

# Introduction to the Valley-head Fens of Oxfordshire

C. R. Huxley-Lambrick

Originally published December 2002

Published online November 2023

## Summary

Certain fens of Oxfordshire have long fascinated the natural historian. They contain many interesting things:

- the growth of peat in a limestone landscape
- encrustations of marl (dispersed calcite)
- the juxtaposition of acid-loving plants such as sundew, with plants only found in lime-rich conditions such as blunt-flowered rush
- an unrivalled diversity of wetland plants, with such delights as devil's-bit scabious, marsh helleborine, lousewort, meadow thistle and marsh valerian
- an extraordinary number of rarities among the higher and lower plants, snails and insects.

## Introduction

It was these natural riches that inspired George Claridge Druce in 1901 to persuade his friend Henry Willett to purchase part of the fen at Cothill. The land cost £14 and was donated to the University of Oxford and the Ashmolean Natural History Society of Oxfordshire. This area, called the Ruskin Reserve, was later given to the National Trust, and is now managed by English Nature. For many years it was the smallest National Nature Reserve in the UK. Now a larger area (the Cothill Site of Special Scientific Interest) is a candidate Special Area of Conservation, under European legislation.

The proximity of Cothill Fen to Oxford University has led to a number of major biological studies being made there. In 1939 Clapham and Clapham published the first pollen diagram showing vegetation change in lowland Britain, using a peat core from Cothill. In this volume Petra Dark presents a new analysis of the pollen evidence combined with charcoal particle analysis and radiocarbon dating. In 1947 E B Ford showed that different colour morphs of the scarlet tiger moth (*Callimorpha dominula*) at Cothill coexist through natural selection in a balanced genetic polymorphism. The riddle of the high diversity of species in these fens remains and even grows as several Red Data Book soldierflies have been found (Porter this volume). These insects breed among the marl which is dispersed calcite, deposited when lime-rich artesian water degases, as distinct from tufa which is a solid concretion of calcite. Later the southern damselfly (*Coenagrion mercuriale*), a priority UK Biodiversity Action Plan (BAP) species which is otherwise only known from Hampshire, was also found here (Steven, this volume). Not least, though very small is Desmoulins' whorl snail (*Vertigo moulinsiana*), famous as the Newbury by-pass snail, a priority BAP and RDB species, which is also found here and in some of the other Sandford Brook sites.

As a centenary celebration of that purchase of the first nature reserve in Oxfordshire, the Ashmolean Natural History Society of Oxfordshire decided to hold a three day course on the valley-head fens and bring together the experts on these diverse topics. This course was hosted by the Northmoor Trust at Little Wittenham, run by the Department for Continuing Education of Oxford University, and is reported in this volume. Two papers by Dark describe the vegetation history revealed by pollen

preserved in the peat deposits. A major study by Morris gives a full account of the hydrology that maintains the critical environment and the distribution of unusual plant communities. Finally came a revelation of the factors which determine the high diversity of these communities; Bryan Wheeler showed the role of low productivity of the soil water in controlling community diversity. This was reinforced by Keith Porter's discussion of the way in which calcite deposition involves the adsorption of phosphate. Calcite is deposited when artesian (deep ground) water degases, the deposit may be dispersed as marl, or a solid concretion as tufa.

Where this occurs on a soil itself already low in phosphate the effect on floristics (the species of plant which are found) is dramatic. The course was enriched by a demonstration of peat coring by Adrian Parker, identification of pollen grains by Judy Webb, microscopic examination of peat samples prepared by Adrian Parker, and visits to Cothill Fen National Nature Reserve, Parsonage Moor, Gozzard's Ford, (courtesy of Arthur Spriggs) and Dry Sandford Pit SSSI, three reserves of the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust.

Our aim was not only to look at these fens, but also to lay foundations for their future survival. While the most important sites are looked after by English Nature as Sites of Special Scientific Interest, for other sites conservation involves the preliminary work of cataloguing the whereabouts and requirements of different valley-head fens (see Appendix 1, Parker, Huxley–Lambrick and Simpson) and then working to inform landowners, devise strategies and carry out safeguards.

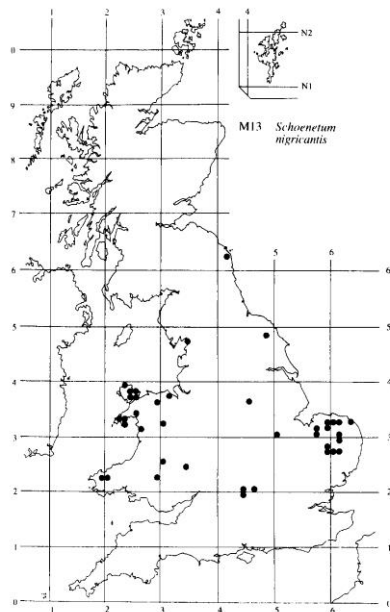
## **Vegetation Types in the Oxfordshire Fens**

Fens, like all British vegetation, have been analysed into communities based on the plant species which are typically found growing together. These are described in the National Vegetation Classification (NVC) by Rodwell (1991, 1995). Each vegetation type is given a code letter (which indicates the broad type of community, in this case M for Mire and S for swamp and tall herb vegetation), a number and a name based on two of the characteristic species. Oxfordshire has a great variety of wetland communities, some of these are very common and widespread, while others are rare in the UK as a whole. It tends to be the rare kinds which are most diverse in the number of species which are found in them. Moreover it is these highly diverse fens which also hold a range of rare species, both plant and animal.

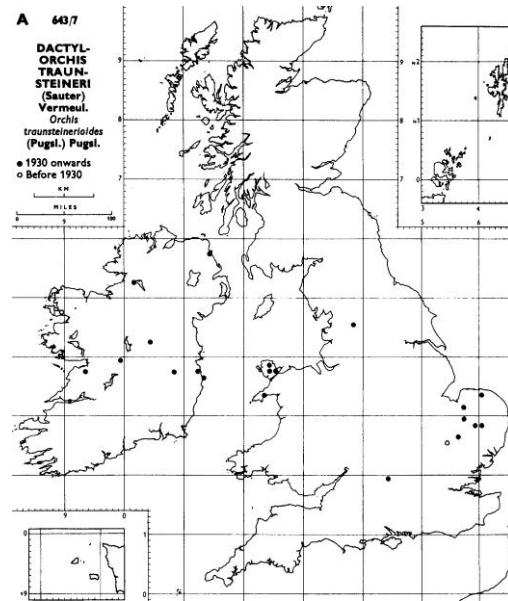
### **Extreme Rich-fen, M13, Species-rich Calcareous Fen**

The most extraordinary community found in the Oxfordshire fens is named after two of its main constituents - black bog-rush (*Schoenus nigricans*) and blunt-flowered rush (*Juncus subnodulosus*) (M13 in the NVC). This kind of fen is extremely rare in the UK, having been recorded at five places in Oxfordshire (Fojt 1983), a handful in each of Norfolk, Anglesey and the Llyn Peninsula, and a few elsewhere (figure 1a). At Cothill Fen the species present are somewhat different from the typical suite, as discussed by Peter Morris in this volume.

Figure 1. a), c) and d) Distribution of fen and fen-meadow vegetation types which are found in Oxfordshire (from Rodwell 1991).  
 b) Distribution map for narrow-leaved marsh-orchid (*Dactylorhiza traunsteineri*) (Perring and Walters 1962).

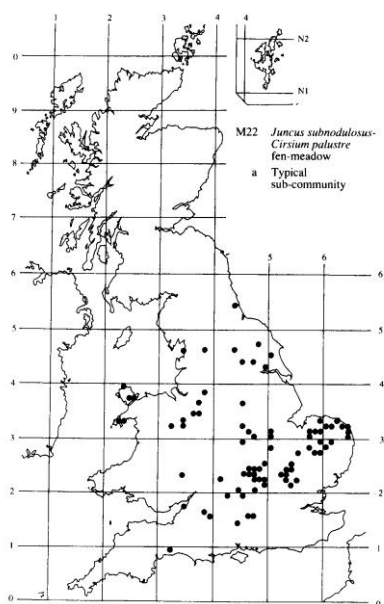


a) Black bog-rush - blunt-flowered rush fen, M13, Extreme rich-fen.

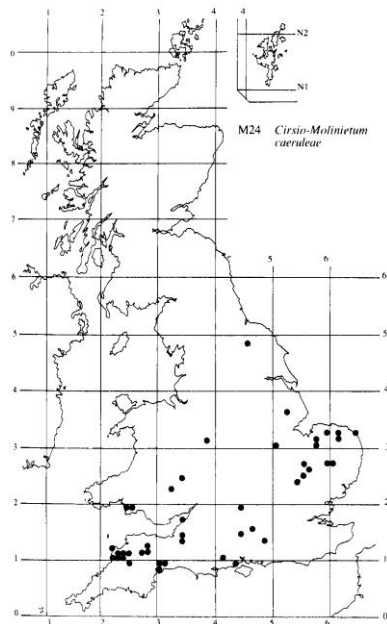


b) Distribution of narrow-leaved, or Pugsley's, marsh orchid.

From The Atlas of the British Flora.



b) Blunt-flowered rush – meadow thistle fen-meadow, M22, rich fen-meadow.



d) Purple moor-grass – meadow thistle fen-meadow, M24.

An outstanding feature of this fen type is that it is one of the most species-rich of all plant communities in the UK. The average number of species found in a 2 x 2 m sample is 27 rising to above 40 in two of the sub-communities (Rodwell 1991). This compares with 27 in the richest of the calcareous grasslands (sheep's fescue - carline thistle community), and less than 10 for swamps. This particular kind of fen vegetation therefore deserves the name "extreme rich-fen" given it by the Swedish botanist Sjörs in 1948. (It might also be called *Schoenus* fen or bog-rush fen, but this is confusing as *Schoenus* is more common in the species- and mineral-poor bogs of the west and north than it is in the extreme rich-fen).

The extreme rich-fen community is remarkable for including plants usually found in the mineral and nutrient-poor, acid wetlands of the west and north, for instance black bog-rush itself, certain sphagnum mosses, flea sedge (*Carex pulicaris*), grass-of-Parnassus (*Parnassia palustris*) and sundew (*Drosera rotundifolia*), as well as species confined to lime-rich soils (calcicoles), for instance the blunt-flowered rush and fly orchid (*Orchis insectifera*). It had been suggested as an explanation for this that the acid-loving species grew on tufts of vegetation perched above the lime-rich groundwater and were kept damp by lime-free rainwater. However this is visibly flawed, because the sundews can be seen growing along the bottom of paths between the tussocks.

There are also plants present which are found either on lime or on coasts such as knotted pearlwort (*Sagina nodosa*) and parsley water-dropwort (*Oenanthe lachenalii*). Interestingly several species of these fens are mostly restricted to calcareous soils in the south but apparently less sensitive to soil type further north, for instance quaking grass (*Briza*), carnation sedge (*Carex panicea*), fragrant orchid (*Gymnadenia conopsea*) and fairy flax (*Linum catharticum*). Two species characteristic of these fens have a distribution similar to that of the fens themselves (though a bit wider), they are marsh helleborine (*Epipactis palustris*) and great fen-sedge (*Cladium mariscus*).

Rare species are also a feature of extreme rich-fens, notably fen pondweed (*Potamogeton coloratus*) and narrow-leaved (or Pugsley's) marsh orchid (*Dactylorhiza traunsteineri*), which is confined to these fens (figure 1b). Many common species are also found in this community, such as common reed (*Phragmites australis*) and hemp agrimony (*Eupatorium cannabinum*), but these often grow only as spindly, scattered stems.

## Fen-meadows

Two further interesting communities are also found in the Oxfordshire valley-head fens. These are both fen-meadows, one is blunt-flowered rush - meadow thistle fen-meadow (M22), and the other purple moor-grass - meadow thistle fen-meadow (M24) (Rodwell 1991). As both can contain meadow thistle, I shall call them blunt-flowered rush fen-meadow and moor-grass fen-meadow for simplicity. Blunt-flowered rush fen-meadow is usually poorer in species (lacking the north and west element), though individual stands can be richer than extreme rich fen. This community is called rich fen-meadow by Rodwell. It is distributed widely in central England (figure 1c), with concentrations in Anglesey and north Norfolk similar to those of extreme rich-fen. Moor-grass fen-meadow (M24) is nearly as rich in species as the extreme rich-fen (M13), with 26 species per sample. It also resembles extreme rich-fen in having a number of species more characteristic of the north and west, such as heath grass (*Danthonia decumbens*) and flea sedge (*Carex pulicaris*), as well as calcicoles such as

dyer's greenweed (*Genista tinctoria*), and rarities like fen violet (*Viola persicifolia*). The distribution of purple moor-grass fen-meadow differs in its being absent from north Wales but found in Devon (figure 1d).

## Tall-herb Fens and Swamps

Other types of wetland vegetation in Oxfordshire are less species rich, for instance the meadowsweet - wild angelica mire (M27), which has on average 15 species per sample. This community is quite widespread in southern England. Tall-herb fens are even less species rich, common reed - hemp agrimony tall-herb fen (S25) has 11 species per sample and is of restricted distribution in ditches and water-side situations. The more widespread common reed - stinging nettle tall-herb fen (S26) only averages nine species per sample and is found in eutrophic (nutrient-rich) wet conditions in Oxfordshire.

Swamp is used to describe vegetation which is usually dominated by a single species of tall monocotyledon, such as common reed (*Phragmites australis*), sedges (*Carex*), reed sweet-grass (*Glyceria maxima*) or reed canary-grass (*Phalaris arundinacea*). Very few associated plants are able to survive in the dense growth. Such vegetation is often found at the boundary between open water and drier land.

## Species Richness of fens

The interest of areas with extreme rich-fen and fen-meadow has long been recognized, but only now shown by Wheeler to be correlated with springs and headwaters where lime-rich, artesian (deep ground) water maintains a constantly high water-table over soils which are poor in nutrients. Hence these fens are referred to as valley-head fens to distinguish them from fens along the river basins and canals. The dependence of high diversity on low productivity is described for the first time in the paper by Wheeler in this volume. The adsorption of phosphate on to fresh calcite not only accounts for the very low productivity of these fens. It may also explain why marl was so valued as a fertilizer - it contains phosphate as well as lime. The positive correlation between species-diversity and low productivity agrees with that known for dry grasslands, where the thin chalk and limestone soils carry a high diversity, and any addition of fertilizer, or presence of deeper soil, will decrease the diversity.

It is interesting that the purple moor-grass fen-meadow (M24), which is found in three of the Oxfordshire valley-head fens (Easington, Cothill and Lashford Lane (Fojt 1983)), is best developed in this area on the Oxford Clay on the flood-plain of the River Ray at Otmoor (Killick et al. 1998). One may suppose that the low nutrient status and low productivity of Oxford Clay has contributed to the development of purple moor-grass fen-meadow here. This site is cut for hay and cattle grazed, unlike typical valley-head fens, which are now mostly unmanaged. Continuous tight grazing leads to a quite different suite of communities, such as the grazed pasture of Port Meadow. The role of management in determining the plant and insect communities in these fens needs further work, not least so that appropriate conservation management can be agreed. Some sites have been long unmanaged but small open areas still persist, as at Barrow Farm Fen and Spartum Fen. At Cothill Fen, English Nature and the Local Wildlife Trust have now put up fencing so that cattle can be re-introduced. This will thin out the dead litter layer and dense vegetation and so maintain the open conditions which are part of the low competition regime required by many of the characteristic species.

The future of the valley-head fens is a matter of concern. As Wheeler indicates these fens may not be quite as fragile as appears because the vegetation is fed by spring water which can be difficult to control by simple drainage. However the ground water itself may eventually become enriched as nutrients are added to the surrounding catchment and rain-water now carries high levels of nitrogen compounds from atmospheric pollution. Further study and monitoring will be required to secure the future of these unique sites.

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**Camilla R Huxley-Lambrick**  
**Picketts Heath, Ridgeway, Boars Hill, Oxford OX1 5EZ**  
**camilla@lambrick.fsnet.co.uk**