that the presence of the plant at a site was well known or because they knew that no comprehensive list of sites was maintained. Most of these unsubmitted records would indeed have been of little significance, as they would have been made in the well-known western woods, but it is difficult to believe that the Oxlip had not been recognised previously in several of the smaller eastern boulder-clay woods in which it was first 'officially' recorded in 1991 or 1992.

The 1991–92 survey

In 1991 the Joint Nature Conservation Committee, in conjunction with the Institute of Terrestrial Ecology and the Botanical Society of the British Isles, launched a recording project to document the distribution of 'nationally scarce' species which, like the Oxlip, are not sufficiently rare to qualify for inclusion in

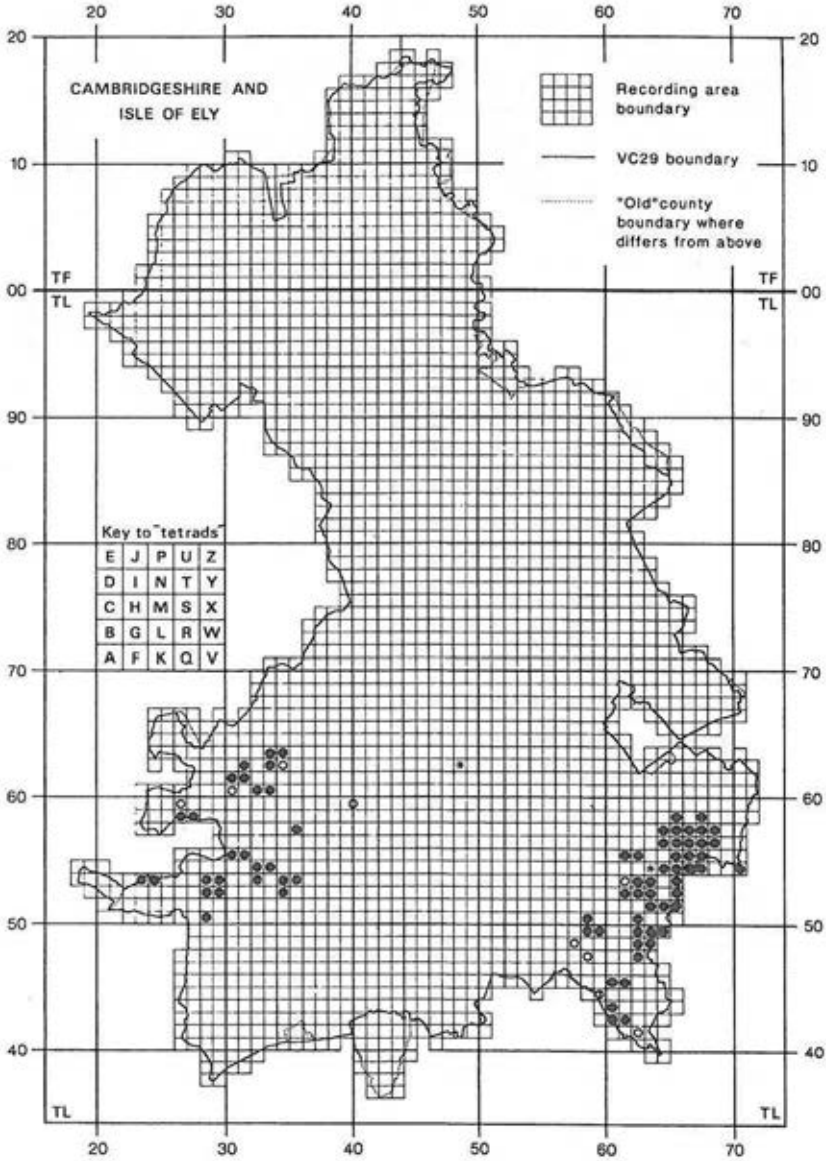
the Red Data Book (Perring & Farrell, 1983) but nevertheless are restricted to fewer than 101 10-km squares in Great Britain. As part of this project, Cambridgeshire recorders attempted to establish the distribution of the Oxlip at both a site and a 1-km square level. Mrs G. Crompton and I compiled a list of the recorded localities, and members of the Cambridgeshire Flora Group and colleagues at Monks Wood helped to revisit these and to survey other sites within the general area in which Oxlips are found. Recorders were asked to establish whether Oxlips were present at a site and, if so, to record the 1-km squares in which they grew. They were also asked to estimate the population size at each site. If an accurate count was impracticable, it was suggested that the population was estimated as 1–10, 11–100, 101–1,000 or over 1,000 plants. These were the standard categories suggested for use in the B.S.B.I. survey. It might have been desirable to distinguish Oxlip sites with over 10,000 and over 100,000 plants, but this would have involved much longer visits to the larger populations. Almost all the known Oxlip sites were revisited and several apparently new localities were discovered during the survey.

List of Cambridgeshire Oxlip localities

Layout of the list

The localities in which Oxlips have been recorded in 'old Cambridgeshire' (v.c. 29) are listed below in alphabetical order within the 10-km squares of the national grid. I have also included a single wood in which the hybrid between *Primula elatior* and *P. vulgaris*, but not *P. elatior* itself, has been recorded. Localities which are listed or mapped as ancient woods by Robinson (1987) are marked with an obelus (†) and those where the Oxlip is believed to be introduced are marked with an asterisk (*). The name of each site is followed, after a comma, by the parish(es) in which the site falls. Parcel numbers, taken from the relevant 1:2,500 O.S. plan, are given for woods which have no name. Grid references of small sites or the 1-km grid squares in which the larger sites lie then follow (in brackets). All sites lie in 100-km square TL (52). Oxlips may not be recorded from all of the 1-km squares in which a site lies. Selected records then follow, in chronological order. There seems little point in listing all known sightings. The first and last records from each site are always given. I have also included most records made before 1860, the date of publication of Babington's Flora. I have usually restricted subsequent records to a single record within each of the date periods 1860–1929, 1930–1949 and 1950–1990.

Figure 2 (opposite): The distribution of the Oxlip in Cambridgeshire (v.c. 29). Records are plotted in the 1-km squares of the national grid. Dots denote squares in which the species has been recorded as native in or after 1991; circles denote squares for which only earlier records are available. Records of introduced plants are mapped as asterisks, regardless of date. The record from Madingley Wood is plotted on the border between the two squares in which Oxlips may have grown, and the record from Westoe Park is plotted in 5944. Records from 6043, 6045, 6145, 6351, 6352 and 6857 were made in 1993; details are not given in this paper but will be published later. The records are plotted on a base map kindly provided by T.J. Bennett and Mrs G. Crompton.


CAMBRIDGESHIRE AND
ISLE OF ELY
Recording area boundary
VC29 boundary
"Old" county boundary where differs from above
Key to "tetrads"
E J P U Z
D I N T Y
C H M S X
B G L R W
A F K Q V
TF
TL
20
30
40
50
60
70
10
00
90
80

Literature references to publications which provide a detailed account of the site are given. I have also tried to cite at least one herbarium specimen from each site, although there are many sites from which no vouchers have been collected. The list of records ends with the results of the current survey. Negative records are only significant if they are stated explicitly; otherwise it cannot be assumed that those recording for the current survey searched all 1-km squares in the site. Details of each record are given in the following sequence: grid reference (usually at 1-km square level), recorder(s), date, estimate of population size and, where relevant, herbarium or literature reference. Dates in brackets are literature references, whereas dates without brackets are those when the plant was recorded.

The records listed below are summarised in Figure 2 as a 1-km square distribution map. One of the purposes of publishing this list is to flush out any records of Oxlips which have not found their way into the vice-county records. I should be very grateful if anyone who knows of Oxlips at a site which is not listed here could send the details to me or to Mrs G. Crompton or D.A. Wells, the B.S.B.I. vice-county recorders. We hope to publish any further significant records together with the results of additional fieldwork in a later issue.

Abbreviations and annotations in the list

†	A wood listed by Robinson (1987) as ancient
*	A site where Oxlip is known or suspected to have been deliberately or accidentally introduced by Man
C.D.P.	C.D. Preston
O.R.	O. Rackham
S.E.Y.	Miss S.E. Yates

List of localities

TL 25

†**Buff Wood, Hatley** (2750, 2850): D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); A.P. Conolly, 4.1937, **LTR**; D.H. Valentine, 1939, 1947 (Valentine, 1948); 2850, C.D. Pigott & S.M. Walters, 12.3.1951; M.H. Martin, 1962–64 (Martin, 1968); Rackham (1990); 2850, J.G. Murrell, 30.4.1992, *c.* 1,000 plants. The Oxlip areas are shown on a map plotted by O.R. and held in the reprint collection of the Department of Plant Sciences. There is no doubt that the area occupied by Oxlips, and probably the number of plants, has increased since they were mapped by Abeywickrama in 1947; this increase includes the appearance of a second Oxlip area (O.R.).

†**Eltisley Wood, Eltisley** (2658, 2758): D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); D.H. Valentine, 1939; R.H. Goode, 6.4.1950, **LTR**; F. Bell & O.R., 3.1967, a very large population, probably over 100,000 plants, occupying almost the whole interior of the recently coniferised wood; G.F. Peterken, 29.4.1969 (Peterken, 1970); both 1-km squares, P.E. Bellamy, 1.5.1991 & 1992, over 1,000 plants. Oxlips formerly grew in the meadow over ridge-and-furrow adjoining the wood on the N.E. side, but by 1967 the grassland had been improved and there were only a few Oxlips left (O.R.; G.F. Peterken, pers. comm.).

†**Gamlingay Wood, Gamlingay** (2353, 2453): W. West, 1892–96 (West, 1898); R.S. Adamson, 22.4.1908, 30.4.1909 & 4.5.1909, **BM**, cf. Adamson (1910, 1912); D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); "full of Oxlips" (Evans, 1939); 2353,

F.H. Perring & L.C. Frost, 22.5.1953; O.R., 1968 & 1991 (Rackham, 1992); both 1-km squares, R. Lawrence & P.E.G. Walker, 1992, 3,675 plants.

†**Hayley Wood, Little Gransden** (2852, 2853, 2952, 2953): W.W. Newbould (undated); Babington (1860); R.S. Adamson, 5.5.1909, **BM**; D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); D.H. Valentine, 9.4.1937 (Valentine, 1948); "full of Oxlips" (Evans, 1939); S.M. Walters, 28.4.1947, **LTR**, the plants drawn by Roles in Clapham *et al.* (1960); B.A. Abeywickrama, 1948, *c.* 4 million plants (Rackham, 1975); M.H. Martin, 9.1963 (Martin, 1968); O.R., less than 2 million plants, some colonising the secondary woodland of The Triangle and others on the edge of the disused railway line alongside the wood (Rackham, 1975); Rackham (1980); all 1-km squares, C.J. & S.M. Pumphrey, 1992, over 1,000 plants. Oxlips decreased in number (but not in area) between 1948 and *c.* 1977, most markedly in 1975–76 probably owing to a combination of drought and deer. Since then there has been a rapid increase within deer-fenced areas and a slow increase elsewhere; droughts since 1980 have had no evident effect (O.R.).

Turtlow Plantation, Croxton (2658, 2659): 262590, A.J. Kerr, 1966, as "a small patch . . . in woodland at Croxton Park" (Kerr, 1967); 263589, P.E. Bellamy & C.J. Pumphrey, 1992, less than 10 plants.

TL 35

†**Bourn Wood, Bourn** (3155): W.W. Newbould's record "between Long Stow and Bourn", confirmed by Babington (1860), may have been made here. West (1898) commented that it was still plentiful there. D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); O.R., 1982, *c.* 20,000 plants doing well in area felled and replanted after Dutch Elm Disease; C.J. & S.M. Pumphrey, 1992, over 1,000 plants; C.D.P. & S.E.Y., 10.5.1992, *Preston 92/6 & 7*, **CGE**. The medieval wood is the W. part; partial grubbing out of the wood in the 1960s separated it from later additions to the east. Oxlips are almost confined to the original wood (O.R.).

†**Eversden Wood, Great Eversden, Kingston & Wimpole** (3452, 3453, 3553): W.H. Coleman, 1834; W. Mathews, 4.5.1851, **CGE**; W.W. Newbould (undated); Babington (1860); A. Malins Smith, 6.8.1905; D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); "nearly as well off" as Hayley and Gamlingay Woods (Evans, 1939); 3452, F.H. Perring, 26.9.1955; 3453, F.H. Perring & L.C. Frost, 8.5.1956; O.R., 5.1966, abundant in about one-third of wood, implying 100,000–200,000 plants; all 1-km squares, R.G.H. Cant, 5.1992, over 5,000 plants, population apparently decreasing rapidly. For an analysis of the complex internal subdivisions of Eversden Wood and the parish boundaries which run through it, see Rackham (1980, 1990).

†**Hardwick Wood, Hardwick** (3557, 3558): W.W. Newbould (undated); Babington (1860); G. Goode, 4.5.1891, **CGE, LTR**; Christy (1897); D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); "nearly as well off" as Hayley and Gamlingay Woods (Evans, 1939); 3557, P.H. Oswald, 28.4.1952; Woodell (1969); Rackham (1980); O.R., 1983, over 100,000 plants; 3557, J. Benfield, 10.5.1992, over 1,000 plants. The northern third of the wood is recent (post-1880) secondary woodland (O.R.). Christy (1897) noted that Oxlips were present at one end of the wood and Primroses at the other; Meyer & Meyer (1951) mapped Oxlips in the S. part and Primroses in the N. part; Rackham found a single Oxlip and a single Oxlip–Primrose hybrid in the northern third in 1983; Benfield was unable to find Oxlips in the northerly 1-km square, 3558, in 1992. The western part of the southern two-thirds of the wood consists of areas added to the wood between the 17th and 19th centuries; it has almost no Oxlips but there are hybrids at its N. end (O.R.). Oxlips have probably increased in the ancient part of the wood in recent years as a result of

coppicing (O.R.). Primrose is a plant of the secondary parts of the wood (Rackham, 1980).

†**Hawk's Wood, Kingston** (3253): Oxlips are mapped in this wood by Meyer & Meyer (1951), although they do not actually name it. O.R., 6.1966, occasional; G. Crompton, J. & P. Reynolds, 5.4.1992, 11–100 plants.

†**Kingston Wood, Kingston** (3253, 3254, 3354): Abundant, Ray (1660); W.H. Coleman, 1834; W.W. Newbould (undated); Babington (1860); Christy (1897); G.C. Druce, 5.1906, **BM**, **CGE**; D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); 3253, F.H. Perring, 26.4.1956; O.R., 6.1966, rather local, abundant over about one-tenth of the wood in the middle and S.; all 1-km squares, G. Crompton, J. & P. Reynolds, 5.4.1992, over 1,000 plants.

†**Longstowe Home Wood and Park, Longstowe** (3055, 3056, 3155): Longstowe Park, A. Shrubbs, 22.4.1889, **CGE**; D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); Longstowe Home Wood etc., 3155, F.H. Perring, 27.4.1956; Longstowe Home Wood, O.R., 4.1967, dominant over about half the wood and very dense, perhaps over 100,000 plants; Longstowe Home Wood and nearby grassland in park N. of Longstowe Hall, 3055 & 3155, C.J. & S.M. Pumphrey, 1992, over 1,000 plants.

†**Madingley Wood, Madingley** (3959, 4059): Abundant, Ray (1660). Oxlips may have been exterminated when half the wood was grubbed out in the second half of the 17th century (Rackham, 1980). The only record since Ray's was made by W.H. Coleman[2]. He drew a sketch showing the cleared eastern half of Madingley Wood as four fields separated by strips of woodland (cf. Rackham, 1980, Figure 5.3). He labelled the N.E. field "A" and the S.E. field "B", stating that Oxlips grew between A and B (presumably in the woodland strip). For reasons discussed above, this record must be regarded as dubious.

†**Pincote Wood, Kingston** (3253, 3353): D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); 3253, J. & P. Reynolds, 3.5.1992, 101–1,000 plants.

Stinnage's Wood, Caldecote (3457, 3458): The hybrid *P. elatior* x *P. vulgaris* was recorded from this wood by T.G. Tutin & E.F. Warburg in 1940. There is no record of *P. elatior* from this wood; Meyer & Meyer (1951) mapped it as a wood with *P. vulgaris* but not *P. elatior*. O.R. has seen neither Oxlips nor hybrids here. The wood was not visited in 1991–92.

Toft Plantation, Toft (3557): O.R., 4.1975, nine colonies of Oxlip, Primrose and hybrids of which four were predominantly Oxlip; these had evidently originated by seed over a few feet from a pioneer individual. This wood was not visited in 1991–92.

TL 36

†**Elsworth Wood, Elsworth** (3061, 3161, 3162): D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); D.H. Valentine, 12.4.1938 (Valentine, 1948); 3161, H.F. Tebbs, 3.4.1961; O.R., 7.1966, local in E. limb, rare in surviving N. part of W. limb, absent from S.W. outlier, perhaps 2,000–5,000 plants; all 1-km squares, P.T. Harding, 22.3.1992, 100–1,000 inflorescences with flowers, over 1,000 plants. Oxlips have probably increased here since 1966, especially after coppicing in 1981 (O.R.).

†**Knapwell Wood, Knapwell** (3260, 3360): J. Carter, confirmed by C.C. Babington (Babington, 1860); D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); D.H. Valentine, 22.4.1937 (Valentine, 1948); T.G. Tutin, 4.1946, **LTR**; O.R., 1967 (Rackham, 1969); G.F. Peterken, 25.4.1969, *c.* 545,000 inflorescences (Peterken, 1970); Rackham (1980); both 1-km squares, P.T. Harding, 4.4.1992, 101–1,000 inflorescences with flowers but 60% of inflorescences bitten off, over 1,000 plants.

†**Overhall Grove, Boxworth** (3362, 3363, 3463): The formal botanical records of Oxlips from Overhall Grove are preceded by a record in a poem by M.C.G. Hooton, originally published in 1928 and reprinted by Peterken (1980). D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); D.H. Valentine, 22.4.1937 (Valentine, 1948); T.M. Owen, 1969 (Peterken, 1970); G.F. Peterken, 13.4.1975, *c.* 863,000 inflorescences of which 8% were eaten off or picked (Peterken, 1980); Rackham (1980, 1990); all 1-km squares, P.T. Harding, 16.3.1992, over 1,000 inflorescences and over 1,000 plants. "Oxlips (except for isolated plants) are confined to the western half of the wood . . . . The densest of all the Oxlip areas, and maybe the densest stand of Oxlip in all England, is under the electricity cables. Here Oxlip has been encouraged by coppicing; it flowered supremely well in 1987. However, the densest Oxlip area extends well to either side of the coppiced area, and cannot be entirely credited to the Electricity Board. . . . It is my strong impression that Oxlips have declined since 1967, when I first mapped them: the densest Oxlip areas were then more extensive. Nettles have probably increased, as in other woods, through phosphate getting in (by various routes) from fertilised farmland." (O.R.)

†**Swansley Wood, Caxton** (3060): R.H. Lock, 29.4.1901, **CGE** (as "wood near Caxton"), det. D.H. Valentine; D. & H. Meyer, 1934–38 (Meyer & Meyer, 1951); D.H. Valentine, 1939; 30.60., F.H. Perring & C.T. Prime, 14.4.1957; O.R., 19.2.1967, very abundant but seldom dominant in the N.E. quarter of the original ring-shaped wood, the plants large but widely spaced, *c.* 15,000 if one assumes half a plant per square metre over 3 ha. The W. half of the wood had been grubbed out shortly before O.R.'s visit in February 1967; the rest was removed in 1967–68. G.F. Peterken recollects seeing Oxlips in the hedge north of the former wood in the late 1960s. A thin strip of scrub survives along the road but P.T. Harding was unable to find any Oxlips in it on 4.4.1992, and he considers that the surviving scrub probably lies outside the former wood-bank.

Thorofare Spinney, Boxworth (3362, 3462): T.G. Tutin & E.F. Warburg, 1940; 3462, P.T. Harding, *c.* 1974, a few plants. Brodie & Major (1980) describe this site but do not report Oxlips from it. P.T. Harding was unable to refind Oxlips here on 16.3.1992.

TL 45

There is no certain record from TL 45. Ray (1660) recorded Oxlips growing abundantly in Madingley Wood, part of which is in TL 35 (q.v.) and part in TL 45. W.H. Coleman[2] recorded them from the eastern half of Madingley Wood and from Moor Barns Thicket, but these records must be regarded as dubious. Specimens labelled "Cambridge district" (C.C. Mountford, 4.1900, **LSR**), "near Cambridge" (Mr Thomas, 4.1904, **BM**) and "Cambridge" (F.G. Preston, 29.4.1905, **CGE**) were presumably collected elsewhere in the county and imprecisely labelled.

TL 46

***Milton** (481623): Introduced with tree stumps dumped in a pit, with other typical plants of the boulder-clay woods, G.M.S. Easy, 25.4.1970; it flowered here until 1974 but the pit is now filled in.

TL 54

†**Balsham Wood, Balsham** (5849, 5949, 5850): Babington (1860); Christy (1897); R.H. Lock, 2.5.1901, **CGE**; J.L. Crosby, 1940; 5949 & 5850, H. Gilbert Carter & S.M. Walters, 6.5.1953; O.R., 8.1967, probably over 10,000 plants in a large area in the middle of the wood; all 1-km squares, P.J.O. Trist, 1991, & G. Crompton, P. Trist & P.J.O. Trist, 24.4.1992, *c.* 10,000 plants, very few of them with flowers.

Bartlow: J.S. Henslow, 8.4.1826, **CGE**, conf. Christy (1897), published by Babington (1860) as "wood near Bartlow". The exact whereabouts of this wood are not known. The small parish of Bartlow was predominantly arable even in 1826, and it is possible that the wood was in nearby Castle Camps. Likely candidates would be Westoe Wood, which appears on a late 16th-century map (Wright, 1978), and the woods at Westoe Park (q.v.).

†**Borley Wood, Linton** (5747, 5748, 5847, 5848): All records from this wood are cited, as they are remarkably inconsistent. Babington (1860); H.N. Dixon (no date but *c.* 1883); W.M. Palmer (no date); W. West, 1892–96; not found, despite a long search, M. Christy (1897); absent, R.S. Adamson (1912); H.C. Gilson & T.G. Tutin, 1932; "nearly as well off" as Hayley and Gamlingay Woods (described as "full of Oxlips") (Evans, 1939); absent, J.L. Crosby, 1940; absent, W.H. Palmer, 1942; 577486, definitely present in small quantity near W. corner of wood, mainly on the ride, O.R., 3.8.1967; 581475, S.E. side of wood, J. Bevan & Lady R. FitzGerald, 12.4.1987; G. Crompton & R. Payne, 29.5.1987; 582478, R. Payne, 7.7.1987; not found, even at S.E. edge of wood where it was recorded in 1987, G. Crompton, C.D.P. & S.E.Y., 20.4.1992. *P. elatior* x *P. vulgaris* was recorded in the absence of *P. elatior* by Christy (1897), Crosby in 1940 and W.H. Palmer in 1942; it was also recorded by Gilson & Tutin in 1932 and (with both parents) by Bevan & FitzGerald in 1987. Neither *P. elatior* nor its hybrid could be found in 1992, but *P. veris*, *P. vulgaris* and their hybrid were present on the ride at the S. end of the wood, 581476 & 581478. As a well-drained, rather acid wood which was successfully replanted with conifers before 1967, Borley is not good Oxlip habitat (O.R.). The inconsistent records are hard to interpret. It is difficult to believe Evans's (1939) statement; perhaps "Borley" was a slip for Balsham. The other records might be explained if the plant is rare in the wood and fluctuates in abundance, especially if it is actually absent in some years or only present as vegetative plants.

Roman Road (Via Devana) near Borley Wood, Balsham & Linton (5748, 5848): E.A. George, 1939. None found here by G. Crompton, B. Jackson & P.J.O. Trist, 29.4.1992.

Westoe Park, Castle Camps: W.H. Coleman, 1833–35. There is no later record from this area, which was not visited in 1991–92. The former Westoe Lodge was once surrounded by woodland, of which 7 acres survived in 1840 (Wright, 1978). See also Bartlow (above).

TL 55

†**Balsham Wood, Balsham**: The Balsham Wood population just extends into TL 55, at 586500. See TL 54 for further details.

TL 64

Burton End, West Wickham (626496): One clump with *c.* 25 inflorescences on grassy bank on W. side of broad footpath to Leys Wood, B. Hakin, S.M. Hakin & C.D.P., 13.4.1991; not refound by C.D.P., 26.4.1992.

†**Cadge's Wood, West Wickham** (6349, 6449): H.C. & M.R. Gilson, 1942; both 1-km squares, S.M. Walters, 21.9.1953; 6349, B. Hakin, S.M. Hakin & C.D.P., 13.4.1991 & 6449, C.D.P. & S.E.Y., 26.4.1992, 11–100 plants, including one on grassy ditch-side between wood and road at 637492.

†**Hare Wood, West Wickham** (6247, 6248): 6247, F.H. Perring, 7.6.1957; both 1-km squares, B. Hakin, S.M. Hakin & C.D.P., 13.4.1991, 101–1,000 plants.

†**Langley Wood, Castle Camps** (6042, 6142): D.H. Valentine, 1937; 6042, F.H. Perring & G.F. Peterken, 19.9.1967; both 1-km squares, M. Strugnell, 5.1992,

over 1,000 plants.

†**Leys Wood, West Wickham** (6249): H.C. Gilson & T.G. Tutin, 1932, as "West Wickham Wood"; C.D. Pigott & R.G. West, 23.4.1950, as "Hill Farm Wood"; G. Crompton & B. Jackson, 2.6.1987; B. Hakin, S.M. Hakin & C.D.P., 13.4.1991.

†**Over Wood, West Wickham** (6248, 6348): H.C. Gilson & T.G. Tutin, 1932; 6248, C.D. Pigott & R.G. West, 23.4.1950; O.R., 8.1967, rare, probably less than 1,000 plants; 6348, J.C. Faulkner, 3.8.1967; 6348, B. Hakin, S.M. Hakin & C.D.P., 13.4.1991.

Wigmore Pond, Castle Camps (6241): H. Gilbert Carter & H.C. Gilson, 1940; no woodland present, pond drained and no Oxlips found, M. Strugnell, 5.1992.

TL 65

†**Basefield Wood, Stetchworth** (6456, 6457, 6556, 6557): P.W. Richards, T.G. Tutin & E.F. Warburg, 1932; O.R., 3.1971, rare; all 1-km squares, E. Norman, 25.3.1992, over 1,000 plants.

†**Brinkley Wood, Brinkley** (6155): A. Hosking, 10.4.1897, **CGE**; L.C. Frost & F.H. Perring, 19.4.1956; C.D.P. & S.E.Y., 20.4.1992, 101–1,000 plants.

Bushy Grove, Burrough Green (6554, 6555): Both 1-km squares, C.D.P. & S.E.Y., 20.4.1992, *c.* 55 plants in the eastern half and one in the S.W. corner.

†**Carlton Wood, Carlton** (6552, 6553): H. Gilbert Carter & T.G. Tutin, 1932; both 1-km squares, E. Norman & M. Stokes, 3.4.1992, over 1,000 plants. Carlton Wood is the remnant of a much larger wood[3].

†**Charcoals Wood, Woodditton** (6557): O.R., 5.1967, rare; C.D.P. & S.E.Y., 4.4.1992, 101–1,000 plants.

Clamp's Lane, Carlton (6353): P.D. Sell *et al.*, 19.4.1968, **CGE**; O.R., 8.1969, *c.* 40 plants; G. Crompton & J.C. Faulkner, 1.5.1987; C.D.P., 14.4.1991, 101–1,000 plants. In 1991 plants grew with *P. veris* on the hedge banks along the track just S. of the bend at the north end of Clamp's Lane, 634530, and from there all along the hedges by the sides of the path to the River Stour at 632532. They were absent from the recent secondary wood S. of the track near the River Stour. This represents an increase since 1969, when they grew from the bend in the track to a point halfway down to the River Stour (O.R.). The hybrid *P. elatior* x *P. veris* was recorded from this site (under the name "Carlton Lane") in 1967, 1968 and 1987 (Crompton, 1988).

†**Combers Wood, Stetchworth** (6457, 6557): 6557, P.H. Oswald, 4.5.1954; 6557, C.D.P. & S.E.Y., 4.4.1992, 101–1,000 plants. Plants which appeared to be hybrids between *P. elatior* and *P. veris* were seen by P.H. Oswald on the roadside bank of this wood (651577) on 4.5.1954 and at the N.E. end of the wood (653578) on 21.4.1990.

Devil's Ditch, Stetchworth & Woodditton: All records are from the wooded S. end of the Ditch in 6558. As the number of plants recorded in this small population has varied, all records are cited. A few plants in the first 50 yards from the S. end of the Ditch, O.R., 3.1971; *c.* 6 plants by path on top very near Stetchworth [i.e. S.] end, D. Jones, *c.* 30.4.1973; 2–3 plants, Devil's Ditch Committee Walk, 1.5.1975; 18 plants, mostly on N.E. side by path, along *c.* 60 paces, P.J. Grubb & Devil's Ditch Committee Walk, 19.4.1982, cf. Leslie (1983); none found by path but a few occur near arable on S.E. side, A.C. Leslie, 15.5.1984; 1 vegetative plant near swing (652585), Devil's Ditch Committee Walk, 10.7.1987; 27 plants in 9 groups of 1–5 over a distance of *c.* 150 m from near S. end (653584) to just S. of large dip (652584), most by path or 2–3 m N.E. of it but some a few metres S.E. of path, none seen near swing (which is just N. of this dip) and none by arable S.E. of Ditch, C.D.P. & S.E.Y., 4.4.1992.

†**Ditton Park Wood, Woodditton** (6656, 6657, 6756, 6757): C.C. Babington, 2.6.1852, **CGE**, cf. Babington (1860); J.L. Crosby, 1940; all 1-km squares, Cambridge Natural History Society Excursion, 24.5.1952; O.R., 5.1967; all 1-km squares, C.D.P. & S.E.Y., 26.4.1992, 101–1,000 plants. Oxlips were moderately abundant in 1967, soon after the wood was replanted. They have greatly declined since then, although the planting has been only partly successful; part of the decline had already taken place before 1975 (O.R.).

Gover's Grove, Carlton (6451, 6551): The "small woods east of Carlton Green" in which H. Gilbert Carter & T.G. Tutin recorded Oxlips in 1932 presumably included Gover's Grove. O.R., 6.1965, *c.* 6 plants; 6451, G. Crompton, L. Farrell, E. Norman & M. Stokes, 18.4.1992, 6 clumps in the plantation itself and a few on the roadside verge N. of it.

Great Chitlings Wood, Stetchworth (6557): C.D.P. & S.E.Y., 4.4.1992, 101–1,000 plants.

†**Great Coven's Wood, Weston Colville** (6253): E.F. Warburg, 1935; O.R., 6.1976, frequent on main ride, otherwise scarce, perhaps less than 1,000 plants; C.D.P., 14.4.1991. The Weston Colville woods have a complex history, and both their names and their extent have changed markedly even since they were mapped in 1828[4]. According to O.R., Great Coven's Wood has many pre-1612 additions from which Oxlip appears to be absent.

†**Great Widgham Wood, Dullingham** (6654, 6655, 6754, 6755): A specimen in **CGE**, without collector's name, which was collected from Widgham Wood in 1935 would be the first record from Great Widgham or Little Widgham Wood if it could be attributed to either. J.L. Crosby, 1940; 6755, F.H. Perring, 15.5.1957; all 1-km squares, C.D.P. & S.E.Y., 20.4.1992, 101–1,000 plants.

Hall Wood, West Wratting (6052, 6152): 6152, C.D.P., 14.4.1991, *c.* 18 plants. Hall Wood is the remnant of a much larger wood which early last century extended S.W. almost up to the village of West Wratting[5].

†**Hay Wood, Westley Waterless** (6255): C.D.P., 14.4.1991, over 1,000 plants. See also "Westley Wood" (below).

†**Hill Crofts, Weston Colville** (6152, 6252): Both 1-km squares, C.D.P., 26.4.1992, 101–1,000 plants. Although Hill Crofts is listed as an ancient wood by Robinson (1987), it is described in the Victoria County History (Wright, 1978) as an early 19th-century wood which developed over open fields. Hill Crofts does not appear as woodland on a 1612 map[6], but by 1828 some (but not all) of the areas currently within Hill Crofts are shown as woods[4].

Horse Pastures, Weston Colville (6252, 6253): 6252, C.D.P., 14.4.1991. Seen only on the Horse Pastures side of the ride which separates this wood from Lower Wood. (Had I realised then that Horse Pastures was a secondary wood I would have made more effort to look for it elsewhere in the wood.)

†**Ladies Grove, Westley Waterless** (6255): C.D.P., 14.4.1991. See also "Westley Wood" (below).

†**Little Chitlings Wood, Stetchworth** (6557): C.D.P. & S.E.Y., 4.4.1992, 101–1,000 plants.

†**Little Widgham Wood, Dullingham** (6555, 6654, 6655): D.H. Valentine, 1937; 6654 & 6655, C.D.P. & S.E.Y., 20.4.1992, over 1,000 plants. In addition, two vigorous clumps grew in a small area of rough grassland in the angle formed by the W. edge of Little Widgham Wood and the N. edge of Out Wood, at 659550; this area lies between the woods and the fence around the adjacent horse pasture.

†**Lopham's Wood, Carlton** (6451, 6551): H. Gilbert Carter & T.G. Tutin, 1932; 6551, E. Norman & M. Stokes, 2.4.1992, over 1,000 plants.

†**Lower Wood, Weston Colville** (6252, 6253): E.F. Warburg, 1935; O.R., 6.1976, perhaps more than 10,000 plants in a quite large area in the middle of the wood; 6252, C.D.P., 14.4.1991.

†**Lucy Wood, Kirtling** (6856, 6857): W.T. Stearn, 1932; 6856, G. Crompton, L. Farrell, E. Norman & M. Stokes, 18.4.1992, 101–1,000 plants.

†**Marmer's Wood, Stetchworth** (6457): C.D. Pigott, 1950; O.R., 3.1971, rare; C.D.P. & S.E.Y., 8.3.1992, 11–100 plants.

†**Out Wood, Burrough Green** (6554, 6555, 6654, 6655): E.F. Warburg, 1935; O.R., 5.1976, at least 50,000 plants in large area in N.E. of wood; 6655, C.J. Cadbury, 21.7.1990; 6554, 6555 & 6654, C.D.P. & S.E.Y., 20.4.1992, over 1,000 plants.

†**Park Wood, Burrough Green** (6354, 6454): P.W. Richards, T.G. Tutin & E.F. Warburg, 1932; O.R., 8.1969, perhaps *c.* 5,000 plants; 6454, C.D.P., 14.4.1991.

†**Pickmore Wood, Stetchworth** (6458, 6558): F.H. Perring, 1967; O.R., 3.1971, frequent, especially in areas which had been felled and perhaps poisoned; 6558, C.D.P. & S.E.Y., 4.4.1992, 101–1,000 plants.

†**Plunder Wood, Burrough Green** (6654): O.R., 5.1971; C.D.P. & S.E.Y., 20.4.1992, 101–1,000 plants. Oxlips were present in the narrow band of woodland which forms the N.W. arm of the wood in 1971, but could not be found there in 1992 when the wood had clearly been heavily grazed by cattle and lacked any woodland herbs. This area is secondary woodland, mapped as "Plaine Stubbins Pasture" in 1674[7] but wooded by 1838[8].

†**Rand's Wood, West Wratting** (6150, 6250): Babington (1860), as "Yenhall Wood"; 6250, B. Hakin, S.M. Hakin & C.D.P., 13.4.1991 & C.D.P., 26.4.1992, 11–100 plants. Not found in 6150 despite careful searching in 1992.

†**Sparrows Grove, Burrough Green** (6554): E.F. Warburg, 1935; F.H. Perring & R.G. West, 4.1957; rather local in 8.1967 but increased by 5.1976 and later, O.R.; C.D.P. & S.E.Y., 20.4.1992 & G. Crompton, J. Hirsh & B. Jackson, 25.4.1992, over 1,000 plants. Sparrows Grove is one of the few places anywhere in the British range of the Oxlip where it occurs on a slope steeper than 5 degrees (O.R.).

Spring Plantation, Weston Colville (6153): W.H. Palmer, 1942 (as "wood W. of Brinkley Road"); no plants found here by C.D.P., 14.4.1991. Despite the name of this wood, the N.E. part is semi-natural Ash–Aspen–Hazel wood with abundant *Mercurialis*: this area corresponds to a small wood mapped here in 1828[4].

Stetchworth: Babington's (1860) record is the first from the parish, but it is not localised to a particular wood.

†**Ten Wood, Stetchworth** (6655, 6656): J.L. Crosby, 1940; 6656, C.D. Pigott & R.G. West, 23.4.1951; O.R., 5.1982, abundant over *c.* 6% of the wood, perhaps 5,000 plants or more; both 1-km squares, C.D.P. & S.E.Y., 20.4.1992, 101–1,000 plants.

The Grove, West Wratting (6151, 6152): 6152, C.D.P., 14.4.1991. Only seen in the thin strip of semi-natural woodland along the W. side of The Grove, 611520–612521, where *c.* 26 plants grew with one *P. elatior* x *P. veris* hybrid.

Unnamed wood at Dukesley Hill, parcel no. 9436, Burrough Green (6454, 6554): O.R., 9.1969, a few plants. This fragment of wood between the road and the parish boundary was not visited in 1991–92.

***Unnamed triangular wood, parcel no. 3280, Brinkley** (*c.* 633548): C.D.P., 14.4.1991, 101–1,000 plants. Oxlips are well naturalised here, where they may have been planted by Lady Keynes, the wife of Sir Geoffrey Keynes, who had "quite a 'thing' about oxlips and used to go oxlipping every year" (M.O. Hill, *in litt.*). One plant has colonised

the stream-bank just outside the wood.

†**Unnamed wood S. of Parsonage Farm, parcel no. 0426, Woodditton** (6658, 6758): 6758, C.D.P. & S.E.Y., 26.4.1992, *Preston 92/4*, **CGE**, *c.* 15 plants. In addition to these Oxlips, which were near the S.E. edge of the wood, one large vigorous plant (*Preston 92/5*, **CGE**) at the edge of a ride in the N.E. part may have been a hybrid between the Oxlip and the garden Polyanthus. Cowslips also grew in the wood. For an interpretation of the history of this wood, see note 9.

†**"Westley Wood", Westley Waterless** (6255): Abundant, C.C. Babington, 3.5.1860, **BM**, **CGE** (cf. Babington 1860, 1897); R.P. Murray, 10.5.1881, **CGE**; N.D. Simpson, 1909, **BM**. Recent records from this wood have been split into the two component woods, Hay Wood and Ladies Grove.

"Yenhall Wood", West Wratting: see Rand's Wood (above).

TL 75

†**Great Wood, Kirtling** (7054, 7055): W.T. Stearn's 1932 record from the Cambridgeshire part of Branches Park Wood presumably refers to this wood; Branches Park Wood is adjacent to Great Wood but is entirely in Suffolk. A specimen in **CGE** collected by M.C.F. Proctor at Upend, near Lidgate, on 11.4.1952 may also come from Great Wood. 7054, G. Crompton & B. Wolf, 25.4.1987, less than 10 plants; 7054, C.D.P., 26.10.1991, less than 10 plants. Both 1987 and 1991 records refer to a single group of plants by the main ride.

Oxlip as an ancient woodland plant in Cambridgeshire

There are two broad but useful ways of classifying woods by historical criteria: one distinguishes ancient from recent woods and the other separates primary woodland from secondary. Ancient woods are those which were in existence in 1600 A.D.; recent woods have developed later. Primary woods are on sites which have been continuously wooded since they were originally colonised by trees whereas secondary woods are on ground which was once cleared of trees but has since reverted to woodland. In a county like Cambridgeshire, where new ground is not becoming available for tree colonisation (e.g. in landslips), primary woods must be ancient; secondary woods can be ancient or recent; recent woods must be secondary. It is useful to make a further distinction between semi-natural secondary woods (where the trees recolonise naturally) and plantations. Individual woods can, of course, have complex histories and may contain blocks of ancient woodland, recent semi-natural woodland and plantations.

Ancient woods can be identified by evidence from documents or by fieldwork or by a combination of the two. It is much more difficult to decide whether a wood is primary or secondary. Ancient secondary woods can sometimes be identified (e.g. if they grow over prehistoric earthworks), but in the absence of evidence from pollen analysis it is almost impossible to prove that a wood is primary.

In the above list I have marked as ancient woods all the sites identified by Robinson (1987) in the Nature Conservancy Council's provisional inventory of ancient woods in Cambridgeshire, one of a series of county reports which list sites larger than two hectares which are believed to have had continuous woodland cover since 1600 (Kirby *et al.*, 1984). I have also marked an additional site, for reasons described in the notes[9].

Table 1: The nature of the Cambridgeshire (v.c. 29) sites where the Oxlip occurs as a native plant. Localities where Oxlips grow in non-woodland sites adjacent to ancient woods are omitted.

	West Cambs	East Cambs	Totals
Ancient woods	16	33	49
Recent secondary woods	3	4	7
Woods of uncertain history	0	5	5
Non-woodland sites	0	3	3
Habitat not recorded	0	2	2
Totals	19	47	66

The nature of the Oxlip sites in the county is summarised in Table 1. It is immediately obvious that most of the Oxlip woods are ancient. Many of the ancient woods in which Oxlips grow may well be primary or at least include some primary woodland within their boundaries. Rackham (1975) puts forward a persuasive case for regarding Hayley Wood as a primary wood. The fact that Oxlips rarely spread from these refuges has often been commented on. The seeds of Oxlips are released from the capsule by a censer mechanism, and unlike those of some related species (including *P. vulgaris*) they have no morphological features which would encourage ants to carry them away. In Hayley Wood Oxlips have spread into The Triangle, an area of secondary woodland which lies immediately alongside the ancient wood, at a rate of only 4 feet (1.2 m) per annum (Rackham, 1975). The presence of Oxlips in some ancient secondary woods is therefore noteworthy. Overhall Grove, a wood which has developed over the ruins of a manor which was occupied until at least the 14th century, is the classic example of an Oxlip wood which is ancient but almost if not entirely secondary.

Not only are most Oxlip sites ancient woods, but Oxlips are present in almost all the ancient woods within that part of Cambridgeshire where they grow. The only one of the ancient woods listed by Robinson (1987) in West Cambridgeshire from which Oxlips are not recorded is Cobb's Wood, Wimpole. This is an ancient secondary wood on the site of a medieval settlement (O.R.). Mrs G. Crompton and R. Payne searched for Oxlips here in April 1992 but failed to find any, reporting that the wood had been recently replanted and that the ground flora was very poor. The two ancient woods in the east of the county in which they have not been found are Bush Park, Great Abington, and Hildersham Wood. Bush Park was searched by Mrs Crompton, P. Daunt and B. Jackson on 17.4.1992. They found no *Primula* species under the old Field Maple standards and very old Hazel coppice. Mrs Crompton searched Hildersham Wood with A. Arbon & P. Stebbings on 27.6.1992 and found a few leafy clumps of *P. vulgaris* but no *P. elatior*. Both sites are in the south-west corner of TL 54 and lie outside the range of the Oxlip mapped by Christy (1897).

The few sites where Oxlip grows in recent woods are worth considering. The three recent sites in West Cambridgeshire are Toft Plantation, Turtlow Plantation and Thorofare Spinney. Toft Plantation dates from the early 19th century and was formerly connected to Hardwick Wood (O.R.). Turtlow Plantation is also a 19th-century plantation[10]. Thorofare Spinney is an ancient

hedge with a shelter-belt running alongside it. An undoubtedly recent wood in which Oxlips are found in the east of the county is Bushy Grove, a semi-natural secondary wood. The area now occupied by Bushy Grove is shown on a detailed map drawn in 1674[7] as pasture belonging to Pembroke Hall. By 1838 the western half was still pasture but the eastern half was wooded; both parts still belonged to Pembroke College[8]. In 1992 the Oxlips were concentrated in the eastern half. The thin strip of roadside wood at Dukesley Hill was described in 1838 as a plantation on a "slip formerly part of road"[8]. It is impossible, for most of these sites, to determine whether Oxlips were present in the vicinity before they were wooded, growing in habitats such as hedges or meadows, or whether they colonised from more distant woodland populations. A fairly clear example of colonisation from a nearby wood is provided by the remarkable population of Oxlips in an apparently recent wood along the top of the Devil's Ditch, a late Roman or Anglo-Saxon earthwork. Early 19th-century maps tend to show the Ditch as a linear feature; the fact that they do not mark wooded stretches is probably not significant. The presence of pollard trees indicates that the south end of the Ditch has a history of wood-pasture, not woodland (O.R.). Relhan (1785) records *Veronica montana* "in the woody Part of the Devil's Ditch" and later (1802) *Lathyrus latifolius* "in the Woody Part of the Devil's Ditch, near Canvass Hall". If Canvass Hall is Camois Hall, this record is from the south end of the Ditch. Oxlips have presumably spread onto the Ditch from Pickmore Wood, which abuts onto its south end. It seems likely that the seeds have been carried there by an animal vector, perhaps on the feet of pheasants (which are reared in Pickmore Wood, are usually present in large numbers, and – P.D. Sell informs me – often have very dirty feet), deer or walkers passing by the wood on the footpath to the Ditch.

I do not know enough about Gover's Grove (Carlton), Great Chitlings Wood (Stetchworth), Hall Wood and The Grove (West Wratting) or Spring Plantation (Weston Colville) to say with certainty whether they are ancient or recent. Great Chitlings Wood was mapped in the same way as the nearby small woods in 1814[11] and might be ancient. Hall Wood is a relic of a larger wood and probably is ancient. Gover's Grove is apparently not the recent plantation which it might appear to be from a cursory examination of the map (O.R.). The history of these woods would be worth investigating. There is also considerable scope for investigating the detailed distribution of Oxlips in particular woods, especially those woods in East Cambridgeshire with a complex history. In the 1991–92 survey it was only possible to establish whether or not Oxlips were present in these woods; there was insufficient time to survey the woods in detail.

Oxlips often colonise the grassy sides of ancient wood-banks and sometimes colonise other open habitats at the edge of ancient woods such as the disused railway alongside Hayley Wood. However, there are very few records of Oxlips in grassland in Cambridgeshire. They were recorded in meadows in the vicinity of Eltisley Wood and still grow in the grassland of Longstowe Park. Had there been spectacular springtime displays of Oxlips in meadows, one might have expected earlier botanists to draw attention to them. However, plants in meadows could easily have been overlooked, especially if the sites were not near Cambridge. Rackham (1980) has suggested that the anomalous

presence of Oxlips in Overhall Grove could be accounted for if they had originally grown in stream-side meadows which later tumbled down to woodland; alternatively, a small central area of the wood may be primary (Rackham, 1990).

The only large population of Oxlips growing in the county outside woodland is that along Clamp's Lane, Carlton. The Oxlips here are about 750 m from the nearest extant woodland population. I have not been able to find any evidence that the sides of this lane once abutted onto woodland. In 1828 there were two small woods east of Clamp's Lane, called Clamps Grove and Jug's Grove; the latter was less than 150 m from the bend in the lane and separated from it by a single field, Little Clamps[4]. However, these woods are not shown on an earlier map[3] and so were presumably secondary.

There are only two sites in the county where the Oxlip is known to be, or suspected of being, introduced by Man. The plants at Milton persisted for only a few years, but those which appear to have been introduced at Brinkley are thriving, perhaps because the soil in this stream-side locality is relatively moist.

A more indirect effect of the activity of Man is the presence of apparent hybrids between the Polyanthus and the Oxlip in one or two localities. Plants which were hybrids between Polyanthus and either Cowslip or Oxlip were reported from the edge of Gover's Grove (649512) by A.C. Leslie on 22.4.1978. These had pink flowers with a yellow eye. The large plant in the unnamed wood south of Parsonage Farm which appeared to be a hybrid between Polyanthus and Oxlip has been mentioned above. Its leaves resembled those of the Oxlip, but they had a less shaggy pubescence, they were less abruptly contracted towards the base, and some of the petioles had a pale purple pigment towards the base. The peduncles and pedicels had a heavy purple pigmentation. The inflorescence was distinctly secund and the petals were deep yellow towards the base with an orange line along the middle, but dull purplish red in the distal part. Rather curiously, this hybrid (at 670583) was about 100 m away from the nearest Oxlips in the wood (a clump found in 1993). Polyanthus plants with flowers which are dark purple with yellow centres – the likely characteristics of the other parent – grow in several gardens in Little Ditton some 500 m away. A Polyanthus–Oxlip hybrid would be a triple hybrid between Cowslip, Primrose and Oxlip, as the Polyanthus is a garden plant derived from Cowslip–Primrose hybrids (Christy, 1924b). Pink-flowered Oxlips which are hybrids with Polyanthus or garden Primroses occur very rarely in Suffolk, as do plants which appear to be naturally occurring triple hybrids, *P. elatior* x *P. veris* x *P. vulgaris* (Simpson, 1982).

Changes in the distribution of Oxlip, 1660–1992

Changes in the distribution of the Oxlip can be considered at various scales. Three are considered here – 10-km square, parish and site. It is fortunate that most Oxlip records are precisely localised to particular woodlands, which can almost always be attributed to a 10-km square and a parish. To consider changes at any of these scales, we must have access to comparable records at that scale over the period of time in question.

The cumulative total of records from 10-km squares, parishes and sites is shown in Figure 3. Sites where the species is believed to have been introduced

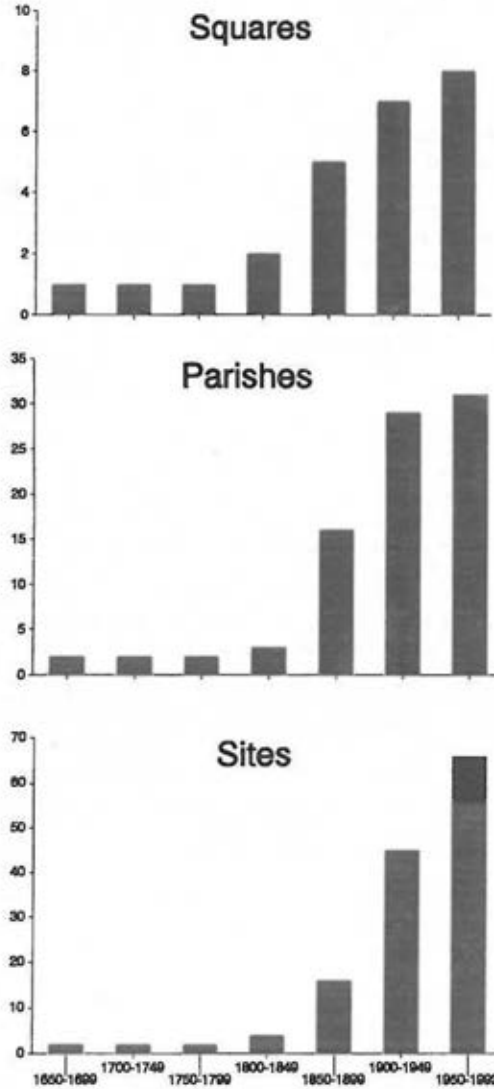


Figure 3: Cumulative totals of 10-km squares, parishes and sites in Cambridgeshire (v.c. 29) in which Oxlips have been recorded. The totals plotted are those known at the ends of successive 50-year intervals from 1650 to 1950. The final column covers the period up to 1992; additions to the cumulative total made in the 1991–92 survey are shown as solid black.

are omitted. It can be seen that records at the 10-km square and parish scale were very rudimentary before 1850, but virtually complete by 1949. We therefore have little chance of making any assessment of changes in the distribution of the Oxlip before 1850 or any quantitative assessment before 1950. We can, however, be fairly confident that we can assess changes since 1950 at these scales. Oxlips were recorded in 1991–92 from all eight 10-km squares for which there were acceptable records made between 1660 and 1990 and from 27 of the 31 parishes in which they had been found during that time. It is clear that there has not been much diminution of Oxlips in either 10-km squares or parishes since 1950. However, the Oxlip is so frequent within its restricted range that only very dramatic changes would be apparent at these scales. Many Oxlips might vanish before the species ceased to be present in a 10-km square or even in those parishes in which it grows at several sites.
At the site scale, Figure 3 shows that recording was certainly not complete by 1950. No fewer than 10 new native sites were placed on record in the 1991–92 survey. The Oxlip is not a mobile species, and it was almost certainly present but unrecorded in most of these sites before 1991. Any hope of using site records to make a quantitative estimate of changes in the distribution of the Oxlip must therefore be abandoned.

In spite of the limited possibilities for assessing changes in the distribution of the Oxlip, some subjective assessments can be made. It seems reasonable to assume that Oxlips were frequent, although not necessarily uniformly distributed, in the 'wildwood' within their current range. Most of the woodland in the county was grubbed out before the medieval period (O.R.), and this clearance must have greatly reduced and fragmented the original populations. Most of the surviving woods were on the boulder-clay plateau, on land which tends to be waterlogged in winter and where Oxlips may have been particularly frequent. Later periods of woodland clearance must have resulted in further losses of Oxlip populations. The pressure on land in the 12th and 13th centuries led to the destruction of half the woods of West Cambridgeshire between 1086 and 1300 (Rackham, 1980). The population decline in the next century halted this period of destruction but, although many woods increased in area, individual woods continued to be lost. It seems very likely that Oxlips grew in Littlehound Wood, a coppiced wood which was close to Hayley Wood until it was grubbed out by William Power in the mid 17th century (Rackham, 1975), in Moyns Wood near Weston Colville, which was last recorded on a map of 1612 but is still marked by a population of *Pimpinella major* (Rackham, 1980), and in Brettons Wood, Burrough Green, mapped between Brinkley and Burrough Green in 1674[7] but gone by 1838[8]. A number of likely Oxlip woods survived into the 19th century: these included Willesey Wood, Castle Camps, cleared for arable between 1840 and 1863 (Wright, 1978), and the Widemouth Woods east of Ditton Park Wood[12]. These examples could easily be multiplied. The presence of Oxlips in all these woods can only be conjectured, however; the woods disappeared before any recorded visits by botanists.

Oxlips have been recorded in 66 Cambridgeshire sites since 1660. In the 1991–92 survey 63 of these sites were visited and Oxlips were found in 55 of them. This is a remarkably high figure in view of the changes in woodland

management which have occurred over this period. Two major sites have probably been lost through habitat destruction. It is particularly sad that Oxlips no longer survive at Madingley Wood, one of the two sites which Ray (1660) mentioned by name. Swansley Wood has been grubbed out in recent years, a symptom of the increased rate of loss of woodland in the county after 1946 (Harding, 1975). Although Oxlips were not seen in Borley Wood in 1992, the species has only been seen there sporadically and there can be no certainty that they will not be found again in future years. Four more populations, at Thorofare Spinney, the Roman Road near Borley Wood, Wigmore Pond and Spring Plantation, were searched for but not refound in 1991 or 1992. With the possible exception of Spring Plantation, these sites are unlikely ever to have supported large populations of Oxlips.

Evidence for changes in the numbers of Oxlips in particular woods is difficult to obtain. There is little historical evidence for size of Oxlip populations, and, even if we had such information, the fact that it is difficult to define an Oxlip plant and that Oxlip populations fluctuate in the medium-term in response to management would make it difficult to interpret. One must assume that the number of plants was greatly reduced when woods like Carlton Wood, Hall Wood (West Wratting) and Hall Wood (Wood Ditton) were reduced to their current size; conversely, Oxlips have spread into a few areas of secondary woodland. Coniferisation has also reduced the size of the populations in some woods: Peterken (1970) found that the initial effect of coniferisation at Eltisley Wood was to reduce the density of plants to 60–70% of the former level and to cause a distinct clumping into groups. There is some evidence for recent changes in the numbers of plants at one or two of the well-studied western woods. These changes have been gradual rather than catastrophic, and, as is often the case with such changes, the reasons are rather obscure. At Hayley Wood, the general vegetation zones (defined by the presence of the common herbs) have remained virtually unchanged since 1948, but the number of Oxlip plants decreased from something in the order of four million to less than half that number in 1975 (Rackham, 1975), probably owing to a combination of drought and deer (O.R.). Since about 1977 there has been a rapid increase within deer-fenced areas and a slow increase elsewhere (O.R.). Similarly, a comparison of Adamson's description of Gamlingay Wood with the current flora led Rackham (1992) to conclude that the numbers of Oxlips had also decreased there, particularly in the last 25 years; the reduction of coppicing combined with drought may be responsible.

The Oxlip in East Cambridgeshire

Much has been written about the Oxlip in the western Cambridgeshire woods, both in the scientific literature and in works aimed at a wider public. There is little that the 1991–92 survey of Oxlip woods can add to the literature on these well-studied woodlands. However, so little has been written on the eastern woods that it may be worth summarising the field observations made there, even though these were often based on fleeting visits.

The boulder-clay area of East Cambridgeshire is more intricate countryside than West Cambridgeshire, with more woods (many of them quite small) and a much denser network of public footpaths, which pass round the woods much more frequently than they enter them. Only one of these eastern woodlands,

Lower Wood, is a nature reserve. Some of the woods are primarily devoted to the cultivation of conifers, but most are kept for sporting purposes. The rides tend to be well maintained but there is little sign of active woodland management in many of the broadleaved woods. What management there is tends to be the clearing of small areas of woodland to plant native broadleaves, including Ash and Pedunculate Oak, or non-native broadleaves such as Beech and Cherry Laurel *Prunus laurocerasus*. Some of the predominantly broadleaved woods have enclaves of planted conifers, many of them now moribund, but there is not much sign that conifers are being planted now.

The number of Oxlips varies from wood to wood, with substantial populations in many of the larger woods. In the smaller woods the number of Oxlips can be very small – about 17 plants in Hall Wood, for example, and six clumps in Gover's Grove. The extreme case is an unnamed wood immediately south of the county boundary, at 636492, where a single plant was present on 13.4.1991. In the absence of any previous population estimates from these woods, it is difficult to know how to interpret these small populations. Although the woods are small, it is not lack of space that restricts the size of Oxlip populations. Are these small populations stable, are they relics of larger populations or are they recent colonists?

The main concentration of Oxlips in the east of the county lies in an area in which Primroses are very rare. Primroses are recorded from Balsham and Borley Woods in TL 54. The only record of native Primroses in TL 64 or 65 was made by Oliver Rackham, who has recorded them in Plunder Wood; he has also seen Oxlip–Primrose hybrids in Ditton Park Wood. There is a Primrose record from Stetchworth (Babington, 1860), about which no details are known, and plants have been seen in Castle Camps churchyard, where they were presumably planted. The only Primrose seen in 1991–92 in the eastern Oxlip area was a single plant on the top of a roadside bank north of Mill House, West Wratting, which was probably an escape from cultivation. However, the chances of detecting Primrose hybrids was greatly reduced by the fact that most *Primula* plants were not seen in flower.

Oxlips grow in several different habitats in the eastern woods. In the broadleaved woods they are most frequent on the rides. On the woodland floor they are usually more thinly scattered. They are particularly scarce where *Mercurialis* forms dense stands, although even in these a few Oxlips can sometimes be found. Plants are more frequent where the ground flora is less dense, although it is rare to find areas where Oxlips are even locally abundant under a tree canopy. The rainfall was below average during the period of the survey, and it was therefore difficult to decide whether the areas in which Oxlips were most frequent were usually subject to waterlogging. In one area of Sparrows Grove, Oxlips grew with *Arum maculatum* and *Hyacinthoides non-scripta* amongst bare soil in an area disturbed by deer. In the small woods with few Oxlips, the Oxlips did not appear to be in a distinct vegetation type found where the ground is waterlogged, but grew (usually grouped rather than randomly scattered) amongst rather mundane species. At Hall Wood, for example, Oxlips grew with *Anthriscus sylvestris*, *Arum maculatum*, *Galium aparine*, *Glechoma hederacea*, *Heracleum sphondylium*, *Mercurialis perennis* and *Urtica dioica*.

In coniferous woods the rides are an even more significant habitat, and plants do not usually grow under the trees except at the margins of stands. In Little Widgham Wood, which has been thoroughly coniferised, Oxlips sometimes grew between those lines of conifers which had been planted *c.* 3 m apart, but not between adjacent closer rows. Plants grew in this situation on the north but not on the south side of the main N.W.–S.W. ride, presumably because sun shining from the south penetrates more effectively into the rows north of the ride. It was also surprising to see that Oxlips were frequent in the same wood along an old track inside the west edge of the wood, even though this was heavily shaded by conifers. They did not grow underneath a belt of planted Beech between this track and the edge of the wood. Almost all the plants under conifers were vegetative and had not even attempted to flower. Oxlips have colonised the wood-banks round the edge of both coniferous and broadleaved woods, often growing amongst grass on the sides of the ditch and sometimes (as on the north side of Hare Wood) also growing along the edge of the footpath running parallel to the ditch outside the wood. In such situations they can be found with *P. veris*.

Ditton Park Wood is another eastern wood which has been coniferised. On 16.3.1991 Oxlips were frequent on the major rides, which also supported an interesting bryophyte flora including *Pohlia wahlenbergii*, not previously recorded in the eastern woods (Preston & Whitehouse, 1992). By 26.4.1992 vehicles used to extract timber had reduced the main rides (including the *Pohlia* site) to deeply rutted morasses of unvegetated clay slurry. Oxlips were still present at the edges of the rides, in small remaining stands of the native broadleaved woodland, in plantations of deciduous trees or occasionally in open conifer stands, but were not abundant anywhere. One might expect bryophytes, which need a degree of disturbance, to recolonise the rides; I do not know if the Oxlips will be able to do so.

The clearing of areas of woodland for replanting is of great short-term benefit to Oxlips, and the best stands in the eastern woods were seen in areas which had recently been cleared or where young trees had been planted. In 1991 Hay Wood was a mosaic of areas which had been clear-felled, areas which had been replanted with young Ash and areas where the Ash–Hazel wood had been undisturbed. Oxlips were flowering well in the cleared areas, showing a similar response to that which happens when woods are coppiced. The long-term effects of replanting will depend on the species planted, the species which persist and the subsequent management of the replanted stands. As Rackham (1992) points out, those who plant trees in woods do not always end up with the species they expect.

The Oxlip flowers in Hay Wood were notable for another reason. Numerous recorders commented on the scarcity of flowering Oxlips in the eastern woods. There were, for example, very few flowers at Charcoals Wood, Little Chitlings Wood and Sparrows Grove, almost none at Balsham Wood and Great Coven's Wood, and none at all were visible along the main ride through Lower Wood. The inflorescences had been removed above the base, but the leaves were quite undamaged. Few of the eastern woods had escaped these depredations, although the plants at Hill Crofts were flowering fairly well and those along the lane at Carlton were undamaged. The symptoms are those of grazing by deer, a familiar problem at Hayley Wood (Rackham, 1975). There is no direct

evidence to indicate which species are responsible. Four species of deer are found in the eastern Oxlip area, Fallow, Red, Roe and Muntjac (Symonds, 1983), and evidence of the presence of deer in these woods is easily found. At the time when Symonds was writing, numbers of Red Deer were very low and those of Fallow and Roe Deer were stable. Muntjac, however, were rapidly increasing, and this was the only species of deer reported from the eastern woods by the botanists looking for Oxlips. This led me to conclude that Muntjac were likely to be the culprits, but Oliver Rackham informs me that in Hayley Wood Oxlip flowers survive in the large exclosures, which contain Muntjac but not Fallow Deer. A more detailed study is clearly required.

The effects of deer-grazing were also reported from the western woods, but there was more variation from wood to wood there. Rackham (1992) has pointed to the difference between Gamlingay Wood, where the Oxlips are relatively ungrazed, and Hayley Wood. Similar contrasts were apparent elsewhere, for example between Elsworth Wood, where Paul Harding found little sign of grazing in 1992, and Knapwell Wood, where 60% of the inflorescences had been bitten off.

The future of the Oxlip in Cambridgeshire

If plants had mottoes, the Oxlip could well adapt that of the Curzon family, "Let Curzon hold what Curzon held". The history of the plant in the county shows that it tends to survive in those woods in which it occurs, whatever their management, and is only likely to be eliminated if a wood is completely destroyed. Now that the importance of ancient woods is appreciated and the demand for new agricultural land is so low, it might seem that its future in the county is assured. The Oxlip is certainly less threatened than many nationally scarce species in the county. Nevertheless, there are one or two causes for concern.

Evidence that the number of Oxlips in one or two well-studied woods has declined in recent years has already been mentioned. The reasons for this are far from clear. It would be very useful to have more accurate data on the number of Oxlips present in the county's woods. In Gamlingay Wood P.E.G. Walker conducted an exemplary survey in 1992, counting the number of Oxlips, Primroses and hybrids in each compartment. Similar surveys in other woods would provide invaluable information, which would allow us to assess future changes with much greater accuracy than we can currently hope to do.

A new element has recently been introduced into the equation with the increase in deer. The number of seeds set by Oxlips in the county must now be much less than it was in the 1950s. In assessing the effect that this will have, we are greatly handicapped by the fact that virtually nothing has been published on the population biology of the species. There seems to have been no attempt to ascertain how long plants live and under what circumstances they reproduce by seed. The burst of flowering which follows coppicing has been studied, but this results from the increased vigour of the plants already present, which produce more inflorescences per plant and slightly more flowers per inflorescence, rather than from an increase in the number of plants (Rackham, 1980). Seedlings are not uncommon, but their fate is not known (O.R.). An investigation into the reproduction of Oxlips, including the effects on plant

longevity of the removal of the inflorescences before seed is set, is urgently needed.

Finally, it is surely desirable that more eastern Oxlip woods should be acquired by the conservation bodies and managed as nature reserves. This is not perhaps necessary to safeguard the continued presence of Oxlips in the area: one suspects that it would be best if the woods were held by a variety of owners. However, the existence of more reserves would surely stimulate the study of the Oxlip in these eastern woods. It is unlikely to be a coincidence that all the detailed accounts of western boulder-clay woods which have been published in recent years have concerned nature reserves; none have been written about woods in private hands.

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Notes

In these notes, the County Record Office, Cambridge, is abbreviated to CRO and the Cambridge University Library to CUL.

1. The material of *P. elatior* drawn as t. 513 of *English Botany* was sent to Sowerby by the Revd John Hemsted; Sowerby's original is annotated "Apr. 8, 1798, Hemsted" (Garry, 1903–1904). Hemsted, described by Sowerby as a "very intelligent industrious Botanist" (Garry, p. 54), sent nearly 50 species for illustration in the 1790s, when he lived at Newmarket. He moved to Bedford between 1798 and 1800, whence he sent a few more. The precise provenance of much of this material is not known (Oswald, 1991). It is highly probable that the illustrated Oxlip came from a wood near Newmarket and quite possible that it was collected in East Cambridgeshire. Hemsted knew Hall Wood, Wood

Ditton, where he discovered *Vicia sylvatica* and later took other botanists to see it (Relhan, 1802; Garry, 1903–1904). Bromfield's (1849) assumption that Hemsted lived in Essex is clearly unfounded. Christy (1897) quoted Bromfield but admitted that "where that gentleman resided I know not".

2. Coleman's records are in an annotated copy of Relhan (1820) and in two manuscript notebooks, *Localities of plants in Cambridgeshire observed by W.H. Coleman, in 1833–34–35* and *Stations of Plants in the Neighbourhood of Cambridge, observed . . . during the years 1833, 1834, & 1835* . . .. All are in the library of the Department of Plant Sciences.
3. The full extent of Carlton Wood is shown on a map of 1767 (CRO R54/21/1), when it occupied 148 acres. This large map, 3.7 m long, is "a plan of the manors of Carleton cum Willingham in the county of Cambridge and of Bradley in the county of Suffolk belonging to Thomas Brand Esqr".
4. Map of John Hall's estate, 1828 (CRO 124/P83 A & B). Tree symbols are not shown on this map, but they do appear on an essentially similar, smaller-scale, undated sketch map (CRO 124/P82).
5. For Hall Wood, West Wratting, in 1813 see CRO P184/26/2.
6. CUL MS Plans 550R.
7. Map of land in Burrough Green and neighbouring parishes owned by Henry Slingsby (1674, CRO 101/P1). Slingsby had inherited this land in 1667 on the death of his father-in-law, Sir Anthony Cage, who had fallen deeply into debt during the Civil War. Slingsby himself died in debt in 1690, his conduct as Master of the Mint having come under suspicion (Wright, 1978). Brettons is the name of a former tenement. The map is a superb one which shows Plunder Wood, Out Wood and Sparrows Grove in addition to Brettons Wood.
8. Tithe apportionment map of Burrough Green (1838, CRO P17/27/1).
9. I believe that the small (3.3 ha) wood S. of Parsonage Farm not only might be ancient but could be a surviving, much disturbed, fragment of Wood Ditton Hall Wood. The enclosure map and the early O.S. maps show Hall Wood as a large wood extending over an area which includes that occupied by the present wood. This wood was grubbed out before 1860 (Babington, 1860, p. 62). Relhan recorded several woodland species from Wood Ditton Hall Wood in the third supplement to his *Flora* (1793) and in the second and third editions. He also found *Allium ursinum* there (Babington, 1860: examination of Babington's annotated copy of Relhan's (1820) *Flora* shows that the record originally came from an interleaved copy annotated by Relhan himself and lent to Babington by Relhan's son). A clone of *A. ursinum* c. 1.5 m in diameter still survives in the N.E. corner of the wood S. of Parsonage Farm.
10. Turtlow Plantation is S.E. of the wood called Mill Boards in Croxton Park. A plan of the parish of Croxton prepared in 1811 (CRO Q/RDc32) shows neither Mill Boards nor Turtlow Plantation. The area of Mill Boards is an open field with a windmill. Although Turtlow Plantation was not present, a hedge bordering Turtlow Closes ran along the approximate position of the current plantation for part of its length. Croxton Park was considerably extended after inclosure of the parish in 1818 (Elrington, 1973). Turtlow Plantation apparently postdates this extension, as it does not appear on an 1826 map (CUL bb.53(1)/93/118).
11. CRO Q/RDc37.
12. The Widemouth Woods are shown as Little and Great Widemouth Wood on the 1823 enclosure map of Wood Ditton (CRO P55/26/1) and as Upper and Lower Widemouth Wood on early O.S. maps. They were immediately E. of the road along the E. side of Ditton Park Wood.

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Stellaria neglecta Weihe in Cambridgeshire

S.M. Walters

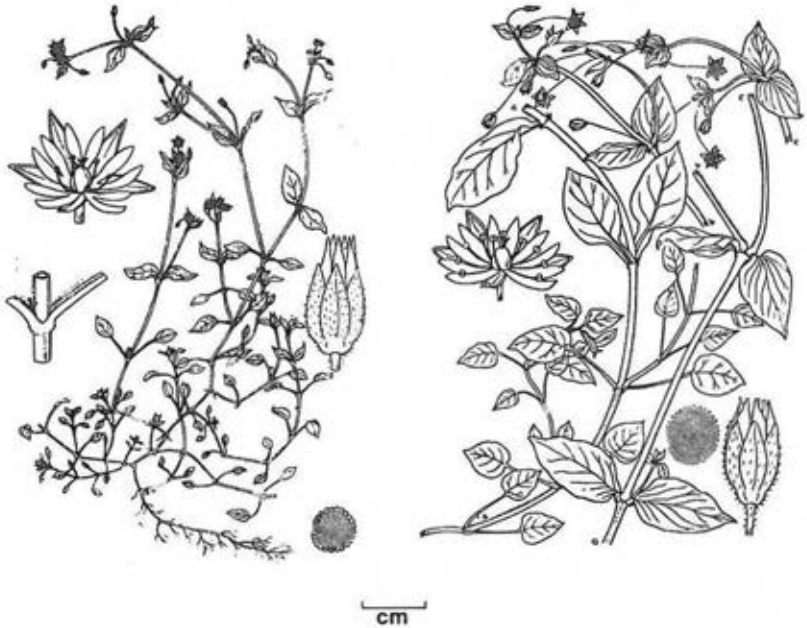
The Common Chickweed *Stellaria media* (L.) Villars must be familiar to everybody. It is certainly one of the commonest weeds in gardens and disturbed ground, both in the city and in the countryside. Botanists have long realised that it is very variable, but much of the variation, especially in habit of growth, looks as if it is the direct effect of the environment, and most early writers were content to treat the variation as of this kind and not to distinguish different variants by name.

Even C.C. Babington, in his *Flora of Cambridgeshire* (1860), makes no mention of any variation, although we know that he was to some extent aware of it as early as 1831 (see below) and he gives some account of it in the first edition of his *Manual of British Botany* (1846). Credit for distinguishing locally the vigorous, large-petalled variant we now treat as a distinct species, Greater Chickweed *S. neglecta* Weihe, goes to Arthur Shrubbs, an assistant in the Cambridge Botany School who added many interesting records backed by herbarium specimens in the Edwardian period and during the First World War. Shrubbs' excellent specimen, labelled "*Stellaria media*, large form '*neglecta*'" and collected at Hinxton in April 1915, is in fact the *only* Cambridgeshire specimen in CGE which its collector identified as *S. neglecta* as distinct from *S. media*, though even Shrubbs was uncertain what rank to give to the variant. There are in fact three other Cambs sheets of *S. neglecta* in CGE, two of them dating from 1831 and collected by Babington in Cambridge and J. Downes at Barton. On the Cambridge sheet Babington wrote "*Stellaria media* var.", indicating his awareness of some variation, but Downes' sheet is identified simply as *S. media*, as is the only other *S. neglecta* sheet in CGE, that of R.H. Lock for Cambridge in 1900.

Until 1992, therefore, the sum total of verified records of *Stellaria neglecta* for Cambridgeshire has remained only four, all of which were recognised by E.F. Warburg in 1938 (pencil identification on sheets) and verified by Peter Sell in 1954. Shrubbs' Hinxton record, made nearly 80 years ago, was therefore the most recent, and most Cambridgeshire botanists, including myself, had rather lost sight of the possibility that the species might occur in the vice-county. It came therefore as a surprise to me when, during a short walk along the road at the Shelford railway crossing on 26 August 1992, I saw on the roadside a large patch of a *Stellaria* in flower which looked like *S. neglecta* as one sees it in south-west England. I collected material in flower and young fruit and verified that it was indeed *S. neglecta* (see record on p. 83). Not only had it the vigour and large size, but the petals exceeded the sepals, there seemed to be regularly 10 stamens, and the sepal size was correct. The large flower must have been what drew my attention to the patch. Perhaps I was lucky, because after overnight rain the sun was shining and the fresh crop of flowers was fully open.

It seems obvious that *Stellaria neglecta* is a rare and possibly impermanent casual in Cambridgeshire, where it does not occur in the sort of semi-natural damp hedgerow or woodland margin habitats where one can see it in south-

west England. On the other hand it may well be true that the species is not as rare as the paucity of records would suggest, because petal size, stamen number and general habit are all variable in *S. media* sensu stricto and some of its variants can approach *S. neglecta* in general appearance, so that *S. neglecta* may have been passed by as one of these. The combination of three characters seems, however, to be diagnostic, namely stamens 10 in most flowers, petals at least equalling sepals, and seeds (1.1–)1.3–1.6 mm. For *S. media* the corresponding characters are stamens 3–8, petals not equalling sepals, and seeds 0.9–1.3 mm. There are excellent full-page illustrations of *Stellaria neglecta* and *S. media* in Stella Ross-Craig's (1951) *Drawings of British Plants*, Part V, plates 34 and 35, and in R.W. Butcher's (1961) *New Illustrated British Flora*, Part I, pp. 436 and 438, the latter reproduced here.



Stellaria media* (left) and *S. neglecta* (right): drawings from R.W. Butcher's *New Illustrated British Flora

There is an interesting question about the flowering time of *Stellaria neglecta*. Most Floras give this as April to July (and all four verified Cambs herbarium sheets were collected between April and June), in contrast to *S. media*, which can be found in flower throughout the whole year. The Shelford plant (luckily!) was in full flower with some developing capsules and very vigorous growth in late August. I am inclined to attribute this to the particular weather pattern of the 1992 season; the long spell of disturbed 'Atlantic' weather which

is still with us at the time of writing (late November) did not really start until late June, but from then on it provided ideal growing conditions for this plant which British botanists associate with the south-west of England.

The micro-evolutionary relationship between these two species and with the third allied species, Lesser Chickweed *S. pallida* (Dumort.) Piré, is interesting. The common plant, *S. media*, is a variable tetraploid, which can be thought of as the product of allopolyploid hybridisation between the other two species, both of which can occupy more natural though contrasting habitats, the one semi-shaded woodland, the other dry sandy heathland. The combination produces a vigorous and successful weed species whose characters show considerable overlap to both its putative parents. The case is very similar to that other ubiquitous weed, Annual Meadow-grass *Poa annua*, a tetraploid related to two more specialised and restricted diploid species of *Poa*.

Calamints in Cambridgeshire

Graham Easy

The distribution of our two calamints in Cambridgeshire has long been uncertain, owing in part to oversimplification of the characteristic features described in reference books. The basal leaves and leaves of non-flowering shoots of Lesser Calamint *Calamintha nepeta* (*Clinopodium calamintha*) are often as large as those of Common Calamint *C. sylvatica* subsp. *ascendens* (*Clinopodium ascendens*), while poorly-growing Common Calamint can show small leaves up the main axis and have reduced calyx features, mimicking Lesser Calamint. There are six main points of recognition, but drawings a and c in Figure 1 indicate the amount of overlap that can occur. The following list is in order of importance for identification.

Feature	Lesser Calamint	Common Calamint
Hairs on lower calyx teeth	short or absent	medium to long
Stalks of flowers in mature plants	branched 1–3 times in lower clusters, at least once in upper	once branched in lower clusters, usually unbranched in upper
Leaves of main axis	small (up to 2 cm)	small to medium (up to 4 cm)
Lower two calyx teeth	usually only slightly longer than remainder in upper clusters	always considerably longer than remainder throughout plant
Hairs in throat of calyx	projecting brush-like beyond opening	remaining mostly within throat
Upper leaves	frequently strongly- and few-toothed, almost lobed	less conspicuously or not toothed

On the basis of these criteria, many of our past records have been inaccurate and several recent observations confused.

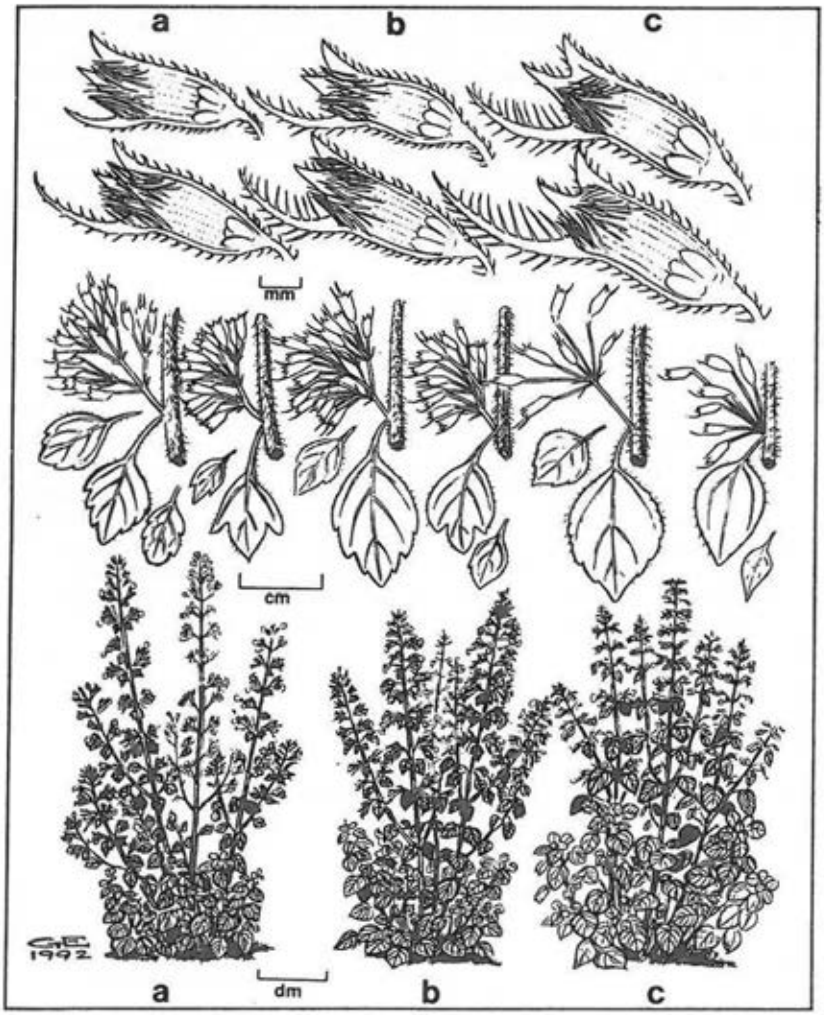


Figure 1: (a) Lesser Calamint *Calamintha nepeta*, (c) Common Calamint *C. sylvatica* subsp. *ascendens*, and (b) plants at Abington showing intermediate features. Detailed drawings show vertical sections of calyces from (top row) upper and (second row) lower flower clusters and, below these, lower (left) and upper (right) flower clusters with related leaves.

Graham Easy

Although both species grow on similar chalky wayside banks, surprisingly there is no mixing of populations, except where a few isolated plants of Lesser Calamint have been introduced by well-meaning horticulturalists. There are two well-defined zones of Lesser Calamint – one extending from its centre in Suffolk, at Moulton, into Cambridgeshire at Ashley, Cheveley, Newmarket and Kennett, and the other in south-east Cambridgeshire bounded by Great Abington, Bartlow, Balsham, Hildersham and Little Abington. Common Calamint can be found in scattered sites to the west of these areas right across to the Fenland edge.

The two species do come close to each other in several places, most importantly along the disused railway line between Sawston and Bartlow. From Sawston to Pampisford there are dense colonies of Common Calamint, at Linton similarly conspicuous shows of Lesser Calamint, while in between at Abington there are scattered groups of Lesser Calamint, with several plants at one site showing features suggesting interbreeding with Common Calamint in the past (see drawing b in Figure 1).

Snowdrops in Cambridgeshire

Gina Murrell & Peter Sell

Snowdrops are widely grown in Cambridgeshire gardens, but nowhere can they be said to be native. They are, however, found in waste places, patches of grassland, roadsides and particularly churchyards and cemeteries. Sometimes they originate from bulbs which have been thrown out and sometimes they have been deliberately planted, but they do seem to survive and even spread. This is particularly noticeable in churchyards and cemeteries, where they have spread from the graves to the surrounding grassland. Whittlesford (52/474485) and Newton (52/435492) churchyards are particularly good. At Whittlesford you can see *Galanthus nivalis*, its cultivar 'Flore Pleno' and its hybrid with *G. plicatus*, as well as *G. elwesii* and *G. plicatus* subsp. *plicatus*. Newton has *G. nivalis*, its hybrid with *G. plicatus*, and *G. plicatus* subsp. *byzantinus*. In the grassy areas of the University Botanic Garden, Cambridge, are found the same taxa as occur at Whittlesford, with the addition of *G. ikariae*. This last species needs to be looked for elsewhere. It is easily recognisable by its shiny yellowish-green, not dull glaucous (bluish-green), leaves. Sometimes snowdrops are found in copses, as *G. plicatus* subsp. *plicatus* is at Babraham (52/510513) and at Pampisford (52/506486).

The main characters for distinguishing the species are the colour, width and margin of the leaves and the number of green blotches on the outer face of the inner perianth segments (petals). *G. nivalis* has flat, glaucous leaves 4–10 mm wide. *G. elwesii* has flat, glaucous leaves 6–30 mm wide. *G. plicatus* has a glaucous stripe down the centre of the upper surface of the leaf and green at the sides; its leaves are 4–25 mm wide and folded back at the margins. *G. nivalis*, *G. ikariae* and *G. plicatus* subsp. *plicatus* have a single green blotch at the top of the outer face of the white inner petals. *G. elwesii* and *G. plicatus* subsp. *byzantinus* have a green blotch at both top and bottom of the outer face of the

inner petals. The hybrid between *G. nivalis* and *G. plicatus* has a narrower leaf than *G. plicatus* but usually shows some folding back of the margin. It often shows the central glaucous area and green margin. In many of its localities *G. nivalis* is the double-flowered cultivar (with numerous petals) 'Flore Pleno'.

Snowdrops always look best in natural surroundings, but if picked in the garden and put in the house in a vase their coldness can be melted by adding a few yellow flowers of the early *Mahonia* species.

Brampton Wood purchased by the Wildlife Trust

Katherine Campbell

Brampton Wood has been a significant feature of Huntingdonshire for at least 1,000 years. A 324-acre Site of Special Scientific Interest, it is one of the largest ancient woodlands in East Anglia, with a rich variety of plant, animal and insect life including many rare species (see pp. 78–79).

The natural woodland consists of a mixture of Ash, Field Maple, Hazel, Common and Midland Hawthorn, Aspen and standard oaks. Primroses, Bluebells and Dog's Mercury are abundant under the shrub and tree canopy. Locally there are good patches of Wood Spurge, Yellow Archangel and Wood Anenome. In all, 226 species of flowering plants have been recorded, more than half of these being found on the wide rides which cross the wood. Brampton Wood has a rich bryophyte flora – 81 mosses and 11 liverworts – and more than 300 species of fungi. It is an excellent bird habitat (with 57 species recorded) and there is a rich invertebrate fauna of butterflies (most notably the important colonies of Purple and Black Hairstreaks), moths (over 300 species), beetles, flies and spiders.

The future of Brampton Wood was thrown into doubt early in 1992 when the Ministry of Defence put it on the open market, offering it in two lots to the highest bidder. This could have meant its loss, neglect or mismanagement and no further public access if it was sold to unsympathetic buyers. Eight months of vigorous campaigning by the Wildlife Trust paid off in late October, when the MOD accepted its bid. During that time the Trust had enlisted the support of many local people, including local authorities and Members of Parliament: the bid itself was accompanied by a petition with several thousand names. With generous financial support already pledged from the National Heritage Memorial Fund and English Nature, the Trust was able to launch an immediate appeal with a target figure of £100,000 to be raised by 15 December. There was an overwhelming response. Donations from the public, received nationwide, far exceeded any previous appeal fund launched by the Trust. Local businesses have given generously and fundraising ideas ranged from jumble sales to parachute jumps.

The Trust will encourage local communities to join practical management tasks in the wood and assure continued public access. Priority for management work this year will be given to clearing the wide grassy rides.

Donations to the Brampton Wood Appeal should be sent to The Wildlife Trust, Enterprise House, Maris Lane, Trumpington, Cambridge, CB2 2LE.

Native and naturalised garlics in the Cambridge University Botanic Garden

Philip Oswald

Observations

On 24 July 1982 I noticed in the grass between two hazel clumps east of Middle Walk in the Botanic Garden (N7 on the Garden plan) a patch of an unfamiliar species of *Allium* bearing heads of purplish-pink flower-buds on long pedicels springing from a cluster of bulbils, with the spathe split into two long leaf-like points. Reference to a Flora (Clapham *et al.*, 1962) suggested that this was Keeled Garlic *A. carinatum* L., a species of mainland Europe and western Asia described as "thoroughly naturalized in a number of places from Shropshire and Lincoln to Kirkcudbright and Angus" but apparently not known as a wild plant in Cambridgeshire. The flowers opened early in August, and the protruding purple stamens confirmed the identification, matching Marjorie Blamey's painting (Fitter *et al.*, 1974). Her later painting (Blamey & Grey-Wilson, 1989) is even better. Both are of subsp. *carinatum*, "with an umbel with many bulbils, with flowers usually few and sterile [but] occasionally many", as opposed to subsp. *pulchellum* Bonnier & Layens, "with an umbel with no bulbils, with many fertile flowers" (translations of Latin of Stearn, 1978).

On earlier occasions I had noticed clumps of *Allium* leaves in the grass of the Garden, chiefly in the winter, for example on 21 February 1982 south of Main Walk in the Gilbert-Carter Memorial Area (R8–11), and had decided these were probably Crow Garlic *A. vineale* L. This is usually regarded as a native British species, but in Professor W.T. Stearn's opinion (*in litt.*, 11 April 1993) "the only truly native British species of *Allium*" are *A. ursinum* L. and *A. schoenoprasum* L.; he believes that *A. vineale*, "like other weeds of southern Europe, . . . has been here through human agency a very long time". In Cambridgeshire it is "fairly common on roadsides, in waste places and as a weed of arable land and permanent pasture on the boulder clay, rather scarce elsewhere" (Perring *et al.*, 1964). However, the cutting of areas of long grass during the summer, after the flowering of spring bulbs and most meadow flowers, had never allowed me to find them with their heads of bulbils and/or flowers.

In February 1983 I started to look for *Allium* more systematically and soon realised that there were three distinct types in the grass of the Garden. One, with conspicuous clumps of bluish-green (glaucous), slightly grooved, stiff, upright leaves reminiscent of rushes, proved indeed to be *A. vineale*. This has almost cylindrical, hollow leaves, which show this feature very clearly after mowing, when they continue to grow and display their open ends well above the level of the surrounding winter grass. On 14 July 1991 I finally observed heads of bulbils, without flowers, on this garlic in R8, thus identifying it as var. *compactum* (Thuill.) Boreau, the common form in Cambridgeshire (Crompton & Whitehouse, 1983). On 24 May 1992 plants in long grass by the large poplar south of Lynch Walk (V4) were about 900 mm tall, with three or four leaves (sometimes withered or broken off) and a thin terminal bud 20 mm

long, the lowest quarter of it swollen and pinkish and the rest forming a long green point (Figure 1, B). By 17 June the compact heads of bulbils were bursting their spathes. Some already had viviparous green shoots, and one head included flower-buds (var. *vineale* = var. *bulbiferum* Syme, var. *typicum* Ascherson & Graebner). On 17 July, of 10 heads, only two had single spherical clusters of bulbils, seven being split into two and one into three clusters. Three of the double heads bore greenish-white flowers (Figure 1, B), one of them at least 33 but the other two only single flowers. The viviparous shoots had all withered. Richens (1947) says that from "observations on the occurrence of the two bulbiferous types it seems that the presence or absence of flowers in the head is purely a matter of chance, the number of flowers when present ranging from 1–2 to 20–30". These plants withered during August and September, but new clumps of leaves were already well developed by the middle of October.

A second garlic, characteristically forming diffuse patches more or less intermingled with grass and itself much more grass-like, was evidently *A. carinatum* from the fact that I found it on 2 February 1983 where I had seen this species in flower the previous summer. Careful observation in 1991 showed that the new leaves appeared between 19 and 29 September, soon after the previous year's flowers had withered in the first few days of that month. In 1992 the new leaves came up about a week earlier, presumably because of the wetter weather. The leaves of this species are also glaucous, but somewhat greener and less stiffly erect than those of *A. vineale*, solid, more or less flat though slightly grooved on the upper surface, and weakly keeled (hence both Latin and English names) or even rounded on the undersurface (Figure 1, A). It is less conspicuous in a vegetative state than Crow Garlic but, like that species, shows up best in grass from November to March. Measurements made on 24 May 1992 showed that plants ultimately often have five leaves, with blades up to 350 mm long and 2–5 mm broad, tapering somewhat at the base and, more gradually, to about 1 mm near the rounded tip; at this stage the leaves were twisted anticlockwise through 360 to 540 degrees. The thin buds of the flower-heads, with the two long but unequal green points of the spathe, appeared by 3 June, even though they did not burst for a month and the flowers did not open till August (Figure 1, A). Some of the plants left uncut under the *Pterocarya* thicket (X4) in 1992 had whitish rather than purplish-pink flowers.

The third garlic, first noticed on 28 March 1982, presented more difficulty. The relatively broad leaves grow in untidy clumps and in the winter often appear at first sight to be of two kinds – broader, matt grey-green leaves, turning outwards, and narrower, glossy green leaves, more upright but usually turning over at their tips and sometimes forming a small spiral coil. Whereas the leaves of *Allium vineale* suggest a rush and those of *A. carinatum* a grass, these leaves definitely have the 'jizz' of a bulbous species, being somewhat reminiscent of *Muscari* in their untidy growth. Closer inspection reveals that the apparently matt leaves are glossy on the reverse side and *vice versa*, the explanation being that the older leaves tend to have their upper sides uppermost, while the younger ones are still somewhat inrolled and display their undersurface. Eventually I noticed a patch of these leaves on the Limestone Rock Garden (S5), labelled "*Allium roseum* L. var. *bulbilliferum* Vis.", which is apparently a synonym for var. *bulbiferum* de Candolle. In the 1962 Flora,

Figure 1: Four species of *Allium* growing in the Cambridge University Botanic Garden – A: Keeled Garlic *Allium carinatum*, B: Crow Garlic *Allium vineale*, C: Rosy Garlic *Allium roseum*, D: Few-flowered Leek *Allium paradoxum*

Graham Easy

E.F. Warburg used his own name – "*A. roseum* L. ssp. *bulbiferum* (DC.) E.F. Warburg" – for the taxon "more commonly naturalized" in Britain, but Stace (1991) says, "Presence or absence of bulbils is not worth ssp. ranking." Rosy Garlic is a plant mainly of the Mediterranean region. Professor Stearn (*in litt.*) says that "one can find plants with and without bulbils growing together in Greece and all have the same chromosome number in those examined".

In May 1992 the patch on the Limestone Rock Garden produced heads of 3–29 relatively large (up to 20 mm across) open flowers of a delicate rosy pink, on long pedicels (10–60 mm) springing from a bunch of 4–10 large shiny bulbils of a deep cherry red and surrounded by the three or four pointed papery sections of the spathe (Figure 1, C). The stamens do not protrude from the flowers as they do from the much smaller and more tubular flowers of *A. carinatum*. One of these heads is quite well illustrated by Marjorie Blamey (Blamey & Grey-Wilson, 1989), but the Cambridge plants of Rosy Garlic have much less vivid and usually fewer flowers, and these are almost white in the more shady areas in which it often grows in grass, as under the *Magnolia* trees (V2–3). Here, too, the bulbils are a very pale green, only partly suffused with cherry red. Measurements made on 24 May 1992 showed that plants had reached up to 670 mm in length, with five leaves all quite low on the solid cylindrical stem, each up to 400 mm long and up to 10 mm wide at the widest point somewhat below the middle, tapering to a long point. These leaves were still matt above and glossy beneath, slightly keeled, and with minute bristle-like teeth (scabrid) on their margins. They also still showed a tendency to form a spiral coil.

Clapham *et al.* (1962) place *A. roseum*, alone among the species which they include, in Section *Molium* G. Don ex Koch of the genus *Allium* L. and give "*Lvs spiral*, linear, flat, almost basal" as a diagnostic character of this section. However, "*spiral*" here refers to the *arrangement* of the leaves around the stem; in other sections of *Allium* these are either distichous (arranged in two opposite rows) or basal. As I have said earlier, the leaves of *A. carinatum* are twisted throughout their length rather than coiled at the end. According to Richens (1947), small plants of *A. vineale* are "frequently seen with a single leaf thrown into one or more spiral coils", presumably like *A. roseum*.

In 1991 Rosy Garlic was more or less dried up by the end of July; new leaves appeared by 10 October that year but about three weeks earlier in 1992.

Even before 1982 I had noticed a fourth, early-spring-flowering garlic naturalised west of the (then) fence of the garden of Cory Lodge (M/N6–8). I was already familiar with this as Few-flowered Leek (or Garlic) *Allium paradoxum* (Bieberstein) G. Don, a "native of the Caucasus, N. Persia and Mountain Turkmenia" first recorded as naturalised in Cambridgeshire in 1928 (Perring *et al.*, 1964) and now known from at least eight 10-km squares in v.c. 29 (Crompton & Whitehouse, 1983). This highly aggressive weed (Barling, 1971; Stearn, 1987) has a very short lifespan above ground, unlike the three winter-green, later-flowering species already described, and tends to occur under deciduous trees, rather than in grass as they do, with a life-cycle similar to, but even shorter than, that of Bluebell *Hyacinthoides non-scripta*. In 1992, the first leaves appeared in the first fortnight of February, leaves were well developed by the middle of March, and some plants bore large, swollen buds by 20 March; flowering was mainly in April, and by the end of May many

of the plants had shrivelled. There is only one developed leaf, which is of a glossy, bright green and is hooded at first, then almost flat with a slight keel; the inner surface curves inwards, so that the keel, which one would expect to be on the undersurface, *appears* to be on the upper side (Stearn, 1987; Davies, 1992). The blade can ultimately be 250 mm long and is usually about 8 mm wide at its widest (above the middle). The flower-stem is triangular in cross-section, with two sides concave and one flat, and can reach 450 mm in length and 6 mm across at its widest (in the middle). At its top is a cluster of about five green bulbils, up to 7 mm long and 6 mm broad, with, usually, only one or two white bell-shaped flowers, 10–12 mm long, on pedicels which can be over 110 mm long (Figure 1, D). Barling (1971) discusses the frequent abnormalities of the flowers.

Also naturalised in the Garden is a species which probably originated in South America; it is related to *Allium* but does not smell of garlic or onion. This is Honey-bells, usually considered to be *Nothoscordum gracile* (Aiton) Stearn (*Allium gracile* Aiton, *N. fragrans* (Ventenat) Kunth, *N. inodorum* auct., non (Aiton) Nicholson) (Stearn, 1986; Walters *et al.*, 1986; Stace, 1991), but recently claimed to be *N. borbonicum* Kunth (Ravenna, 1991; Kent, 1992). It is illustrated, as *N. inodorum* (Aiton) Nicholson, by Rix & Phillips (1981, p. 143 (i)). It has strap-shaped, glaucous basal leaves, present all round the year, 4–12 mm wide and 200–450 mm long, tapering to a rounded tip, and a more or less cylindrical scape, up to 700 mm long, with an umbel of up to 18 sweetly-scented white flowers with a two-valved spathe and no bulbils. The tepals (which in *Nothoscordum* are fused at the base) are 10–14 mm long, with the midrib reddish on the outside. This species occurs mainly as a flower-bed weed, and Norman Villis tells me that it was at one time so abundant around the glasshouses (P4–S4) that the soil had to be carted away to reduce it. It still grows there, however, as well as in the nearby bed north of Lynch Walk (T/U3) and in the Systematic Beds (principally U9, where it has presumably spread from the *Allium* bed in T9) among other places. Honey-bells "spreads rapidly by seed and persists by prolific bulblet production" (Stearn, 1986).

Discussion

Little that is definite can be said about the origin of the garlics in the Botanic Garden. There seems no reason to think that *Allium vineale* has been introduced since the 'New Garden' was opened in 1846 (Walters, 1977, 1981). It occurs in the grassland across Trumpington Road, and it is not 'officially' grown in the Garden (King, 1990). Ruth Richens (1947) provides a detailed account of the biology of this species based principally on studies carried out in Cambridgeshire. She describes its behaviour as an "extraordinarily resistant" arable weed as well as a plant of pastureland and road verges. It is widespread in less intensively managed grassland areas in the western half of the Garden, but, perhaps surprisingly, I have so far detected it in only two places in the eastern half of the Garden, which was allotments until its development as the 'New Area' in the 1950s (Walters, 1977, 1981): on 29 November 1992 I noticed a single clump among young trees by East Walk (on the boundary of F5 and F6) and on 22 March 1993 several clumps among planted daffodils in long grass south of South Walk (G11). Richens says that she had no exact information on the effect of repeated cutting in the field, but that "small-scale

experiments on repeated cutting of the foliage down to the ground during the spring have shown that the treatment does not destroy the plant". In the Garden, the areas where it grows are normally all cut well before it can produce ripe bulbils, and several times thereafter into the winter; but it does not appear to exist in the closely-mown lawns. Richens also says that not more than about 30% of any population consists of "scapigerous plants" (i.e. those destined to produce heads of bulbils and/or flowers) in any one season, the rest being "smaller, less conspicuous plants, with shorter, more slender foliage during the growing season, which dies back during May or June". This no doubt accounts for the apparently much greater frequency of this species in the Garden during the winter months than in the early summer before the long grass is mown.

Professor Stearn (*in litt.*) suggests that "all forms of *Allium* with bulbils originated from seed-producing populations without bulbils but that bulbil-bearing forms had a much greater capacity to survive and prosper and spread widely under man-made conditions". In a recent book for gardeners interested in growing *Allium* species, Dilys Davies (1992, pp. 59–60) warns against bulbil-bearing forms, linking *A. carinatum* subsp. *carinatum*, "scourge of heavy soils", with *A. vineale* as "principal villains, because of their ubiquity," and describing bulbilliferous forms of *A. roseum* and *A. paradoxum* as "lesser thugs".

Allium carinatum is grown 'officially' in the Garden only on the Systematic Beds (T9) (King, 1990), the stock possibly surviving from an acquisition in 1954 (Botanic Garden card index). Soon after that, Dr Louis K. Mann removed some *Allium* plants from the *Acer* section (described as K4 in the card index, but this square was renumbered X4 when the 'New Area' was opened), grew them on and later determined them as *A. carinatum* on a postcard dated 18/10/56. The next August Dr P.F. Yeo recorded this species flowering in uncut grass in J9 (now W9) and "probably naturalized throughout area J10–K4" (now W10–X4) – an area where it is still abundant. It is inconceivable that this widespread population had derived so rapidly from the 1954 stock, which in any case Dr Yeo thought might have been swamped by *A. schoenoprasum* until he found it flowering on the Systematic Beds in August 1957; *A. carinatum* has never spread through these beds as *Nothoscordum gracile/borbonicum* has. How long it has been in the Garden must remain a matter for conjecture, but, though it grows right up to the boundary in N6, 7, 9 and 10, I have not yet found it in the 'New Area'. Possibly, its spread in grassy areas antedates the use of grass-mowers; the bulbils do not ripen until the end of summer, when they would be scattered widely by any late haymaking.

Frost *et al.* (1991) discuss the naturalisation of *A. carinatum*, *A. roseum* (apparently var. *bulbiferum*) and *Nectaroscordum siculum* (Ucria) Lindley subsp. *siculum* (*Allium siculum* Ucria) in the Avon Gorge, dating back to the first decade of this century. They comment that *A. carinatum* "persists but does not flower" in areas "heavily mown today by motorized gang mowers", "perhaps imitating the condition [presumably of the native or long-naturalised *A. sphaerocephalon* L.] when the area was heavily sheep grazed", as depicted in the 18th and 19th centuries. Like *A. vineale*, *A. carinatum* survives cutting in the Botanic Garden but again probably does not occur in the most frequently

mown lawns. It certainly does not survive in the spot where I first noticed it in July 1982, which is now close-mown, though it is abundant in the longer grass a few metres away and flowers at the base of the nearby hazels (N7).

Allium roseum var. *bulbiferum* grows, as I have said, on the Limestone Rock Garden (S5); this was constructed in the 1950s, but the card index reveals that Dr Yeo found the plant "unlabelled, presumably self-sown" and identified it in June 1967. Ten years earlier, in May 1957, he had found and determined it from Lynch Walk and the wall of the tropical fern house and neighbourhood. Once again, there is no evidence of when or whence the plant came into the Garden, but again I have not found it in the 'New Area', though it grows as close as N10 and N11. Like the two species already discussed, it is cut several times a year in many of the places where it grows, though nowadays mainly outside its earlier flowering period.

Frost *et al.* (1991) say that the number of flowering plants of the *Allium* species on St Vincent's Rocks "may vary widely from year to year, depending especially on climatic conditions", responding "by much increased numbers of flowering plants in the year following a period of severe drought with high temperatures and insolation". I have no firm evidence for this phenomenon in the Botanic Garden, but I have the impression that flowering of *A. roseum* has increased under the *Magnolia* trees in the last three years, though this *may* be related to the grass-cutting regime. Frost *et al.* also say that "numbers tend to be low following a severely cold winter, which may damage the autumn-emerged leaves, or prolonged periods of very wet, cloudy and cool conditions, especially in spring". Richens (1947) writes of *A. vineale*: "Extremely frost-hardy; no permanent damage observed even after many weeks' intensive frost: . . . foliage dies back from the tip, but growth is renewed rapidly as soon as thaw sets in, leaves which have died back elongating from the base." I have as yet seen no sign of frost damage to *Allium* leaves in the Garden, for example after the bouts of severe weather of the last winter.

Honey Garlic *Nectaroscordum siculum* subsp. *siculum* is grown in the bed north of Lynch Walk (T4) from stock acquired in 1962 and spreads locally, but it has so far shown no sign of becoming naturalised in the Garden, though it has been recorded as naturalised in Millington Road Pit, Cambridge, with *A. paradoxum* (Cadbury & Smith, 1981). It is a much larger plant than the others discussed here, with striking umbels of nodding, sweetly scented, brown and green, bell-shaped flowers (see Rix & Phillips, 1981, p. 152 (e)) opening early in May on stems over a metre high. Nearly thirty other *Allium* taxa are also grown out-of-doors in the Garden (King, 1990), most of them on the Limestone Rock Garden and Systematic Beds, but none of these have spread far from their labels.

The origin of *Nothoscordum gracile/borbonicum* in the Garden is unknown, though it was recorded by Dr Yeo as long ago as November 1953 by the glasshouses (D4, E4, now Q4, R4). *Allium paradoxum* was apparently introduced to the garden of Cory Lodge (L/M7), and the infestation of the neighbouring area (since somewhat reduced by weedkilling) and, quite possibly, populations elsewhere in the Garden derive from this source (Norman Villis, pers. comm.). However, Dr Yeo recalls finding the late Dr William Balfour-Gourlay (*c.* 1879–1966) engaged in digging up *A. paradoxum* around the *Pterocarya* thicket, an area which, Dr Yeo says, has often been heavily

infested with it; Dr Balfour-Gourlay said that he had been accidentally responsible for its introduction here and felt it his duty to try to extirpate it! The bulbs or bulbils are easily spread by gardening activities (cf. Barling, 1971), and possibly also by animals such as Grey Squirrels, and this is the only introduced garlic that I have so far found in the 'New Area' (in L11 on 15 March 1992). *A. paradoxum* var. *normale* Stearn (Stearn, 1987) flowers in March in the Alpine House from material collected at Van in Turkey in 1968 and on 4 April 1993 was flourishing under a tree of *Prunus serrulata* 'Alboplena' in V5. It has a cluster of attractive delicate-looking white flowers, without any bulbils, and looks very different from its badly-behaved relative. There is a good photograph in Davies (1992, p. 7). The photograph in Rix & Phillips (1981, p. 70 (e)) seems to be of a poorer form, though also without bulbils.

Nomenclature

The scientific names of garlics used in this paper, except for those of varieties of *Allium vineale*, are taken from Walters *et al.* (1986), in which the account of *Allium* species is by Professor W.T. Stearn.

Acknowledgements

I am grateful to Dr Peter Yeo, Clive King, Norman Villis and Judy Cheney for assistance while I was researching the past history of these garlics in the Botanic Garden, to Professor William Stearn for helpful comments on an earlier draft of this paper, to Dr David Coombe for useful advice about spirals, and to Graham Easy for providing the excellent drawings of four of the species.

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Some diatoms of a small saline habitat near Cambridge

Hilary Belcher & Erica Swale

Though many diatoms are tolerant of a range of freshwater habitats, certain species are known as indicators of somewhat saline conditions, and authors who have classified freshwater diatoms by their salinity preferences have termed them 'mesohalobous' or moderately salt-loving (Kolbe, 1927, 1932; Petersen, 1943; Hustedt, 1957). The finding of a thriving population of these diatoms near Cambridge led us to investigate them and their habitat in more detail.

The northern end of the M11 motorway passes through the parish of Girton along an embankment, which at the site of study is about 5 m high and is pierced by a concrete tunnel for a farm track and footpath (52/418607). Drainage water from the bank emerges near the bottom from two metal pipes, one on each side of the northern entrance to the tunnel, the southern entrance having no such pipes. Instead of draining away immediately, the water from these collects in two permanent shallow puddles, with surrounding wet areas. On the mud of these puddles are conspicuous brown patches of diatoms, which have been seen for over 13 years.

In 1979, soon after the motorway was constructed, a collection from the north-west puddle was dominated by the diatoms *Cylindrotheca gracilis* (Figure 1, G), *Nitzschia sigma* (D), *N. hungarica* (C) and the very similar *N. constricta*, and *Surirella brebissonii* (B). While the last species is tolerant of a wide range of fresh and brackish conditions (and is therefore termed 'indifferent'), *Cylindrotheca gracilis* is an uncommon diatom which is an indicator of saline conditions. The above species of *Nitzschia*, when they are seen in quantity, usually indicate brackish conditions, though they do occur in small numbers in the local large calcareous rivers, the Cam and the Great Ouse. Later collections showed that the species composition of the puddles was more or less constant.

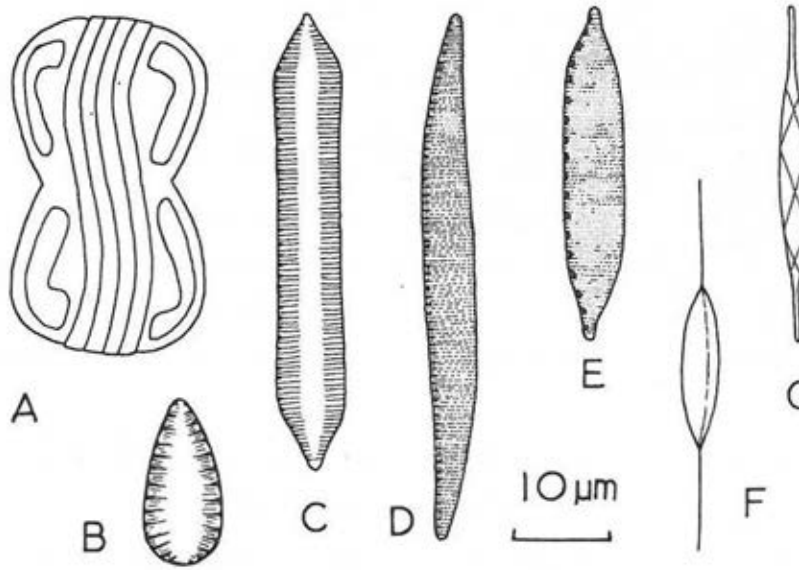

Figure 1: Seven diatoms listed on pp. 75–76 (x 1,250) – A: *Entomoneis paludosa* var. *salinarum*, B: *Surirella brebissonii*, C: *Nitzschia hungarica*, D: *N. sigma*, E: *N. vitrea*, F: *N. closterium*, G: *Cylindrotheca gracilis* The two last named are very thin-walled and the narrow ends are slightly flexible. *N. constricta* is omitted as it is so like *N. hungarica*. A, F and G were from preparations cleaned by incineration, the others cleaned by using nitric acid.

The same diatoms were present in samples taken on three occasions this year (1992) and had been joined by others which also favour brackish conditions, particularly the guitar-shaped *Entomoneis* (*Amphiprora*) *paludosa* var. *salinarum* (Figure 1, A), *Nitzschia vitrea* (E) and *N. closterium* (F), all of which are common near the coast and in inland saline habitats. The last-named sometimes occurs in quantity in the marine plankton.

Water samples taken this summer from the drainage pipes had a salinity ranging from 0.90 parts per thousand (‰) to 1.33‰, about ten times that in the nearby Great Ouse but only one-thirtieth of that of sea water (about 36‰). Nevertheless the conditions obviously favour certain diatom species which prefer brackish water, while presumably discouraging many common freshwater ones. The high salt content is almost certainly due to the rock salt spread on the road above in bad weather dissolving in rainwater and slowly percolating downwards throughout the year.

'Mesohalobous', the category in which most of the diatoms listed below have been placed, has been defined by Kolbe (1932) as preferring a salinity of 5–20‰, about four times that measured by us. However, Petersen (1943)

thought that the effects of high salinity began to be shown above about 0.18‰, a sixth of that which we measured, while Hustedt (1957) placed the lower limit for his β-halobous diatoms at 0.2‰.

The principal diatoms of the site are listed below, with their salinity preferences as estimated by the above authors:

Cylindrotheca gracilis (Breb.) Grun.: mesohalobous (Hustedt)
Entomoneis paludosa (W. Sm.) Reimer var. *subsalina* (Cleve) Krammer: mesohalobous (Petersen)
Nitzschia closterium W. Sm.: mesohalobous (Kolbe)
N. constricta (Greg.) Grun.: mesohalobous (Petersen)
N. hungarica Grun.: mesohalobous (Petersen)
N. sigma W. Sm.: mesohalobous (Petersen)
N. vitrea Norm.: mesohalobous (Petersen)
Surirella brebissonii Krammer & Lange-Bertalot: indifferent (Petersen)

Other species occurred in smaller numbers but have been omitted at this stage for conciseness. We are continuing to observe the site and would be pleased to receive any information regarding other possibly salt-rich places, since the study of diatom floras can obviously complement that of angiosperms in determining the occurrence and effect of unusually high levels of salinity.

Acknowledgement
We wish to thank Mr J.R. Carter for help with identification.

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A note on Hazelcroft in Gamlingay Wood

Charles Turner

As Oliver Rackham points out on pp. 8 and 10 of his paper on Gamlingay Wood in the last issue of *Nature in Cambridgeshire*, a small but integral part of the wood is in the parish of Waresley, Huntingdonshire. An entry in the Waresley parish registers emphasises the antiquity of this situation: "Memorand yt there is a piece of Gamlingay Wood wch belongs to ye parish of Waresley it abut on Waresley field and there is a ditch wch separate and divides it from the rest of ye wood the contents of it are three acres or a hundred poles for both I recd tyth in ye yere 1688 as also in ye yere 1697 viz 58 pole as my predecessors

had done before me." When the Waresley tithes were commuted to a cash payment in 1842, this small patch of woodland, said to amount to 3 acres, 1 rood and 6 poles, was still owned by the Warden and Scholars of Merton College, Oxford, and let to Ann Paine. The tithe charge for the vicar was set at 3*s*. 3*d*.

In 1834, however, the Waresley estate had been acquired by Charles Duncombe, First Baron Feversham, as a country seat for his youngest son, Octavius Duncombe. It is clear that the Duncombes set out to acquire virtually the whole of the rest of the parish. This cadet branch of the Duncombe family died out in 1930, and the estate was sold by auction in 1932. Lot 10 was "Part of Gamlingay Wood, extending to about 4 acres, 0 roods, 11 poles, being Ordnance No. 161 in Waresley Parish and in hand". The map attached to the sale catalogue confirms that this related to Hazelcroft. It seems that, to satisfy their territorial ambitions, the Duncombes had managed to purchase this small fragment of the wood from Merton College at some time between 1842 and 1930. Details of this transaction may perhaps exist in the Duncombe papers, now in the Huntingdon Record Office. It seems likely that Merton College repurchased Hazelcroft at the auction in 1932, but this is, as yet, unconfirmed. Although the bulk of the Waresley and adjacent Tetworth estates was acquired in 1932 by the Earl of Sefton, much of it passing subsequently to the Crossman family, legal records and Lady Crossman herself confirm that the Crossmans did not own Hazelcroft before their purchase of the whole of Gamlingay Wood in the 1970s.

Reviews

The Natural History of Brampton Wood
edited by T.C.E. Wells. Huntingdonshire Fauna and Flora Society 1992. From S.E. Wells, 94 High Street, Upwood, PE17 1QE, £5 including postage.

Brampton Wood is one of the biggest natural woods in the east Midlands. By good fortune this book appeared just before the wood was bought by Bedfordshire & Cambridgeshire Wildlife Trust (see p. 66). It is a collection of studies by specialists in various groups of animals and plants. Besides flowering plants, bryophytes, fungi, mammals, and birds, there are some remarkably detailed lists of invertebrates, notably moths by Barry Dickerson and flies by Jonathan Cole.

Terry Wells and his colleagues had to start almost from nothing, since Brampton is too far from Cambridge to have been much visited by earlier botanists and zoologists. They are to be congratulated on the progress they have made towards understanding this wood. This is a preliminary publication of work which will be a worthy companion to the well-known studies of Monks Wood and Bedford Purlieus.

Brampton is an unusual and mysterious wood. It has been the same shape and size for at least 250 years, but in Domesday Book it was much smaller. Where was the original nucleus of the wood, and when did it grow to its present size? Why is such a big wood called after the local village, instead of

having its own name? How was the coppicing of this huge wood organized, and where did the produce go? Why is so little to be seen of its coppicing history today? Where did the big old maples and hawthorns, a speciality of the wood, come from? Let us hope that Terry Wells and his colleagues will discover the answers.

Oliver Rackham

Breck, Fen and Forest
M.G. Rutterford. Privately published by Bruce Rutterford, Broom Hill Road, Lakenheath, Suffolk, 1992. 72 pp. £6.50 (which includes postage).

If you are a Suffolk man or have known the Breckland you should read *Breck, Fen and Forest*. It is the delightful records of a naturalist whom you may 'join in a walk', reading his chapters in any order. It is the fulfilment of the author's wish to record a little of local history, of characters and customs together with the changes and losses of the landscape, plants and birds of the West Suffolk Breckland. The book also includes chapters with brief accounts of his travels to Snowdonia, where he met an 'opposite number' in Evan Roberts, to the Burren in Western Ireland and to the Alps.

An index would have been useful and a title page appropriate. As one of his many friends, I knew of his plan to write some years ago. The record shows that Marg, as he was always known, picked up his pen at intervals, logged some thoughts and recorded his observations on a day's outing. The form of his short paragraph notes was meant as such, but they could have been drawn together with no harm to his writing. It is a pity that Marg did not more often give the location of his plant species lists and record the date. Records such as that of the five-acre field of Grape Hyacinths which he showed to William Farren ought to have been located and dated, although it is likely that some of Marg's friends know of this site.

This book also tells us much of the author. His love of nature is unfolded in descriptions of cobwebs on a frosty morning or of the varied markings on Stone Curlews' eggs. His detailed recordings over many years of the fortunes of the Lizard Orchids on Maidscross Hill show the deep interest of the naturalist. He was highly observant, and to the above record we can add discoveries of *Teucrium scordium*, *Corynephorus canescens* and *Veronica triphyllos* as well as the rescue of the last plant of *Gnaphalium luteo-album*. Marg was known far and wide. People came long distances in the hope of information on Breckland species or the great pleasure of even a short time with him in the field. Those who knew him well will share the thoughts which he expressed: "the fen, a paradise for wild duck . . . now drained, the wildfowl gone and with them many of the wild flowers . . . often I have wished that in this country, there could be a re-incarnation of the fierce ancient tribes which once roamed the Anglian Kingdom to drive the invaders away."

Read this book, for, if you knew him, you will understand him and, if you did not, you will at least gain some appreciation of a great countryman. As Rutterford of Breckland passed on his way, the Mallard soared high in formation over the fen, the Scots Pines sighed and the little Fingered Speedwell bowed in recognition.

John Trist

The Cambridgeshire Flora Group in 1992

Derek Wells and others

This year sees the end of the Survey of Nationally Scarce Species co-ordinated by the Botanical Society of the British Isles, to which a number of local botanists have contributed. We warmly thank all who took part.

The Cambridgeshire Flora Group has contributed a further 17,000 or so parish and tetrad records for v.c. 29. Several parishes are now well covered, but there are quite a number still to receive the feet and eyes of a botanist. There is no requirement to be an expert, simply a willingness to go out and enjoy and learn about wild flowers from friendly botanists. If you would like to help, please contact Derek Wells (Tel: 0480 830226).

The U3A Botany Group, led by Kathleen Tucker, is giving valuable support to field botany in Cambridgeshire and is an excellent example of a group of people increasing their knowledge and enjoyment of the local flora by self-help topped up by some outside expertise. Edna Norman and Liz Whetton continue to compile a botanical gazetteer of Cambridgeshire which will include Professor C.C. Babington's localities.

James Cadbury and others have completed a survey of riparian, emergent and aquatic plants of 42 pools and some 700 ditches in the Ouse Washes, jointly funded by the R.S.P.B., English Nature and the Wildfowl and Wetlands Trust. This has included recording of the distribution of the scarce Greater Water-parsnip *Sium latifolium*. A population survey in 1992 by Gigi Crompton and Kathleen Tucker of Spotted Cat's-ear *Hypochoeris maculata* at a site on the Devil's Ditch showed a drop of 50% since a survey in 1985.

Once more it is a pleasure to record our thanks for all the help and facilities offered to us by Professor T. ap Rees, David Briggs, Peter Sell and Gina Murrell in the Herbarium. This was in spite of the flooding which occurred in the Herbarium, causing so much extra work for the staff. Their efforts on our behalf are much appreciated.

The following accounts of the excursions of the Cambridgeshire Flora Group during 1992 have been edited from texts provided by various members.

Saturday, 25 April: Out Wood and Sparrows Grove

For the first meeting of the year we set out by coach, together with members of the Cambridge Natural History Society, about 36 participants in all, and travelled to the south-east of the county to visit these two woods, which lie between Carlton and Borough Green. The woods are contiguous, Sparrows Grove being on the valley slope and passing into Out Wood on the plateau. The soil is mainly boulder clay, and the principal trees are Pedunculate Oak, Ash, Field Maple and Hazel, but we also saw a few fine specimens of Sweet Chestnut, no doubt originally planted. These are Oxlip woods (see p. 45). Other abundant herbs were Bluebell *Hyacinthoides non-scripta* and Dog's Mercury *Mercurialis perennis*, together with attractive spring-flowering species such as Wood Anemone *Anemone nemorosa* and Bugle *Ajuga reptans*. However, these woods also contain acid sandy patches with species that are absent or very rare in the West Cambridgeshire woods. We saw Wood Sorrel *Oxalis acetosella* and the grasses Wood Melick *Melica uniflora* and Wood Millet *Milium effusum*, but Wood Speedwell *Veronica montana*, which has been recorded here, eluded us.

Reaching the break of slope where Sparrows Grove merges into Out Wood, we had a clear view over the upper Stour Valley, and it was here that we heard the bad news from Mr Martin

Reynolds, Chairman of Carlton Parish Council. All the valley that was before us is under threat from the proposed Great Bradley Reservoir, which, if constructed, will flood an area of approximately six square miles, including both Sparrows Grove and nearby Great Widgham Wood, both SSSIs, and will lap at the margins of Out Wood. We were urged to assist in any possible way to oppose this devastating plan and to press for alternative methods of water supply and conservation. The party then moved to a nearby barn, where Mr and Mrs Reynolds had very kindly laid on afternoon tea.

Saturday, 16 May: Great Wilbraham Common

Thirty-six people turned up on a warm, sunny day to walk round this cattle-grazed common, with Cuckoo and Turtle Dove calling, Common Toads laying spawn, and Holly Blues, Brimstones, Orange-tips and even a Painted Lady on the wing. Before the botanical recording began, we were very fortunate to listen to the man responsible for the upkeep of the common, Mr Johnson, who outlined the management regime. He explained that the common was used in the past by certain specified individuals in Great Wilbraham for summer grazing but that the demand for grazing had waned, allowing scrub to invade parts of the common to the detriment of the grassland flora; fortunately, grazing had been reinstated and the Wildlife Trust was helping to remove the developing scrub. We saw a number of interesting grassland plants, including Dwarf Thistle *Cirsium acaule*, Clustered Bellflower *Campanula glomerata*, Dropwort *Filipendula vulgaris* and at least 14 grasses. We searched for Green-winged Orchid *Orchis morio*, previously recorded here, and Sharon Brown of the Trust found one plant. Some members seemed to spend less time looking at the flora than at the rather large bull!

Saturday, 20 June: Great Chishill

Twelve members met to record this parish, which is in the administrative county of Cambridgeshire but in the botanical vice-county of Essex. We divided into small groups, each taking a tetrad within the parish. We did not enter the woods, as they are used for rearing Pheasants and the owners had asked that these should not be disturbed; consequently, recording was along roads, public footpaths, field edges and hedgerows. Most people found Knapweed Broomrape *Orobanche elatior*, which was in full flower like its host, Greater Knapweed *Centaurea scabiosa*, on the Chalk. Kathleen Tucker and Philip Oswald walked round Monkshole Wood, which is on boulder clay, and spotted Pendulous Sedge *Carex pendula* inside it and recorded a good range of shrubs on the margins, including Field-rose *Rosa arvensis*, Spindle *Euonymus europaeus* and both hawthorns *Crataegus* species. A hedgerow surviving from part of the wood felled some years ago contained Aspen *Populus tremula* and Hornbeam *Carpinus betulus*.

Saturday, 11 July: Mill Pits, Over

About 25 people braved the light rain to join this walk, which was led by Owen Mountford and Tim Parish, the warden of Mare Fen. Mill Pits are privately owned rough grazing land which lies to the east of Mare Fen reserve, sharing the Swavesey Drain as a common boundary. The area is undisturbed in summer but heavily grazed in the autumn and winter. The water's edge provided Purple-loosestrife *Lythrum salicaria*, Water Mint *Mentha aquatica*, Skullcap *Scutellaria galericulata*, Water-pepper *Polygonum hydropiper* and False Fox-sedge *Carex otrubae*, and in the water were Water-violet *Hottonia palustris* and *Elodea nuttallii*, a relative of Canadian Waterweed, also from North America, first recorded in Cambridgeshire in 1974 and now spreading rapidly (see also below and p. 84). The drier pasture had three plantains *Plantago* spp., Common Restharrow *Ononis repens*, Spotted Medick *Medicago arabica*, Fiddle Dock *Rumex pulcher*, Red Bartsia *Odontites verna* and the long-awned form of Common Couch, *Elymus repens* var. *aristatus*. The plants of Cotton (or Scotch) Thistle *Onopordum acanthium* found in and around Mill Pits do not have the white cotton to be found on most garden specimens and may be a native form. A short walk to the

north of Mill Pits brought us to a flood-bank with Knotted Hedge-parsley *Torilis nodosa* and Corn Parsley *Petroselinum segetum*.

Our thanks were given to Tim Parish for his willingness to share his local knowledge and to Owen Mountfield for entertaining and educating us in his own inimitable style.

Saturday, 8 August: The Gullet to Jolly Banker's Bridge, Sutton

Cars were parked near The Gullet, and Philip Oswald and Chris Preston led the party along a route they had reconnoitred on 26 July, along the Counter Wash between the Old Bedford Low Bank and the Counter Drain parallel to the Old Bedford River, then over Jolly Banker's Bridge to a willow holt in the Hundred Foot Washes close to the New Bedford River. Notable plants seen included the nationally scarce Fringed Water-lily *Nymphoides peltata*, Rigid Hornwort *Ceratophyllum demersum*, Nuttall's Waterweed *Elodea nuttallii* (see above) and Spiked Water-milfoil *Myriophyllum spicatum* in the Counter Drain, Whorled Water-milfoil *M. verticillatum* in the Low Bank ditch, *Potentilla* x *mixta* (see p. 84) and Field Pepperwort *Lepidium campestre* along its banks, and Knotted Hedge-parsley (as at Mill Pits) on the Barrier Bank by Jolly Banker's Bridge. In the wetter parts of the Counter Wash were Marsh Dock *Rumex palustris*, Pink Water-speedwell *Veronica catenata* and Tubular Water-dropwort *Oenanthe fistulosa*. We also saw Fine-leaved Water-dropwort *O. aquatica* and were able to compare four species of duckweeds *Lemna* (including *Spirodela*). The holt provided three willows, *Salix purpurea*, *S. triandra* and *S. viminalis* as well as a bush of a puzzling hybrid of *S. viminalis*. A striking metallic green Musk Beetle *Aromia moschata* was seen nearby.

Saturday, 19 September: Devil's Ditch north-west of A1304

The primary purpose of this meeting was to study roses *Rosa* spp. on a stretch of the Devil's Ditch where this genus has puzzled botanists in the past. The Revd A.L. Primavesi, co-author of a forthcoming B.S.B.I. handbook on roses, kindly agreed to lead the party. He told us that it is not too difficult for botanists to get to know their local species and the obvious hybrids between them, although some plants of complex hybrid origin may be indeterminable even by an expert. There is still no agreement on the taxonomy of *Rosa canina*, but in Clive Stace's (1991) *New Flora of the British Isles* and the proposed handbook four informal groups are recognised.

Rosa canina Group Dumales and Group Transitoriae were soon found. The plants from this stretch of the Ditch illustrated as "*R. stylosa* (?)" on p. 43 of *N. in C.*, No. 26 (1983) were examined closely. They are clearly referable to *R. canina* rather than to *R. stylosa*, but the conical disc with the styles passing through it in a channel of uniform bore indicated introgression with *R. stylosa*, and one bush was discovered with deltate prickles similar to those of *R. stylosa*. Unfortunately no pubescent rose in the *canina* complex was found, although one similar to that illustrated as "*R. coriifolia*" in *N. in C.* (*loc. cit.*) had been seen earlier in the week. The distinctive Sweet-briar *R. rubiginosa* was frequent and *R. caesia* subsp. *glauca* x *R. canina* was occasional amongst the variants of *R. canina*; this hybrid is apparently frequent in the vice-county, despite the absence of *R. caesia*.

Although roses were our main preoccupation, there were still herbs of interest in the chalk grassland. We found flowering plants of Autumn Gentian *Gentianella amarella*, and a few flowers of Dwarf Thistle *Cirsium acaule* lingered on. Bastard-toadflax *Thesium humifusum* was locally frequent in open turf, especially along a path on the steep south-west side of the ditch, its fruiting yellow stems surprisingly conspicuous at this time of year. Eyebrights *Euphrasia* spp. caused much heartache: some with large flowers and small capsules fitted the description of *E. pseudokerneri*, but smaller-flowered plants were less easily identified.

Saturday, 21 November: Hayley Wood

In the dark noon of a drizzling day, a party of enthusiasts assembled at the entrance to Hayley Wood to look for bryophytes. Harold Whitehouse handed out a list of species for the wood. Oliver Rackham, our leader, took us first to the disused railway, where we examined

the tiny mosses of the open compacted ground, including *Pottia bryoides*, an annual moss that is something of a Cambridgeshire speciality. We proceeded into The Triangle, a nearby area of secondary woodland. Here the soil surface was almost uniformly unsuitable for bryophytes because of the thick covering of slowly-decaying oak leaves. In one or two places, where the tree canopy was composed of ash and birch, the liverwort *Plagiochila asplenioides*, an 'ancient-woodland species', was seen, but *Cirriphyllum piliferum*, *Eurhynchium striatum* and *Plagiothecium nemorale*, characteristic of long-established woodland, were seen only close to the boundary with the ancient part of the wood. Evidently these bryophytes have been slow to colonise The Triangle, but this may be due as much to the oak litter as to poor dispersal.

In the ancient part of the wood we searched especially on ash trunks and stools, which rewarded us with *Anomodon viticulosus* (new for the wood), *Homalia trichomanoides*, *Neckera complanata*, *Radula complanata* and, best of all, the tiny Atlantic liverwort *Lejeunea cavifolia*. Another interesting habitat in the wood is decaying logs and branches. These yielded *Brachythecium salebrosum* (new for the wood, on elm with bark on), *Dicranum tauricum* (also new for the wood, on oak without bark), and the liverwort *Lepidozia reptans*. We searched in vain for *Nowellia curvifolia*, which has been found in this habitat in the past; its occurrence in Hayley Wood, as in a few other localities in eastern England, may be transient. *D. tauricum* is increasing and has appeared in numerous new localities (mostly ancient woods) in recent years. It virtually never produces spores in Britain and must be spread from wood to wood by leaf-fragments on birds' feet. Mammals may also spread bryophytes: on the deer-trampled root-plate of a fallen maple we found *Bryum rubens*, an open-ground species that would never be expected under a tree canopy. Finally, towards the end of the afternoon, we examined a moist ride in a part of the wood with slight surface acidification. Here we found the thallose liverworts *Pellia epiphylla* (calcifuge) and *P. endiviifolia* (calcicole) growing together. This juxtaposition is rarely seen and can occur only when the soil pH is in the range 5.0–6.0: Oliver Rackham suggested that it might be 5.5!

Vascular plant records

Derek Wells & Gigi Crompton

Papaver somniferum L. subsp. *setigerum* (DC.) Arcang. Disturbed soil at east end of Chaucer Road, Cambridge, 52/452568, J.R. Akeroyd & C.D. Preston, *c.* 1988, det. J.R.A. NCR. One plant at Milton Gravel-pits, 52/480619, G.M.S. Easy, 14.7.1986, **Herb. G.M.S.E.** 2nd CR.

Stellaria neglecta Weihe One large patch in full flower on grassy roadside verge in front of houses, west side of road just N.E. of Shelford Railway Station level crossing, 52/465524, S.M. Walters, 26.8.1992, **CGE**, det. S.M.W. (see pp. 61–63). 5th record for v.c. 29 and first since 1915.

Spergularia media (L.) C. Presl East bank of River Nene, Walpole St Peter, Norfolk (but in v.c. 29), 53/467177, J.C.A. Rathmell, 16.6.1990, det. D.E. Coombe. One plant, with abundant *S. marina*, west bank of River Nene, Foul Anchor, 53/466176, C.J. Cadbury, 10.7.1992. Last recorded by D.E. Coombe in 1982.

Tilia cordata Miller Two coppiced trees on a wood-bank at north end of Buff Wood, East Hatley, 52/283508, C.J. Cadbury, 11.7.1990. Dr C.D. Pigott described these (1993) as "typical native form with ring counts indicating trunks aged about 34 years". Tree at Quy,

52/520604, C.D. Pigott, 1990. One large tree outside churchyard wall, Kennett, 52/699683, R. Payne & G. Crompton, 30.5.1991, conf. C.D. Pigott. One tree near Toft churchyard, 52/363558, R. Payne, 7.7.1992. One tree in roadside hedgerow, Chatteris, 52/383838, R. Payne, 26.7.1992. An overlooked planted tree in Cambridgeshire.

Bunias orientalis L. Whittlesford, 52/468475, A. Arbon, 17.9.1992. Recorded from four 10-km squares in v.c. 29, including 52/44 (Hinxton) in 1920, but only firmly established (since at least 1952) near the Devil's Ditch in Stetchworth parish, 52/618614.

Rorippa x *anceps* (Wahlenb.) Reichb. (*R. sylvestris* (L.) Besser x *R. amphibia* (L.) Besser) Wisbech, 53/40, Elizabeth Metcalfe, 1835, K, det. B.E. Jonsell. NCR; this specimen provides a localised record for v.c. 29 for a hybrid referred to in the 1983 *Checklist* only as recorded in Stace's (1975) . South of railway line, Ouse Washes, Downham, 52/498889, C.J. Cadbury, J.M. Croft & C.D. Preston, 26.8.1992, CGE, conf. T.C.G. Rich. 2nd CR.

Cardaria draba (L.) Desv. subsp. *chalepensis* (L.) O. Schulz (*Lepidium draba* L. subsp. *chalepense* (L.) Thell.) With *Papaver argemone*, *P. hybridum*, *Lamium hybridum* and *Kickxia elatine*, by approach road to Morden Grange Chalk-pit, Steeple Morden, 52/295401, A.J. Showler, 22.9.1992, det. T.C.G. Rich. First confirmed record; the specimens in CGE and K collected in 1955 at Cherry Hinton are of subsp. *draba* with immature fruit according to T.C.G. Rich (*BSBI News*, No. 48 (April 1988): 13).

Hirschfeldia incana (L.) Lagr.-Fossat Very large colony on former rubbish-tip, Gamlingay, 52/234509, G.M.S. Easy, 6.7.1992, **Herb. G.M.S.E.** 3rd CR.

Umbilicus rupestris (Salisb.) Dandy Flowerbed on north side of house, 202 Gilbert Road, Cambridge, 52/445603, K.M. Tucker, 25.6.1992, conf. D.E. Coombe. NCR. Apparently spontaneous; no likely source identified. Still present in 1993.

Spiraea x *pseudosalicifolia* Silverside (*S. salicifolia* L. x *S. douglasii* Hook.) By footpath west of road to Swavesey, Over, 52/368701, J.C.A. Rathmell, 7.9.1992, CGE. 2nd CR; a previous occurrence (Milton Gravel-pits, 52/468625, G.M.S. Easy, 23.8.1985) was wrongly recorded as *S. salicifolia*.

Potentilla x *mixta* Nolte ex Reichenb. (*P. anglica* Laich. x *P. reptans* L.) Old Bedford Low Bank, Sutton Meadlands, 52/417782, P.H. Oswald & C.D. Preston, 26.7.1992, CGE, conf. Dr Brenda Harold. This sterile hybrid has colonised the rather bare top of the ditch bank under barbed wire, a habitat similar to that in the two previously known sites nearby (see *N. in C.*, No. 34 (1992): 71); it may prove to be more widespread along such fen ditches.

Cotoneaster bacillaris Wallich ex Lindley One plant on old railway bridge, Bartlow, 52/582449, G.M.S. Easy, 6.8.1991, **Herb. G.M.S.E.** NCR.

Myriophyllum aquaticum (Vell. Conc.) Verdc. Three patches amongst dense *Elodea nuttallii* in ditch in front of houses, Willingham, 52/408703, C.D. Preston & S.E. Yates, 6.9.1992. NCR. Parrot's-feather is commonly grown by aquarists and is becoming naturalised where thrown out.

Plantago coronopus L. Roadside verge, Nine Mile Hill, Swaffham Bulbeck, 52/575602, G.M.S. Easy, 17.6.1992; third recorded verge site. Between paving stones, Prince William Court, Victoria Road, Cambridge, 52/443596, A. Rees, 1992 & 1993; attributed to "boot-cleaning". One rosette in paving, Bateman Mews, Cambridge, 52/455573, P.H. Oswald, 20.9.1992.

Verbascum bombyciferum Boiss. x *V. phlomoides* L. Some 40 plants by edge of path, Great Abington, 52/524473–525475, G.M.S. Easy, 26.6.1992, **Herb. G.M.S.E.** 2nd CR.

Scrophularia vernalis L. Well established by sandy track, Chippenham, 52/673690, J.C.A. Rathmell, 3.5.1992; also 1993. Native in mountains of central and southern Europe.

Deschampsia flexuosa (L.) Trin. Two clumps by ride in Gamlingay Wood, 52/243536, T.C.E. Wells, 16.9.1991. Last recorded in v.c. 29 in 1977.

Bryophyte records

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

Mosses

Anomodon viticulosus (Hedw.) Hook. & Tayl. Vigorous clumps in several places on the exposed roots and bases of Ash trees, S. end of Devil's Ditch, 52/65-58-, C.D.P., 4.4.1992 & 14.11.1992. One large patch on base of Ash, Hayley Wood, 52/29-52-, M.O. Hill, 21.11.1992. Although never very abundant in the vice-county, *A. viticulosus* was frequently recorded in the 1950s but has apparently become much rarer in recent years. It has not been recorded since 1976, so these two records are particularly welcome.

Brachythecium salebrosum (Web. & Mohr) B., S. & G. Rotting elm log, E. section of Elm Grove, Hayley Wood, *c.* 52/293529, P. Martin, 21.11.1992, conf. M.O. Hill. An under-recorded species.

Dicranum tauricum Sapehin Several small patches on decorticated oak branches at edge of Ditch Ride, Hayley Wood, 52/292527, C.D.P., 21.11.1992, **CGE**. The 5th record of a plant which was first recorded in the vice-county in 1977 and is spreading nationally.

Ditrichum flexicaule (Schimp.) Hampe *sensu stricto* Chalky soil on the Roman Road, P.C. Hodgson, 2.1932, **CGE**. Fleam Dyke, H.L.K. Whitehouse, 18.2.1961, **CGE**. Common on chalk embankment, Fleam Dyke near Fulbourn, T. Laflin (*Laflin 1407*), 25.6.1950, **CGE**. Short turf on chalk, Devil's Dyke, P.W. Richards & E.F. Warburg, 27.4.1929, **NMW**. Dr A.J.E. Smith has recently re-examined British material of *D. flexicaule* and finds that a segregate recently recognised on the continent, *D. crispatissimum* (C. Müll.) Par., is much commoner here than *D. flexicaule*. However, all the Cambridgeshire specimens which he has examined (listed above) are *D. flexicaule*. He tells us that Cambs is the only vice-county from which *D. flexicaule* has been recorded but not *D. crispatissimum*.

Grimmia trichophylla Grev. Plants with gemmae, growing with *Dicranoweisia cirrata* on a rock from The Cheviot (a memorial to R.C. Parker, d. 1955, & M. Parker, d. 1968) in Boxworth churchyard, 52/348645, C.D.P., 15.2.1992, **CGE**, conf. H.L.K.W. *G. trichophylla* is a calcifuge which has not been recorded in the vice-county in natural habitats and is only known from a few localities.

Leucodon sciuroides (Hedw.) Schwaegr. A small patch on the Wimpole Stone, Wimpole Hall, 52/334500, D.E. Coombe, 6.9.1992, conf. H.L.K. Whitehouse. A further record of *L. sciuroides*, not (as all the other recent records have been) on a church wall or churchyard monument but on a Mesozoic sandstone glacial erratic brought to Wimpole from a railway

cutting last century. This species formerly grew as an epiphyte in the vice-county, and one possible explanation for its occurrence on the Wimpole Stone is that it spread from a nearby tree.

Platygyrium repens (Brid.) B., S. & G. On stems of Hazel and young Field Maple and on trunks of Ash trees, Ten Wood, Stetchworth, 52/663559, N.G. Hodgetts, 14.11.1992. Like *Dicranum tauricum*, *Platygyrium repens* was first recorded in the vice-county in 1977 and has since been found in several sites; it is also thought to be spreading nationally. This is the first record from an eastern boulder-clay wood.

Rhynchostegiella curviseta (Brid.) Limpr. Fruiting plants on horizontal shaded oolitic limestone gravestone, Little St Mary's churchyard, Cambridge, 52/448579, N. Jardine, 11.11.1992, CGE, conf. H.L.K. Whitehouse. A second site in the vice-county for this southern species, which was discovered (new to East Anglia) by Professor Jardine at Newnham in 1985 and has since been found in East Suffolk.

Tortula virescens (De Not.) De Not. Tarmac path, with *Bryum argenteum*, *Orthotrichum diaphanum* and *Tortula latifolia*, St Andrew's churchyard, Chesterton, 52/462596, C.D.P., 15.2.1992. Tarmac path, with *Bryum capillare* and *Ceratodon purpureus*, Boxworth churchyard, 52/348645, C.D.P., 15.2.1992. Tarmac path, Wootton Way, Cambridge, 52/433579, C.D.P., 14.3.1992, conf. H.L.K.W. Further records of this under-recorded species, which until 1991 was known in the vice-county only from Cambridge.

Zygodon conoideus (Dicks.) Hook. & Tayl. On Elder, S. end of Devil's Ditch, 52/65-58-, M.O. Hill & N.G. Hodgetts, 14.11.1992. The 2nd vice-county record of a species which was first recorded from Cambridgeshire at Ditton Park Wood in 1991.

Liverworts

Lejeunea cavifolia (Ehrh.) Lindb. Small patch on Ash coppice stool in ditch, Ditch Ride, Hayley Wood, 52/292527, C.D.P., 21.11.1992. Confirmation that this species is still present in one of the two localities in which it has been seen in the vice-county since 1950; it was refound in the other locality, Ditton Park Wood, in 1991.

Metzgeria fruticulosa (Dicks.) Evans Abundant on several Elders, mixed in places with a small amount of *M. furcata*, and also present in smaller quantity on Field Maple, S. end of Devil's Ditch, 52/65-58-, P.W. Richards, 14.11.1992. A further record of a species which has been recorded with increasing frequency in the vice-county in recent years.

Charophyte records

C.D. Preston

Nitella tenuissima (Desv.) Kütz. A small patch *c.* 60 cm in diameter in water 50 cm deep on a peaty shelf at the edge of Wicken Lode, 52/557701, N.F. Stewart, 1.8.1992. The small and delicate *N. tenuissima* is a nationally rare species. It was formerly present in quantity in Wicken Lode, "covering the whole bed of the dyke in many places with its thick mosslike growth" (J. Groves & G.R. Bullock-Webster (1920), *The British Charophyta*, Vol. 1, *Nitelleae*). This is the first post-1950 record from Wicken Lode, although it was seen elsewhere on the Fen in 1957 and 1979 after extensive excavation of peat (see J.A. Moore (1986), *Charophytes of Great Britain and Ireland*, p. 102).

Weather notes for Cambridgeshire 1992

J.W. Clarke

January: Changeable, mild and wet to 10th, with 2.32 ins of rain over the period. Anticyclonic thereafter, with frequent overnight frost and fog. Several days with fog slow to clear or persisting all day. Rainfall much above average, on only 7 days; three-quarters of total rain fell on one day, 8th. Temperature by day 3°F below normal, about average at night. No snow.

February: Anticyclonic in the first two days with fog persisting all day on both days. Mainly changeable for the rest of the month, but, with an anticyclone to the S.E. over the Continent, rainfall was much below average. Temperature about average by day, but much above normal at night. No snow. Fog on 3 days.

March: Changeable and very mild throughout. The high pressure to the S. persisted until 12th, pushing rain-bearing winds to the W. and N. The second part of the month was much wetter, with frequent heavy falls. Temperatures above average, with no frost recorded. Rainfall above average, on 17 days.

April: Changeable, with a brief settled period (8th–12th). Much warmer than usual, with the last frost of spring on 4th. All natural phenomena very early (Hawthorn seen in bloom in Cambridge on 8th). Rainfall about average, on 12 days.

May: A warm and sunny month. Changeable until 12th, then anticyclonic to 28th, becoming unsettled at the end. Temperature above average, with 12 days over 70°F (81°F on 25th). Much thunder on 5 days. Rainfall below average.

June: Changeable at first, with fronts running down the North Sea and round a persistent high over Scandinavia. After 12th mainly anticyclonic, sunny and warm; very warm in the last week. Temperature much above average. Rainfall below average, on only 6 days. A very early season, with barley being harvested in Cambridgeshire on 29th.

July: Cloudy, cool and sunless for the first 10 days, changeable but warm to 27th, then settled and very warm and dry, with the temperature exceeding 80°F on 30th and 31st. Rainfall slightly below average. Temperature about normal.

August: Sunny and hot on 1st, then becoming changeable but remaining very warm until 9th, when, in the early hours of the morning, an intense electrical storm or 'summer tempest' crossed Cambridgeshire, bringing heavy rain to the W. of the county and almost continuous vivid lightning for several hours. The rest of the month was very unsettled and autumnal. Temperature and rainfall near average. The cereal harvest on the chalklands at Swaffham Prior was completed by 8th – the earliest since 1976, indicating the earliness of the spring and summer seasons this year.

September: Changeable, cool and wet. Temperatures only exceeding 70°F on two days. An anticyclone gave a few settled days in the middle of the month, ending with a thunderstorm in the early hours of 18th, again with vivid lightning. (This type of thunderstorm has its origins in very hot and humid weather over France.) Rainfall 1 in over normal. Daily maximum temperature 2°F below average.

October: Changeable, very wet and very cold throughout. The rain fell on only 11 rain days (average 15), being concentrated in heavy falls – 1.17 ins on 2nd and 1.35 ins on 20th. Daily maximum temperature 6°F below average. Ground frost on several mornings, but no air frost. Rainfall 1 in above average. Thunder on 2 days.
November: Changeable and mild throughout, with no fog and only 2 days with slight air frost. Temperature and rainfall both above average.
December: Changeable and mild until 21st, then anticyclonic with frost and frequent fog; much hoarfrost at times. Much sunnier than usual. Rainfall and temperatures below average; daily maximum temperature 3°F below normal.

Weather records at Swaffham Prior 1992

Temperature °F

Month	*Mean max.*	*Mean min.*	*Highest*	*Lowest*	*Rainfall (ins)*	*Rainfall (rain days)*
January	41	34	53 on 5th	22 on 22nd	2.49	7
February	46	36	55 on 23rd	28 on 1st	0.46	8
March	50	40	60 on 20th	34 on 14th	2.35	17
April	55	41	63 on 18th	31 on 4th	1.68	12
May	67	48	81 on 25th	40 on 2nd	1.33	10
June	71	53	82 on 15th	45 on 19th	1.28	6
July	72	58	80 on 30th	49 on 7th	1.95	12
August	71	57	82 on 1st	48 on 31st	2.05	15
September	64	52	74 on 28th	44 on 5th	2.96	13
October	51	40	61 on 2nd	33 on 17th	3.59	11
November	51	40	59 on 6th	31 on 14th	2.57	13
December	42	33	55 on 2nd	23 on 29th	1.34	10
Annual means	56.6°	44.4°		Totals	24.05	134

Number of days over 80°F	6
Number of days over 70°F	73
Number of days with a maximum under 32°F	4
Number of days with a minimum under 32°F	35
Last air frost of the spring	4th April
First air frost of the autumn	13th November
Days with snow lying	None
Days with thunder	16
Fog persisting all day	5
Highest temperature	82°F on 15th June and 1st August
Lowest temperature	22°F on 22nd January

Rainfall

Ten-year average 1982–1991	21.52 ins
Average of 34 years' records to 1991	21.63 ins
Wettest year	1958
Driest year	1990