The History of Cothill Fen National Nature Reserve

(the Ruskin Reserve)

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for

The Freshwater Habitats Trust (FHT)

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Ruskin Reserve, Cothill National Nature Reserve,
looking south-east from centre, southern marsh orchids in flower
Photo J. A. Webb 7th June 2019

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[2] 'Before Present' (BP) is a term used in radiocarbon dating, with the 'present' defined as 1950 AD

Summary

Cothill Fen National Nature Reserve (NNR), which includes the Ruskin Reserve, is a relatively small wetland site with important ponds; it has a very long history of conservation, wildlife recording, study and research. This NNR is part of a wider wetland area of exceptional biodiversity and habitat rarity, now designated as Cothill Fen Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC). Its history shows how vulnerable it is to a wide range of influences, both off and on-site. As an alkaline groundwater-fed fen, crucial factors are protection of its rainwater catchment and the need for plenty of clean calcium-rich groundwater. It will face many pressures in future, such as climate change to regular hotter and drier conditions, sand extraction and new developments. Luckily it is receiving much care – long may this continue.

This is an attempt to tell its interesting story so far, bringing together in one place historic information, images, and personal memories.

Introduction

This report has been prepared for the Freshwater Habitats Trust (FHT) as background to a site in which they have a keen interest. It describes the current structure of the site, how it came to be that way and the issues that affect it. Cothill Fen NNR, and especially the centre of the Ruskin Reserve section, has high priority biodiverse ponds in old peat cuts. FHT have studied and helped to improve these ponds, which are in their Flagship Ponds Project series. Flagship Ponds are the very best pond sites in England and Wales that support populations of some of the UK's rarest species (see https://freshwaterhabitats.org.uk/cothill-fen-flagship-site/). FHT funded a critical hydrology and water chemistry survey of the whole Cothill Fen SSSI/SAC (Lamberth, 2018). This was important in informing subsequent site management to help improve the condition of the ponds and fen in general. A lot of the observations in this document are based on my own voluntary regular wildlife surveys since 2008, when I began recording plant species for Natural England and for the Oxfordshire County Rare Plants Register, an initiative of the Oxfordshire Flora Group (OFG), which is a subgroup of the Ashmolean Natural History Society of Oxfordshire (ANHSO, https://anhso.org.uk/). This Rare Plants Register was published in 2018 as *Oxfordshire's Threatened Plants.*[3]

Bladderwort Utricularia australis flowers in the Ruskin Reserve Flagship Pond in an old peat cut. This is a rare aquatic plant in Oxfordshire. Photo J. A. Webb 11.08.2019

[3] S. E. Erskine, H.J. Killick, C. R. Lambrick and E. M. Lee, *Oxfordshire's Threatened Plants – a register of rare and scarce species*, Pisces Publications, 2018 ISBN:978-1-874357-84-1

I became interested in researching the site history and working as a practical volunteer. I am grateful to have seen records of information on the site from 1902 in the Annual Reports of the ANHSO and in the Natural England archive. This report is mainly about the two hectares of the Cothill NNR that constitute the 'Ruskin Reserve', as that area has the longest recorded history and includes a very important pond. Other parts of the current SSSI/SAC (e.g. Parsonage Moor, Lashford Lane Fen) are equally valuable, biodiverse, sites mentioned in passing or where relevant to a particular issue. Of course, the opportunity remains for a further, more detailed, history of the whole site complex, but that is beyond the scope of this report. This current account is not claimed to be complete; there will be information I have not yet discovered. This is not an official history of the site produced by, or for, any of the bodies or organisations involved in the management of the site in the past or currently. It is my interpretation of the information to which I have had access. Records are not always very precise or clear about all activities on site, therefore some interpretation is required. All information in this report is believed to be correct (subject to veracity of sources). Any errors are my own.

Site habitat description and current rarity

Cothill fen NNR/the Ruskin Reserve contains both wet and dry habitats and is now a small part of a larger designated area known today as Cothill Fen SSSI and SAC. A groundwater-fed alkaline valley mire system, or calcium-dominated spring/seepage fen, it is critically dependent on water supply from a large rainwater catchment area far beyond the limits of the actual reserves. Tufa formation is widespread.

Spring/seepage fens have particularly high biodiversity due to a long history of a stable environment. Springs and seepages running today have done so for thousands of years on the same spot. Species that arrived a very long time ago are still there; this explains the presence of some so-called 'ice age relic' plants (grass of Parnassus, for example). The botanical diversity includes a range of vegetation types including: short-turf fen, fen-meadow and tall-herb communities with reed-dominated and greater tussock sedge dominated areas, willow scrub and ash/alder carr wet woodland with some marginal drier woodland.

In the Ruskin Reserve some drier, acid, sandy-soil, ground to the north, adjacent to the fen wetland areas, has mixed woodland with much hazel, birch, ash and oak, with a ground flora featuring abundant bluebells indicating its ancient woodland status. However, the rarest community is the alkaline short-turf fen vegetation type known in the National Vegetation Classification (NVC) system[4] as M13, the black bog-rush-blunt-flowered rush association.

This has also uncommon 'brown moss' bryophytes and can have rare invertebrates including soldierflies and damselflies. This habitat was always of very rare and fragmented occurrence (requiring specific calcium-rich groundwater flow) and is now extremely rare in England due to drainage or neglect of management. The Alkaline Fen inventory for England (Tratt et al 2012) shows that there are 40 ha of M13 and M13-related vegetation in England.

Black bog rush Schoenus nigricans flowering in the Ruskin Reserve on 26.04.2019 Photo J. A. Webb

[4] NVC - *British Plant Communities*: Volume 2, Mires and Heaths, J S Rodwell (editor), 1992

Of this total of 40 ha, vegetation unambiguously referable to M13 covers 19.1 ha. It is of international importance due to its restricted European distribution. Also present is another rare fen habitat, M24, the purple moor-grass *Molinia caerulea*–meadow thistle *Cirsium dissectum* fen meadow. At a European level the site is also significant for the wet woodlands (alluvial forests) of alder and ash.

The Special Area of Conservation (SAC) designation confers a stronger level of protection than SSSI status in recognition of the site's European importance. See the Conservation of Habitats and Species Regulations 2017 (provisions of EC Habitats Directive in UK law)[5].

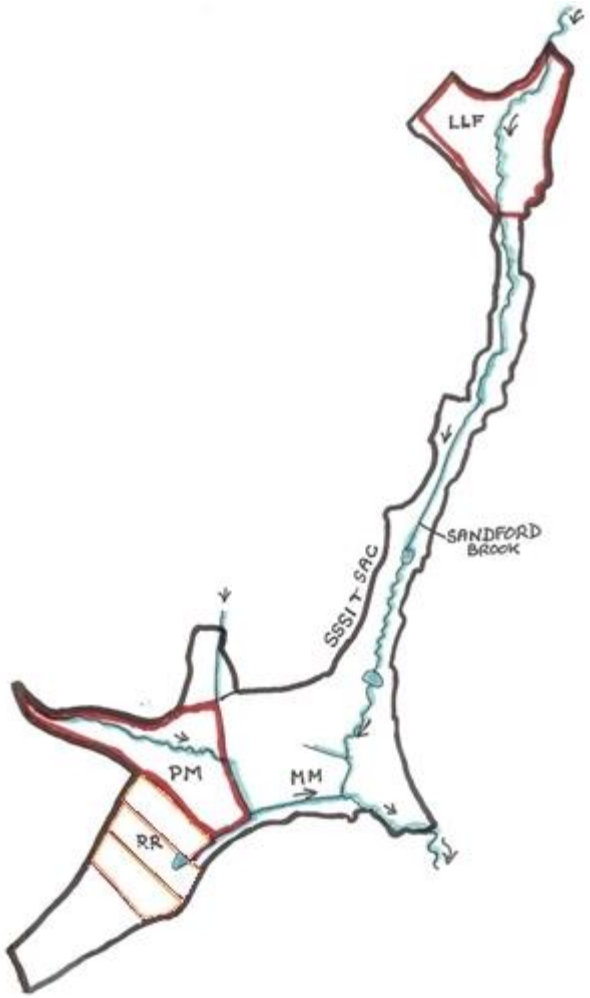


Figure 1: *Sketch map of the whole Cothill Fen SSSI and SAC*

This sketch map indicates the area covered by the Ruskin Reserve (RR) within the now much larger designated area of Cothill Fen SSSI and SAC (43.55 hectares, **black** outline) and the relationship between the various reserve sections.[6]

Key:

LLF Lashford Lane Fen

MM Morland's Meadow

PM Parsonage Moor

RR Ruskin Reserve in Cothill Fen NNR.

Red outlines indicate BBOWT-owned or tenanted reserves.

Yellow lines demarcate Natural England and National Trust land.

[5] https://sac.**jncc.gov.uk**/site/UK0012889

[6] The area as indicated on Defra's MagicMap https://magic.defra.gov.uk/magicmap.aspx?startTopic=magicall&chosenLayers=sacIndex&sqgridref=SU463999&startscale=30000

For more detailed information see Natural England website: https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1006668 and for the SAC http://publications.naturalengland.org.uk/publication/5691343946907648

Access

Land ownership across the whole SSSI/SAC is complex; multiple owners and two conservation bodies are involved. For information on public access to the two BBOWT reserves see the Trust's website pages for Parsonage Moor and Lashford Lane, the Cothill Fen Wild Walk and guidance on visiting during COVID-19 restrictions.

Cothill NNR, the central area owned by the National Trust and managed by Natural England, has a fen section with pools of deep water with floating vegetation mats and tussocks. It is considered too hazardous for access and is fenced. There are permissive paths in the east and west NE-owned compartments for access to the bluebell wood; these paths have sections of boardwalk and a small bridge. NE policy is to maintain the site as low-profile open access, primarily for local people. Dogs should be kept under control, in line with the Countryside Code. Grazing stock (p onies belonging to BBOWT) may be on site from summer to November. Cothill NNR staff from Natural England can be contacted on Tel. 01844 351833. Cothill village is three miles north-west of Abingdon. The NNR (SU495995) can be reached by walking 500m along String Lane, a public footpath, from opposite the Merry Miller pub in the village to the gate near the Cothill NNR sign. There is no parking in the village specifically for the reserve

History – Section I

Origins of the Reserve area – prehistory from the end of the last ice age: 10,000 BP to 6,500 BP[7]

Clapham and Clapham[8] were the first to investigate the fen in detail and show how the area containing the Ruskin Reserve and Parsonage Moor developed where three small valleys converge on the Sandford Brook, from the north, north-west, and south-west, to form an almost star-shaped 'basin', which supports a patchwork of habitats divided by a network of drains.

Over thousands of years since the last ice age, spring flow (actually seepage zones) from a mainly limestone aquifer within the catchment has fed first a lake and subsequently a fen wetland plant community, which formed a depth of peat and marl/tufa (calcium carbonate) sediments in the basin.

Despite being now a low-biodiversity grazed field, Morland's Meadow is included within the fen SSSI/SAC as important for its 'Earth Heritage' value, i.e. the stratigraphic record. It was once wet fen.

Under its grassy surface lie accumulated organic wetland deposits, which are an archive of past environments lain down over thousands of years. These deposits have allowed some understanding of the history of the vegetation of the fen area and surrounding landscape to be gained from sub-fossil remains of pollen, spores, and other plant remains, such as seeds and leaves, preserved in the peat.

It is rare for any such substantial body of peat (and here tufa/marl) to be available for such palaeoecological study in southern England, hence its importance for research into aspects such as long-term climate change and its effect on vegetation.

The pollen record contained within the peat is nationally significant for the information it provides about vegetation in southern England in the post-glacial period, since just after the end of the last Ice Age approximately 10,000 years ago. The evidence comes from cores taken from the eastern end of Morland's Meadow, around **point 'B'** indicated in the diagram on p. 5, sufficiently near to Parsonage Moor and the Ruskin Reserve for the vegetation history found here to broadly reflect that of the whole basin system.

[7] 'Before Present' (BP) is a term used in radiocarbon dating, with the 'present' defined as 1950 AD

[8] Clapham A. R. and Clapham B. N.,'The Valley Fen at Cothill Berkshire: Data for the Study of Post Glacial History. II'. *New Phytologist* Vol 38, Issue 2, July 1939, pp 167-174, (p. 168), published by Wiley on behalf of the New Phytologist Trust.

Figure 2:

Original diagram, with original caption beneath it, from coring investigations by Clapham and Clapham[9] showing the basal depth contours of the whole valley system below the peat and marl. The convergence of three small valleys to form a 'star-shaped' basin is clearly shown. The Ruskin Reserve occupies the lower left 'arm' of the star. Within it, the rectangular areas of peat cuttings adjacent to the mill leat next to String Lane are shown by dotted lines.

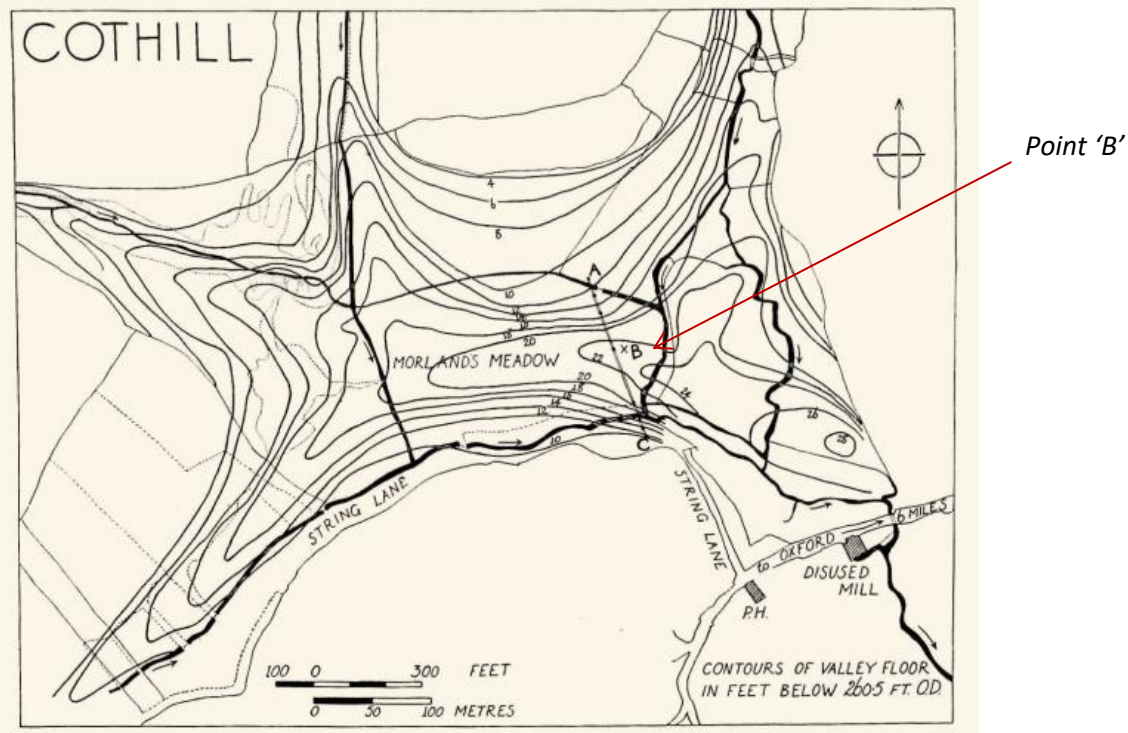


Fig. 1. Map of the valley-fen area at Cothill, Berks, six miles south-west of Oxford. The shape of the valley, as made out by boring, is indicated by contours at intervals of 2 ft. *A–C* is the transect shown in profile in Fig. 2. Samples for pollen analysis were taken from a boring at *B*. Streams are shown in black with the direction of flow indicated by arrows. The lightly dotted areas are peat cuttings.

Borings throughout the whole valley system by various investigators show that underneath the organic sediments the whole floor of the shallow valley has a base of a blueish-green sand of the Jurassic Corallian series. On top of this, variably distributed deposits of peat and whitish marl or tufa have accumulated, formed over several thousand years, initially in a shallow lake with marginal fen and carr wet woodland. This ancient water body must have been the result of the development of some impediment to drainage thousands of years ago at the eastern end of the valley near the Sandford Brook.

Much of the early sediments are a soft mud composed of the remains of tiny microscopic algae, but the first larger aquatic plants of the lake community to leave identifiable remains are the milfoils (*Myriophyllum* sp.), Chara stonewort algae and bog bean (*Menyanthes trifoliata*). Fringing swamp communities are indicated by remains of sedges, greater reed mace, marsh fern *Thelypteris palustris* and by the sub-aquatic giant spear moss.

[9] Clapham A. R. and Clapham B. N., 'The Valley Fen at Cothill Berkshire: Data for the Study of Post Glacial History. II'. *New Phytologist* Vol 38, Issue 2, July 1939, pp 167-174, (p. 168), published by Wiley on behalf of the New Phytologist Trust.

The depth of peat, marl and tufa deposits underlying the site varies, being just over 2m in Cothill NNR/Ruskin Reserve, 3m under Parsonage Moor and 3.97m nearer Sandford Brook under the eastern end of Morland's Meadow. Cores taken here were analysed for preserved pollen using microscopy in 1939 by Clapham and Clapham, who produced the first 'pollen diagram'. Later, more cores and more detailed analysis of pollen by microscopy, other assessments and radiocarbon dating were carried out in the same location by Petra Day (later P. Dark) whilst studying for a D. Phil. (1986-1990) on the post-glacial vegetation history of the Oxford region at the University of Oxford's Department of Plant Sciences.[10] The following account summarises the key findings of both investigations.

Radiocarbon dating enables us to understand that the pollen record for this site began just after the final warming at the end of the last Ice Age (Glaciation) and the start of the current Post Glacial (Holocene or Flandrian) roughly 10,000 years Before Present (BP).[11] The lowest achievable radiocarbon date on organic matter was at 2.97–2.98m, giving a date of 9,070 ± 110 carbon fourteen (14C) years BP. The date towards the top of the core, just under a layer disturbed by ploughing, was 6,790 ± 100 (14C) years BP. Even allowing for the damaged topsoil peat accumulation of 30cm, sediment accumulation in the ancient lake/fen seems to have ceased around 6500 BP, near the end of the Mesolithic period, before the advent of tree clearance with farming (agriculture) and pastoralism in the subsequent Neolithic period.[12]

The history from the pollen evidence shows a sequence of tree invasions after the end of ice and the beginning of warm conditions and a climate similar to today. First back came birch and pine forming light, open, grassy, woodland with short vegetation areas with rockrose on the drier slopes and willow in the fringing swamp or wet woodland around the lake. Hazel came next, followed by wych elm and oak. Late to arrive and expand were alder and lime/linden (expanding from around 6790 BP) with very rare hornbeam and beech.

The last pollen evidence from the core at around 6500 BP indicates alder and willow fringing the lake (perhaps in carr) with drier land around the basin likely occupied by a woodland of predominantly small-leaved lime with hazel, elm and oak, some remaining pine and a little ash. This would have been the time of the 'climatic optimum' with a warm and wet climate. Almost pure white marl formed in the lake. There is, of course, no evidence of the animals that might have roamed at the time, but from dated evidence elsewhere we might expect: beaver, wild boar, red deer, roe deer, wild cow (aurochs) and European elk. It is probable that these would have drawn Mesolithic hunters to the area, as would the abundant hazel, as hazelnuts were a favoured food of Mesolithic humans. They were hunter-gatherers and fishers, who mostly lived in temporary dwellings, used fire and made finely-chipped flint tools including microliths.

An interesting finding of Petra Day's work was the presence of macroscopic and microscopic charcoal (soot, burnt plant fragments) throughout the Cothill core sequence right from the very oldest dated sediment, so there must have been regular fires locally, thus indicating activity of Mesolithic humans nearby from the earliest times after the warming from the Ice Age. The microscopic charcoal included burnt cells from the centre of rush (*Juncus* sp) leaves, so marginal wetland rush vegetation was being burnt (or perhaps the rushes were cut and utilised by humans and then burnt). Tool evidence of human occupation nearby exists.

[10] S. P. Day, 'Post-glacial vegetational history of the Oxford region', *New Phytol.* (1991), 119, 445-470 and, as P. Dark, (2002), 'Mesolithic environmental change at Cothill Fen, Oxfordshire' *Fritillary* 3, pp 8-13 https://anhso.org.uk/special-interest-groups/fritillary/ Edition 3 is not available to download from the website.

[11] 'Before Present' (BP) is a term used in radiocarbon dating, with the 'present' defined as 1950 AD.

[12] Clapham & Clapham, 1939; Day, 1991

A note in the NE archive from a G. Lambrick (presumed to be Mrs G. M. Lambrick) states 'there is a high quality Mesolithic site to the north of Parsonage Moor'. The evidence was a flint scatter of Mesolithic tools with evidence also from the Neolithic and Bronze Age. It was stated that sites of this quality were very rare. Mesolithic human presence immediately adjacent to the site is also discussed in Day (1991) and Dark (2002).

It is not clear why there are no sediment deposits at this fen site that are younger than around 6500 BP. Explanations suggested by the Claphams and Day are either the start of seasonal falls in the water table at a time when the climate became drier (meaning oxidation of peat as it formed, so none accumulated) or removal of later (younger) layers of 'peat' by humans from the whole site and not just from the obvious excavation sites visible today. Once the lake became full of sediments, a point may have been reached where the effect of calcareous groundwater from springs was lost; insufficient rainfall in this area did not then allow progress to raised bog formation, as is seen in more northern sites with higher rainfall.

History – Section II 1500s to 1940s

The Water Mill. Land enclosure. In the early 1900s a wooded area then known as Hurst's Close/Hurst Copse and the nearby wetland fen became a nature reserve, the 'Ruskin Reserve', thanks to the inspired and determined action of botanist George Claridge Druce.

Early management and the effect of Sandford Water Mill

As the site is a wetland unsuitable for agriculture, its use for centuries most likely would have been light extensive grazing by stock such as cows and horses, which cope well with wet conditions, likely combined with cutting and harvesting for litter (stock bedding or fen hay) as suggested by Clapham and Clapham. This would have kept scrub and tree invasion in check and maintained the widespread short wet turf conditions indicated in old maps of the area from the 1880s to early 1900s.[13]

At an uncertain time in the past the natural hydrology of the fen was influenced by the development of the overshot Sandford Water Mill at what is now the nearby village of Cothill adjacent to the Sandford Brook. The Sandford Mill is on John Rocque's 1761 map of Berkshire, but may have been in place much earlier.

The first draft management plan for the Ruskin Reserve in 1962, held in the Natural England archive, was authored by J. M. Laptain. It includes land-use history investigations which state that the first title deeds found for the mill date from 1615 and that these title deeds refer to '*the ancient waters and currents for the enjoyment of the Mill owner'*; in other words, the mill owner had the right to keep the channel (leat) clear to ensure a continuous supply of water to his mill. The management plan describes the mill leat as a carefully contoured drain, travelling westwards from the mill and running along the south-eastern margin of the fenland, slightly higher than the lowest point in the centre of the valley. It harvested water from the wetland at a level high enough to then turn the overshot mill wheel when it arrived at the mill.

The mill leat channel travelling east from the Ruskin Reserve, and visible alongside String Lane, would have had its flow augmented by water from drains mostly running north-south on the edges of Parsonage Moor and Morland's Meadow. The needs of the mill initiated a change to the hydrology of the whole wetland area, i.e. the beginning of a degree of dehydration of the whole fen system to the west of Cothill village.

[13] The OS County Series for Berkshire is available from old-maps.co.uk
https://www.old-maps.co.uk/#/Map/446011/199477/12/100067

Figure 3: *Sketch map showing the position of the Ruskin Reserve within the southern section of the Cothill fen wetland system and the names of areas mentioned in the text, plus location of drains, mill leat, Sandford Brook, String Lane and Sandford Water Mill in Cothill village.*

The leat delivered water initially to a long millpond on the north-east side of Cothill Road, from where the water was directed under the road to the mill house. This mill ceased grinding corn in the 1920s. Much of the original mill leat is now dry, as the water it once carried is now re-directed to a parallel, deeper, drain slightly to the north, connecting the western section of the leat directly to Sandford Brook, by-passing the old mill. The millpond became dry and colonised by trees by the 1930s. It was located under the current car park owned by Cothill House School, opposite the Merry Miller pub (formerly the 'Fleur de Lys'). The long hole was filled in using the hedgerows uprooted by a steam traction engine for the creation of Abingdon airfield in the 1930s (pers. comm. local Cothill resident Stephen Grigson, 2019). The millpond location can be seen clearly on the old Berkshire 25-inch 1892-1914 map.

Land enclosure and peat cuttings

Historical information in the first management plan of 1962 states the land that is now Cothill NNR/Ruskin Reserve is within the Parish of St Helen Without (covering the Wootton, Dry Sandford and Shippon area) and that enclosure happened early, in the reign of Elizabeth I.

In 1588 leases were granted on seven long rectangular strips of land, one of which included the strip named Hurst Close (later the Ruskin Reserve). The ancient green lane 'Droveway' on 19th century tithe maps (later the path called String Lane) passes on the south-eastern side. Down from the 'Droveway' each rectangular strip of land stretched across the fen in a north-west direction and had a passageway (stone bridge) across the mill leat. 'Droveway' was obviously an ancient route for stock to be driven to market. One can imagine groups of cows or sheep or geese grazing on the grass in past centuries in this wide, green, lane and perhaps drinking from the adjacent mill leat, as they passed on their way. Most of the seven strips of land now have, or had in the past, rectangular pools in the wetland sections, which would have been dug out during work to obtain peat (or lime-rich marl?) by each of the strip owners (see maps Figure 1 and Figure 2).

The land-use history investigations referred to in the 1962 management plan quote a property lease pertaining to 'Hurst Close' in 1773: '*Except …all peat and turfs…to pay 40/-*[14] *a load for any peat dug without Mary Wright's consent*…'.

The area newly-named the Ruskin Reserve was up until then known as Hurst (or Hurst's) Close, but so also was the plot adjacent to it. 'Hurst' means 'wooded hill' in Old English. The rectangular pools resulting from peat-cutting have been called 'fish ponds' but no information has been found as to whether or not these were actually used for fish. Between each of the rectangular pools a strip of original fenland (causeway or baulk) was left, presumably for access to the part of each strip that was drier land on the other side of the fen. It is conjectured that the peat was cut from the rectangular pool areas at a later date than the cutting of the mill leat. Each of the land strips had a proper bridge of stones enabling crossing of the leat.[15]

Maybe the main use of peat was for fuel, but it was also commonly extracted for fertilizer between c. 1700 and 1870. Similar practices with alkaline peat sites were practised elsewhere, e.g. Thatcham, near Newbury.[16] When peat was used for fertilizer, the procedure was commonly to dry it and burn it on site, so that only ash was removed to be spread on the land. Calcareous peat and marl, which are found abundantly in deposits here, produce a high-nutrient alkaline ash because of the high calcium content from the marl/tufa; this would have been useful to fertilize and raise the pH of an acid soil, equivalent to the effect of liming.

The purchase of the first part of the reserve (Ruskin Plot)

George Claridge Druce in his mayoral robes around 1901. The office of Mayor of Oxford was one of many roles he held in the city. Photo by kind permission of the Department of Plant Sciences, University of Oxford.

The botanist George Claridge Druce (1850-1932) discovered the interesting wetland flora of the area in the 1890s and the site is mentioned as 'Cothill Marsh' or 'Cothill Bog' in his *Flora of Berkshire* published in 1897. (Cothill was then in Berkshire but the area is now included within the administrative boundary of Oxfordshire, although it remains in Vice County 22 for botanical recording.)

According to Druce, in 1899 he was visiting his friend Henry Willett in Brighton and saw a newspaper announcing the gift to Cambridge of a portion of Wicken Fen, home to the swallowtail butterfly and many interesting species of insects and fen plants. Mr Willett said '*I should like to do something of the kind for Oxford*' and asked if Druce knew any suitable land in the area. Druce replied that he did and described the '*piece of marshland situated between Cothill and Besselsleigh... of a specially interesting character*'.

[14] 40/- = 40 shillings. Before decimalisation in 1971 there were 20 shillings to one pound sterling. £2.00 in 1773 would have had the purchasing power of £307.92 in 2019 according to the Bank of England.

[15] From 'Land Use History' in the 1962 draft management plan, plus note on correspondence between reserve warden Ms J. M. Laptain and historian Mrs G.M. Lambrick in November 1961.

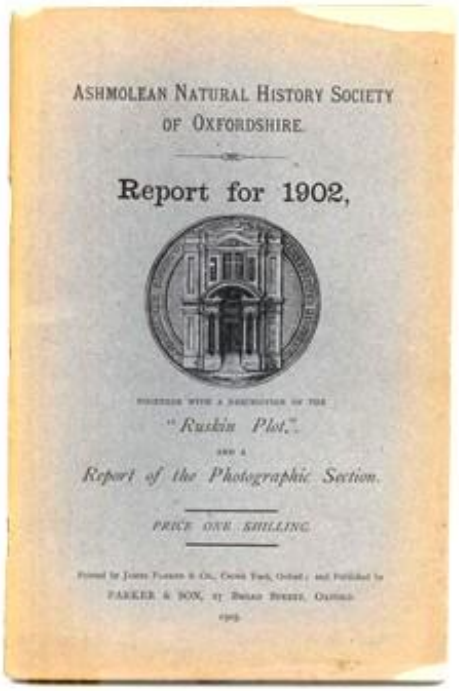
[16] Source: a document in Natural England's archive

Subsequently Henry Willett visited the site with Druce, was enthusiastic about it and agreed it met his requirements. He also wished to connect the place with the name of his friend John Ruskin (a prominent Victorian art critic, art patron, draughtsman, water-colourist, social thinker and philanthropist) and suggested that when acquired it should be known as the 'Ruskin Plot'.

Henry Willett wanted '*to have a piece of virgin soil which should be preserved in its pristine undisturbed condition for all time'.* He had desired to purchase this piece of marshland, as well as the much larger portion of wetland to the east known as Parsonage Moor or Parson's Moor (at that time described by Druce as '*a wet grassy field'*) and further fenland sections of land as far as, and including, the Sandford Water Mill adjacent to Sandford Brook in Cothill village to the east. This would have made a very good functional wetland reserve. However, the price of all that area was greater than Henry Willett could afford and also there were difficulties, the main one being that the water mill owner, Mr Morland, was not prepared to sell, as he said he required to retain control over the water at that point for the benefit of his other lands.

Negotiations proceeded and at the ANHSO meeting in May 1901 came the announcement of the purchase of the first small, rectangular, wetland portion of Hurst Close, to be known as the Ruskin Plot (1¾ acres or 1 acre 3 roods and 2 perches) from the owner, Mr Aldworth, for a total of £90 *'to be kept untouched as a zoological and botanical reserve for all time*'. This significant purchase was meant to signalise the amalgamation of two previous societies, The Ashmolean Society (founded 1828) and The Oxfordshire Natural History Society and Field Club (founded 1888), creating the new combined society as it is known today: 'The Ashmolean Natural History Society of Oxfordshire'.

This plot was acquired while Druce was Mayor of Oxford. Originally it was thought that the site should be donated to the Corporation of Oxford, but later the feeling was that it should go to a purely scientific body. Ownership was transferred to the ANHSO with Druce and Professor Poulton as Trustees, all finally completed by 2nd June 1902 and fully reported in the ANHSO journal report for that year.


ASHMOLEAN NATURAL HISTORY SOCIETY
OF OXFORDSHIRE.

Report for 1902,

"Ruskin Plot."

Report of the Photographic Section.

PRICE ONE SHILLING.

Photo: The relevant ANHSO journal edition detailing the purchase of the Ruskin Plot. Reproduced by permission of ANHSO.

The land purchased is described in that journal report as '*Portion of grass covered lane (*String Lane*), sloping ground to two shallow natural ponds, separated by a grassy causeway or baulk'*. The report goes on to explain the margins of pools were spongy (=mossy?) and had the insectivorous sundew and butterwort, marsh orchids and fragrant orchid. Adjacent wet marsh had marsh helleborine orchids, cotton grass, grass of Parnassus, marsh lousewort and many other species including bog pimpernel, meadow thistle, various sedges and purple moor grass. The pools contained fen pondweed, bottle sedge, blunt-flowered rush, lesser water plantain, brookweed, fen pondweed and the carnivorous water-flea-eating bladderwort, with stonewort Chara algal species, encrusted with lime from the spring water.

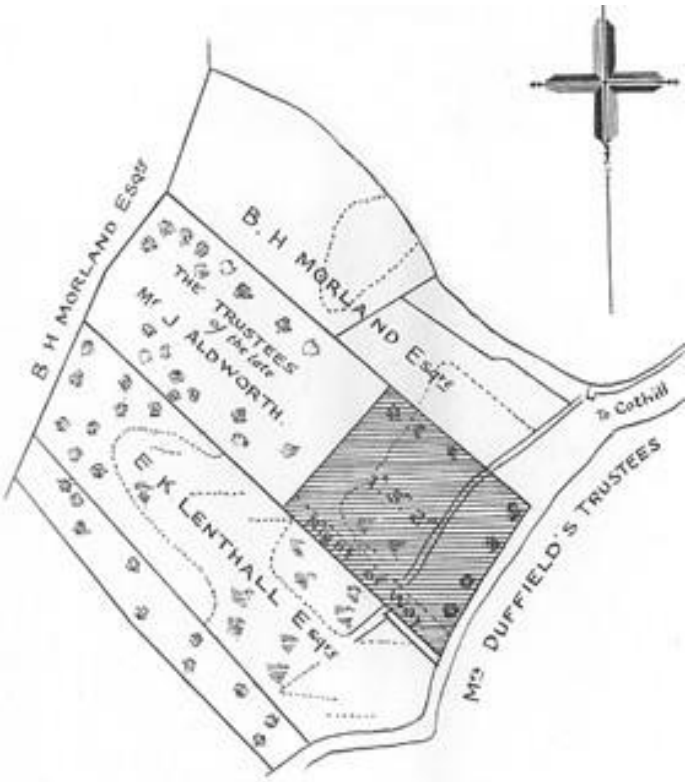
Common reed was present, but obviously in lesser amounts than currently. Marginal grassland had eyebright, milkwort, yellow rattle and both dyer's greenweed and petty whin. Marginal scrub had spindle, guelder rose, dogwood, buckthorn and willows. Under oak trees adjacent to the String Lane were bluebells.

Druce's article on the 'Ruskin Plot' in the 1902 ANHSO journal, which includes a full plant species list (for this site and some for adjacent Parsonage Moor), is now available from the *Fritillary Extra* section of the current ANHSO website – https://anhso.org.uk/wp-content/uploads/Fritillary/fritx-ruskfac.pdf and searchable version https://anhso.org.uk/wp-content/uploads/Fritillary/fritx-ruskread.pdf

Figure 4:

Map from account in ANHSO Report for 1902 of the newly-purchased 'Ruskin Plot' (the shaded area).

Reproduced by kind permission of the ANHSO.



THE "RUSKIN PLOT."

String Lane (Droveway) is on the south-east margin. Note that the route of the mill leat ran through the site, just to the right of its middle, on the south-east edge of the fen at that time (1902). Dotted lines enclose the lower wetland areas, now thought to be peat cuts.

There are photographs of actual herbarium specimens of sundew and fragrant orchid collected by Druce from Cothill Fen in another *Fritillary Extra* article by S. Marner (2001)[17] written to celebrate the Centenary of the formation of the ANHSO. Round-leaved sundew and fragrant orchid are two important species currently lost from the Ruskin Reserve, not yet returned with recent restoration management. They persisted longer at nearby Parsonage Moor.

[17] S. Marner, 'In celebration of the centenary of the Ashmolean Natural History Society of Oxfordshire 1901-2001', *Fritillary Extra*: https://anhso.org.uk/wp-content/uploads/Fritillary/fritx-centenary.pdf

Purchase of the second section of the Reserve, Hurst Copse

On the south-west side of the purchased plot, the strip of higher land (causeway or baulk, see map below) was a right of way (18ft wide) for access by the owners to the woodland (Hurst Copse) on higher, drier, ground to the north-west. In 1903 those owners of the woodland behind and above the Ruskin Plot felled and extracted conifers and hardwoods from their land. The next year (1904) this Hurst Copse, to the north-west of the Ruskin plot, was sold at auction, the owner having died. Druce heard of this and in haste to secure the area personally advanced the money on behalf of the society to purchase the land on June 20th.

This portion of woodland on drier, sandy, ground to the north-west, known as Hurst Copse (an area of 2 acres, 2 roods and 22 perches – cost in total £93 1s. 6d), contained mixed deciduous woodland with mainly oak, ash, hazel, birch and few planted conifers of larch, pine and spruce. Woodland flowers included abundant bluebells plus violets, cow-wheat, columbine, green helleborine orchid, yellow pimpernel, wood melic grass and others indicating what today we recognise as ancient woodland ground flora.

The whole long rectangular section of fenland and woodland now owned by the ANHSO was termed the 'Ruskin Reserve' and the woodland purchase abolished the need for the 'right of way' on the southwest margin, as well as giving a beautiful natural boundary to the wetland. In total, the cost of the whole area purchased by 1903, from the combined resources of Henry Willett and the ANHSO, was thus approximately £184.

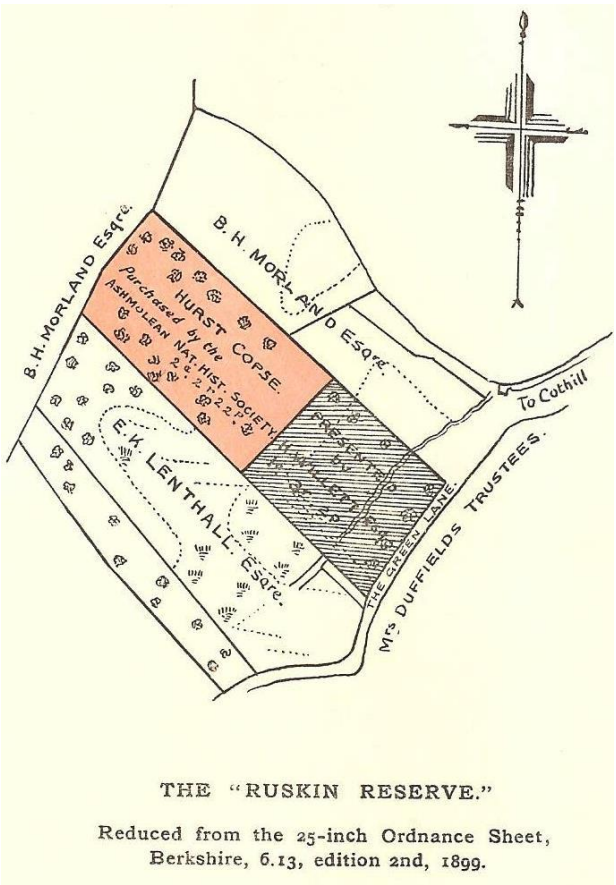


Figure 5:

Map of site from the 1904 ANHSO report.

Reproduced by kind permission of the ANHSO.

The area with black diagonal lines is the original wetland purchase in 1902.

The pink area is the second purchase of the Hurst Copse woodland section.

Photo of bluebells in Hurst Copse, 04.05.2018, J. A. Webb

The fen habitat in the early 1900s ('Cothill Marsh' or 'Cothill Moor')

What did the Ruskin Reserve look like in 1904? Describing its appearance in the ANHSO journal of the same year, Druce says *'a shallow pool of water is observed bordered with reeds, sedge and rushes, and feathering into a woodland with a few dark conifers. To get into the woods a grassy walk between the pools is to be followed*.'

Druce's enthusiasm for the site is evident from his description of the flora in 1903:

'the amethystine heads of the meadow thistle…the glistening silky plumes of the cotton grass wave in the wind…in autumn the magnificent reed grass displays it's blackish purple panicles and glaucous blueish green foliage …the white cymes of the water elder (guelder rose) …the rosy pink spikes of the orchid Habenaria conopsea (fragrant orchid)…the small valerian its palest rosy tints …the water plantain in its only locality near Oxford….' '…the margins of the pools are spongy and afford two insectivorous plant, the sun-dew (Drosera rotundifolia) and the butterwort (Pinguicula vulgaris)…'

Anyone keen on wildflowers would enjoy reading Druce's full account at
https://anhso.org.uk/wp-content/uploads/Fritillary/fritx-ruskread.pdf

Plants found in the Ruskin Plot in 1902:
broad-leaved cotton grass, marsh valerian, fragrant orchid – the first two are still there today

Plants also found in 1902: lesser water plantain with Chara algae (left), round-leaved sundew (right) Photographs are from an Anglesey alkaline fen because both these species, present in 1902, have not been seen at the Ruskin Reserve for many years. All photos by J A Webb

As to bryophytes, in the ANHSO report for 1910 there is a list of mosses found at 'Cothill' by H. Napier, presumably the more uncommon ones, as common species did not get a mention. The 10 species listed for Cothill are all still present, although some only in very small quantities.

Moss names are somewhat different these days. The most notable in a county context (all good quality wetland species) are: intermediate hook-moss (now *Scorpidium cossonii*, then *Hypnum revolvens)*, bog groove-moss *Aulacomnium palustre*, maiden-hair pocket moss *Fissidens adianthoides*, lustrous bog-moss *Sphagnum subnitens* (then *S. acutifolium*) and thick-nerved apple-moss *Philonotis calcarea.*

Invertebrates discovered in the early 1900s

There are patchy records of invertebrates in the reserve from surveys in the early 1900s reported in the ANHSO journals. Perhaps the most important is the first record of the tiny Desmoulin's whorl snail *Vertigo moulinsiana* by H. Napier in 1906. His description of the finding is:

> '*While hunting for snails along the banks of the stream at Cothill on Mar 30th 1906, I was fortunate enough to discover a few specimens of V. moulinsiana Dupuy. From subsequent visits to the place I find that it occurs fairly frequently with V. antivertigo over an area of some 20 square yards among the thick tussocks of Carex paniculata, at a point where the stream frequently overflows its banks and forms a marsh*'.[18]

This now rare snail has subsequently been searched for at the Ruskin Reserve by local mollusc expert Arthur Spriggs in the 2000s but not re-found (pers. comm.). Although the area in the reserve with abundant greater tussock sedge *Carex paniculata* that Napier refers to may still be identifiable, and such sedge tussocks could easily be over 100 years old, a more likely survival site might be around the current pond edge.

[18] From *The Journal of Conchology,* published by The Conchological Society of Great Britain and Ireland, Vol 12 (1908), p. 106

Desmoulin's whorl snails Vertigo moulinsiana from another Oxon site. Photo Phil Cutt

White-clawed crayfish were recorded in the early 1900s, but are no longer present today.

In 1912 a marsh fritillary butterfly was recorded on June 3rd and described as '*the special butterfly of the reserve and its vicinity'*. This butterfly needs devil's-bit scabious *Succisa pratensis* as a caterpillar food plant, so presumably there must have been a lot of this species present, although strangely it is not mentioned in flora lists – probably so common as to not be of especial note. Devil's-bit scabious is still present today but not abundant enough to support the caterpillars of this now rare butterfly (extinct in Oxfordshire at time of writing, but there are current moves to re-introduce it to Otmoor after planting large numbers of its food plant). Marsh fritillary butterflies persisted at Cothill at least until the 1940s (in 1944 described as 'common' in the ANHSO journal reports).

As to moths, in 1926 a micro-lepidoptera expert (E. G. R. Waters) reported that Cothill was one of the most interesting localities in the district for such small moths, '*in spite of repeated fires'*.[19] The fires probably indicate the increase in the highly combustible uncut reed in the fens. Also, deliberate firing of areas to flush out rabbits is reported later on in ANHSO reports.

Preservation, not Conservation

At that time most people interested in wildlife preservation were concerned with protection of sites from the damaging effects of over-collecting of, for example, rare plants or butterflies, or detrimental activities such as drainage of marshes.

In the ANHSO journal for 1904 Druce exhorts the society's members to visit the Ruskin Reserve but they are '*asked not to introduce any plants and seeds, plus to take no roots of any plants. The sundew, which is very scarce, should not be plucked'.* Druce had also witnessed the loss of sundew from a wetland by the drainage of a marsh on the north side of Shotover, near Oxford.

[19] From J. J Walker, ed., *The Natural History of the Oxford District,* 1926, pp 235-236

In those early 1900s there seems to have been little understanding within the Society of how important management (especially grazing and cutting for fen hay) were to the perpetuation (conservation) of the desired wetland community that Druce had striven so hard to protect for the future. Thus no efforts were made to arrange any such habitat management; this was not seen as a priority. Plant species losses are documented and they may have been due to a variety of causes: from natural succession leading to scrub invasion, reduction in rabbit numbers, changes in hydrology and natural or deliberate fires. Isolation within an increasingly arable landscape would mean little chance of re-colonisation once a plant species was lost.

Early change to the fen water levels

Whilst an undamaged, continuous, water supply from the groundwater catchment is the key factor in the health of this type of fen wetland, not having excessive water loss by drainage is also important. Having been so successfully saved for the future, the rich marshland in the Ruskin Reserve was nearly destroyed within the very first few years of the Society's ownership by workmen of the neighbouring landowner, B. H. Morland, who owned the Sandford Water Mill, the leat for which travelled though the southern side of the Ruskin Reserve.

This is described fully in the ANHSO journal for 1906: on visiting the Ruskin Reserve on 29th September that year, ANHSO members found that '.. *owing to the previous dry weather, a bordering ditch had been extended into the Society's property in order to provide water for the mill*. *The marsh had been so much drained as to leave the Charas (stoneworts) and other plants usually covered by water quite dry'*.

When informed of the problem, Morland instructed his men to repair the damage. Peat and turf that had been dug up were replaced and a wooden dam was installed in the drain (leat) to hold back water to re-wet the pond and fen in the reserve. Water levels slowly rose again. The construction of this dam was '*to a height of 1 foot, made by driving 5 foot long oak stakes in across the leat, then it was puddled with earth and clay'*. This was said to be effective in holding back the water in periods of drought. The location of this wooden dam was to the immediate east of the Ruskin Reserve. This dam is reported as staying in place until 1938, when it collapsed (details of dam and loss from a letter in NE archives). It was not replaced and there is no sign of it today. The excavated peat and turf replaced in the ditch would not have retained water as efficently as undamaged fen, hence the requirement of a dam. Therefore it is possible that following the collapse of the dam in 1938 water levels generally in the fen dropped below what they were before Morland's men extended the ditch into the pond.

Cothill House School has occupied land adjacent to the site since 1879. The History section of the school website includes some historic photos, among which is one of some boys with a teacher standing on a frozen pond.[20] This is presumed to be the Ruskin Reserve and clearly shows a high level of (frozen) water on site in that year, which would have been when the dam was still in place and working.

Maps from the 1870s show Cothill well established as the site of a mill pond (the mill closed in 1926), with Dry Sandford Mill for corn, and Cothill House as the parsonage for St Helen's Church in Dry Sandford.[21]

[20] https://www.cothill.net/page/?title=History+of+Cothill&pid=15
A small version of the photo is shown on that website. A slideshow previously accessible included a larger version with a caption indicating the date; this is reproduced on p. 17 with kind permission of Cothill House School.

[21] Wootton and St Helen Without Parishes, Character Assessment, April 2018, p. 11: http://wshwnp.org.uk/wp-content/uploads/2018/08/WSHWNP-Character-Assessment-Introduction-full.pdf

'Ice-skating on the marsh (Dec 1933)'
Reproduced with kind permission of Cothill House School

Attempts to achieve a larger Nature Reserve

In 1914 G. C. Druce tried again to get the whole of the area originally wanted by Henry Willett (and more beyond) designated a protected nature reserve. This was to be through the Society for the Promotion of Nature Reserves (SPNR, forerunner of the Wildlife Trusts), newly formed by wealthy banker and entomologist Charles Rothschild, a friend of Druce, who had bought Wicken Fen in 1899 and donated it to the National Trust (NT) as the first Nature Reserve. The area Druce desired to protect (and which he drew a red line round on a map, calling it 'Reserve no 231') stretched from the wet woodland west of Ruskin Reserve through Parsonage Moor and Morland's Meadow up to the millpond and Cothill village. This area was on the 'provisional schedule of sites worthy of preservation' in 1915.

There were 284 sites proposed for protection on the list (sometimes known as the 'Rothschild Reserves') and there seem to be two relevant entries in the account on the Wildlife Trusts' website: No 66 is 'Cot Hill Berkshire' but there is also a separate entry for No 212 'Ruskin Reserve, Oxfordshire'. For both, the same original document by Druce is accessible. This says:

> '*A suggested area worthy of permanent preservation, recommended for its insects and plants being a 'typical piece of primeval country' … 'a breeding place of one or more scarce creatures' and 'a locality for one or more scarce plants'.*[22]

The Ruskin Reserve becomes property of the National Trust

In 1916 the ANHSO handed the two land portions of the Ruskin Reserve over to the National Trust on the condition that the pieces of land should be '*held on trust that the same may be retained as far as possible in their present state and condition and so as to maintain their natural aspect and features and to preserve the existing flora'.*

[22] Rothschild presented the list to the Government in 1915, but 40 years were to elapse before the plan for designation of reserves was put into action. View the original list entry documents by Druce for this site at: https://issuu.com/wildlifetrusts/docs/231-ruskin_reserve-cothill-nr_oxford-berks_rothsch

The members of the ANHSO were to retain special rights to visit this permit-only reserve. A Committee of Management was appointed with three members from NT and five from ANHSO, including Druce and Poulton for the duration of their lifetimes. NT marked the four corners of its property with engraved stones. All four survive today, although the westernmost one of the two on String Lane was apparently lost until it was re-discovered laid down as a lintel to the access gate at that point. It was excavated and re-instated in its correct position in 2018.

National Trust land corner marker stones placed presumably in 1916. One at each of the four corners of the Ruskin Reserve. All four are identical and still in place. Shown here are: left photo, the south-east corner stone (on String Lane), and right photo, the north-east corner stone at the north edge of Hurst Copse

In the years after this, the ANHSO reports detail occasional visits made by members to the reserve to survey and check that the special plants recorded by Druce were still present. Visits in 1936 and 1937 revealed the vast majority of special plants were still present in healthy populations (grass of Parnassus and marsh helleborine abundant) but the butterwort and sundew were reduced to a few tufts. They failed to find brookweed and lesser water-plantain. Bog bean was found in two places in fair quantity, and twayblade orchid commonly distributed all over the plot - both not found there today. Early purple orchids were present in Hurst Copse and these also cannot be found today. Of course, no grazing or conservation cutting and raking was happening, so it is not surprising species began to be lost. By the time the members visited in 1945 the round-leaved sundew was still only hanging on in a patch of sphagnum moss.

Study of taxonomic complexities of Cothill's marsh orchids

Cothill was important for the early study of marsh orchid taxonomy from the late 1930s to 1940s. H. W. Pugsley studied the purple-flowered marsh orchids in the area. Over-collection must have been happening, as it was a site well known to botanists and there are many specimens of marsh orchids from the site in various herbaria.

One example was recorded in NE archives: in 1943, when botanist C. E. Hubbard made a collection of 26 specimens of 'Narrow-leaved Marsh-orchid' on 26th June from '*near Cothill in Juncus-Schoenus-Carex swamp near Hurst's Swamp*'; this was a note from the sheet with the herbarium specimens (Hurst's Swamp could well have been a local name for part of the National Trust area in the times before it was named Ruskin Reserve).

These slender, narrow-leaved, marsh orchids were known as *Dactylorhiza traunsteineroides*, partly based on observation of specimens collected from Cothill in 1945 by H. W Pugsley; later they were named 'Pugsley's Marsh orchid'.

In recent years other orchid experts have suggested that the slender marsh orchid plants present at the Ruskin Reserve and at Parsonage Moor nearby are not true *D. traunsteineroides* but a subspecies of the southern marsh orchid *Dactylorhiza praetermissa* and should be named *Dactylorhiza praetermissa* ssp. *schoenophila* (Bateman and Denholm, 2012), a sub-species of the southern marsh orchid that specialises in occupying calcareous fens dominated by black bog rush *Schoenus nigricans.* It is also possible they are hybrids with the common spotted orchids also present.

An example of one of the narrow-leaved and slender marsh orchids found on the site today that may be an example of Pugsley's Narrow-leaved marsh orchid Dactylorhiza traunsteineroides, or maybe a hybrid with the common spotted orchids also present.

Cothill NNR, 07.06.2019, J. A. Webb

History – Section III 1940s, 1950s, 1960s

Statutory protection for the Ruskin Reserve obtained by conservation designation (*SSSI and NNR status achieved). More hydrological change. Involvement of University of Oxford ecologists in surveying and academic study. The Nature Conservancy*[23] *leases Ruskin Reserve from The National Trust. Pond succession reversed by extensive 'cleaning-out'. The Berkshire, Buckinghamshire and Oxfordshire Naturalists Trust (BBONT) is formed and leases Parsonage Moor nearby.*

The future protection of many wildlife-rich sites improved with the founding of the Nature Conservancy (NC) in 1949. It was not until Government legislation that year (The National Parks and Access to the Countryside Act) that statutory protection for places for wildlife began in the form of National Parks, National Nature Reserves and Sites of Special Scientific Interest (SSSI).

Charles Rothschild's list was one of the starting points for this process, and some of the places on the list began to receive statutory protection from the 1950s onwards, one of them being the Ruskin Reserve. Regrettably, at that time this did not cover the very large fenland reserve area that Druce had originally wanted to protect, although it did protect a bigger hydrological unit than just the Ruskin Reserve. In 1950 'Cothill Fen' was designated as one of the first SSSIs (under the 1949 Act) and it included the Ruskin Reserve plus land nearby and Parsonage Moor. This original SSSI covered a much smaller area than the current SSSI. Today it is recognised that the designation of a bigger area, with a larger wetland complex, would be more conducive to long-term ecological resilience.

[23] **The Nature Conservancy** (NC), established by Royal Charter in 1949, was replaced by **The Nature Conservancy Council** (NCC) in 1973 and then by **English Nature** (EN) in 1991. English Nature was merged with the Countryside Agency and Rural Development Service in 2006 to form **Natural England** (NE), the Government's adviser for the natural environment in England, which now leases the Reserve from The National Trust.

Involvement of University of Oxford scientists in the study of Cothill and providing advice

From 1941 onwards E. B. Ford (1901–1988), lecturer and ultimately Professor of Ecological Genetics at Oxford University, carried out his studies on the scarlet tiger moth, *Panaxia* (now *Callimorpha*) *dominula* in the Cothill fen areas. He and his assistants counted scarlet tiger moth wing pattern variants and carried out mark-release-recapture studies on the population for two weeks every July in the fen at Cothill over a wide area to gain evidence of genetic polymorphism in connection with theories on random genetic drift and natural selection (three genetically controlled wing pattern variants are present: one common form and two much rarer forms). This work is one of the longest running studies of genetics in the field and research into this subject of polymorphism using data on this moth at Cothill has continued for more than 60 years – see, for example, Jones D. A., (2000).

Scarlet tiger moth Callimorpha dominula showing one form of fore- and hind-wing patterning. Parsonage Moor, July 2009. Photo J. A. Webb

In 1949 and through the 1950s ecologists from the University of Oxford began to be involved in the site. Botanist A. R. Clapham carried out a full botanical survey of the whole fenland area in March 1949. His valuable records indicate that, at the time, the series of rectangular pools – possibly fish ponds (peat cuts) in the parcel of land immediately to the west of the Ruskin Reserve – were not yet covered by trees, but were being steadily colonised by rush and reed, together with young birch and ash. These areas, nevertheless, still retained important fen species such as marsh helleborine orchid, *Sphagnum* bog mosses, black bog-rush, bog pimpernel, butterwort and sundew. He considered this area botanically very valuable and recommended that it should be included in any future extended protected reserve.

In 1950 a University of Oxford ecologist, Charles Elton, undertook land ownership research in the Cothill area with the aim of identifying land areas near to the Ruskin Reserve and Parsonage Moor, where control could be acquired and conservation favoured, to make a larger, more resilient, reserve. There had been a big sale of land (the Morland's sale) of parcels of portions of fen and nearby land in 1949, with new ownership of several important wetland areas adjacent. This new owner stated his intention to drain some areas to get them into cultivation. Water supply is critical for a wetland reserve to function properly, and increased removal via drainage will cause problems. Therefore, it was particularly important to obtain control of more land involving the inflow and outflow of water to the SSSI to maintain beneficial wet conditions.

At this time the Ruskin Reserve, although supposed to be a permit-only site, was unfenced and open to all and sundry. Elton reported the Reserve Pond contained 19 large metal floats (jettisoned aluminium aircraft fuel tanks from World War II) used by local boys as rafts or canoes when swimming in the pond, and the margin had been heavily trampled and the purple moor grass burned.

This aerial view, taken in **1962**, clearly shows the Ruskin Reserve central pond area on the left of the photo as a circle in woodland, with some water visible between mats of vegetation, and with much scrub encroachment all around.

String Lane and Cothill House School grounds are to the left.

Below the Ruskin Reserve pond and the line of scrub, Parsonage Moor is the large open site, at that time mostly open with scattered clumps of scrub. Morland's meadow is the open field at the bottom of the photo.

Above image: AFT49 from Cambridge University Collection of Aerial Photography © copyright reserved, reproduced here with kind permission of CUCAP

In this aerial view from **1977** the Ruskin Reserve pond area is visible on the left of the photo in surrounding scrub, with open water in the centre (white rectangle) resulting from pond clearing, surrounded by mats of vegetation. There is much scrub encroachment all around.

String Lane, and a golf course in the grounds of Cothill House School, are to the left.

Below the Ruskin Reserve pond and the line of scrub, Parsonage Moor is the large open site, at that time mostly open with scattered clumps of scrub. Morland's meadow is the open field at the bottom of the photo.

Above image: CE134 from Cambridge University Collection of Aerial Photography © copyright reserved, reproduced here with kind permission of CUCAP

Another aerial view from **1977,** taken from a different angle. The Ruskin Reserve pond area is visible as a triangular scrub-free area in the lower part of the photograph, with open water in the centre surrounded by mats of vegetation.

Below the pond area are String Lane bounded by trees and a golf course in the grounds of Cothill House School. The wooded area to the left (West) of the Ruskin Reserve is mostly an area known as Hitch Copse.

Above image: CE135 from Cambridge University Collection of Aerial Photography © copyright reserved, reproduced here with kind permission of CUCAP

Further hydrological change and increased public pressure

A big hydrological change happened in 1956. Morland's Meadow had already been dried from wet fen to a wet meadow by marginal drains and the mill leat. In 1956 the new owner of Morland's Meadow obtained a Ministry of Agriculture Fisheries and Food (MAFF) grant to under-drain the meadow and also dig a new six-foot-deep drainage channel along the southern edge of the meadow, north of, and parallel to, the mill leat. It was deeper than the leat by several feet and thus took water previously carried by the leat. This new, deeper, drain conveyed water from the under-drained Morland's Meadow (and, of course, all fen areas previously drained by the leat upstream to the west) directly to the Sandford Brook. The old leat channel, thus deprived of water, dried up. It is visible today next to String Lane as a dry channel. Morland's Meadow was then ploughed and a crop sown, but this failed.

Up until then Morland's Meadow had been the main site of University of Oxford geneticist E. B. Ford's research on scarlet tiger moth wing pattern polymorphism. Here, the moth's food plant, comfrey, grew abundantly. Ecologists from the University of Oxford (Ford and Elton) had tried unsuccessfully to stop this new drainage and save the wetland the moths depended on. When awarding the grant, MAFF had no knowledge of any site of wildlife importance that would be impacted. With the installation of this deep six-foot drain, all wetland sites to the west (Parsonage Moor, Ruskin Reserve and more western areas) would have suffered an increased rate of water removal from this time on and there is a record that the effect of this new drainage was noted almost immediately.

A comment by J. H. Hemsley is recorded in the Natural England archive: '*the water level in the reserve* (i.e. Ruskin Reserve) *has been dropping steadily of late, the cleaning out and deepening of the ditch system on the village side has had a lot to do with this'*.

As a consequence of these observations Hemsley and others suggested that a sluice at the extreme south-east corner of Ruskin Reserve, where the stream/leat exits, be reinstated and the water level thus raised by two feet. This may have been done, but no water-retaining structure has survived there.

The Ruskin Reserve at that time had no sign and was not fenced or gated; it was suggested that it should be fenced to limit damage caused by public access. Jettisoned aluminium aircraft fuel tanks from the war were still left in the pond, encrusted with tufa. The reserve was 'permit only' at this stage but known as an important ecological site visited by University of Oxford students and staff. Parties of up to 90 people were reported to be visiting the area and there was much trampling of the vegetation, and collection of plant specimens was happening.

Ruskin Reserve leased to the Nature Conservancy and NNR designation

1959 was another key year for the Ruskin Reserve. On 2nd July it was leased from the National Trust for 99 years to the Nature Conservancy (NC)[24] and on 17th July it was declared a National Nature Reserve (NNR) under the National Parks and Access to Countryside Act 1949. For the first time a management plan was drawn up and resources could be allocated for wardening and habitat management. NNR status brought with it an increased emphasis on using the land for education and research, one of the primary purposes of NNR declaration. The size of this NNR was still only 1.8 hectares. It was one of only two NNRs created in Oxfordshire at this time (the other was Aston Rowant in the Chilterns).

Expert botanical survey in the 1960s and BBONT[25] leases nearby Parsonage Moor

The first expert re-survey of the vegetation communities in the Ruskin Reserve since Druce was carried out in 1961 by D. F. Chamberlain and S. R. J. Woodell (ecology lecturer at the University of Oxford's School of Botany). A species list and vegetation map were produced. The map (see Figure 6, p. 24) showed open water in the central peat cut reduced to three small pool areas (shaded black in that map), surrounded by an area of parallel vertical lines that is keyed as Juncetum (all blunt-flowered rush) with black bog rush, bottle sedge and parsley water-dropwort and therefore likely to be floating mat. The pools contained fen pondweed. Reed (marked as P) was confined to the ditch to the south-west.

Referring to the pools, this report says '*the pond is rapidly filling in, partly due to natural succession and partly to a drop in water level'*.

An area of damp grassland on the String Lane side of the stream (indicated in Fig. 6, p. 24) was reported to contain what now would be recognised as a wetland transitional fen-meadow community: purple moor grass, cocksfoot and tufted hair grass, meadowsweet, devil's-bit scabious, pepper saxifrage, tormentil, bird's-foot trefoil, tufted vetch, meadow buttercup. The damper parts had occasional tawny sedge, marsh valerian and grass of Parnassus, all currently on the county Rare Plants Register (in Erskine et al, 2018, *Oxfordshire's Threatened Plants*).

[24] The **Nature Conservancy** (NC), established by Royal Charter in 1949, was replaced by the **Nature Conservancy Council** (NCC) in 1973 and then by **English Nature** (EN) in 1991. English Nature was merged with the Countryside Agency and Rural Development Service in 2006 to form **Natural England** (NE), the government's adviser for the natural environment in England, which remains extant.

[25] Berkshire, Buckinghamshire and Oxfordshire Naturalists Trust, formed in 1959 - now Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT)

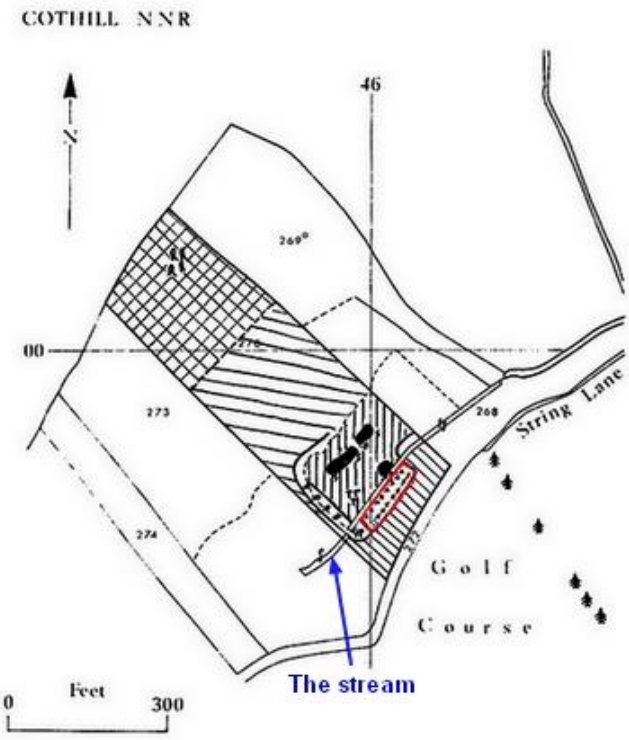


Figure 6:

1961 vegetation survey map by Chamberlain and Woodell shows, with detailed mapping, the Ruskin Reserve as a central strip, and in outline the D'Arcy land strips on either side.

Source: unpublished report in Natural England archives, reproduced by kind permission of NE.

For clarity, indications of the stream, and the area of damp grassland referred to on the previous page (red line) have been added to the original map.

The first draft NC management plant for the NNR in 1962 (prepared by J M. Laptain) contains the interesting observation on the reserve drainage: *'Today the banks of the leat in the Ruskin Reserve have broken down...'*. This presumably led to the situation observable today, namely that the water course (old leat) entering from the west edge of the Ruskin Reserve does not proceed straight along the edge of the fen and out to the east as shown on the very earliest site map in 1902, but now meanders and spreads out over the lower centre of the fen before entering the pond. Water leaves the east side of the pond and travels off site in a straight drainage ditch. In this plan there is, again, the observation that water in the NNR pool had shallowed, and a suggestion of excavation of 'the old fish pond' and introduction of sluices to hold up water leaving the site. Again, there is no written evidence and no visual evidence on the ground that sluices were installed.

In 1966 the National Trust requested the long edges of the Ruskin Reserve be marked with concrete posts at intervals to define land ownership. Boys from Magdalen College School helped with this and most of these posts can still be found. The two String Lane National Trust land-edge marker stones were moved to the reserve side of the path, which was said to be a more accurate position.

The adjacent Parsonage Moor part of the fen SSSI/SAC is within the parish of Besselsleigh. The name comes from 'Parson's Moor' meaning it was part of the 'living' of the vicar of nearby Besselsleigh village. This meant he could remove peat (and presumably marl/tufa) for his use. When this digging-out happened is unclear but obvious irregularly-shaped presumed peat cuts are visible in this area on the earliest OS Berkshire map of 1876[26], so this activity must have happened before then. The shape of these peat cuts mapped then appears the same as today, and these lower, wetter areas are very important, as they are now very rich in key calcareous fen species and the rare M13 habitat. Parsonage Moor came under conservation management for the first time in 1964 with the leasing of this important fen portion to Berkshire, Buckinghamshire and Oxfordshire Naturalists Trust (BBONT), formed in 1959, now known as Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT). Parsonage Moor in the 1960s was described as largely reed-swamp with beginnings of willow and alder carr.[27] Since then conservation management by the Trust, including pony grazing, has reduced scrub invasion and restored a proportion of the site to open, shorter fen habitat.

[26] Map available from old.maps.co.uk https://www.old-maps.co.uk/#/Map/450160/203351/12/100067

[27] From an early 1970s BBONT Reserves handbook

Ruskin Reserve central pond management in the 1960s

All ponds undergo natural vegetational succession to dry land communities as a result of invasion by mats of vegetation of species such as rush, reed and sedge and accumulation of sediment, unless that succession is halted by intervention. It was decided that it would be valuable to retain open water in the central pool on site, so some of the invading rush mat vegetation should be removed with the agreement of the National Trust.

Between 1966 and 1969 summer activities on the pond in the centre of the Ruskin Reserve involved the labour of boys mainly from Abingdon School with their teacher, Mr Milton. All work was by hand. The area cleared to open water again was estimated as *half an acre (0.2 ha)*, which seems a lot for such a small site. The work was done using forks, rakes, drags and a barge/punt, with material brought to the pond margin in a defined area on the String Lane side. This may not have been the first clearing-out; there is a note in Natural England archives that this pond had been cleared 40 years before (no further information).

A small island with alder saplings on it was left un-cleared. Some logs and lumps of vegetation dredged from the pond were placed on the island. Most peat and vegetation dredgings were removed off-site with a tractor by a Mr Tallett and dumped in his garden (pers. comm. Mr Tallett). After initial removal of a lot of vegetation and peat, it was estimated that 6 tons of mud were taken away and the resultant pond was now three feet deep. The work was estimated to have taken 100 man (and boy) days. Glass and metal rubbish (including six more jettisoned aluminium aircraft fuel tanks) was removed. This information is from a report by the site warden, D. C. Ungley, in the Natural England archive.

Boys from Abingdon School and their teacher, Mr Milton, in the process of 'cleaning-out' the Ruskin Reserve central pond. Some boys pull on a drag line, others unload vegetation and mud from a punt and fork it up the bank to be removed offsite via String Lane.

Dated 1969

Photo by kind permission of the Natural England Archive

View from the south side of the pond during cleaning-out activities, punt visible near the island with an alder tree. Notice mud and vegetation piled onto the island. Dated 1966.

Photo by kind permission of the Natural England Archive

Further academic botanical and hydrological study

The latest records of the rare lesser water plantain *Baldellia ranunculoides* from the site are those from 1978 according to M. Crawley's Flora of Berkshire.[28] Presumably it lived in the pond margins. This plant is currently rare in the county and found now only in a pond on Otmoor.

In the 1970s Peter Morris, lecturer at what was then Oxford Polytechnic (now Oxford Brookes University), started his important and very detailed vegetation, peat and hydrology study of mainly Parsonage Moor. His students benefitted from this site as an educational resource (e.g. Mawdesley 1972). He monitored hydrology and vegetation on site and in the wider area intensively from 1976 to 1978. His survey of peat/marl/tufa depth and distribution on site confirmed and expanded the discoveries by the Claphams on this in 1939. He was the first to work out the site rain water catchment and the relationship between plant assemblages and hydrology and water chemistry. A summary of his findings are in Morris (2002).

Morris found the catchment was relatively small and included leached Corallian Sands, but he observed that the fen's groundwater supply was derived mainly from the Upper Corallian Limestone. He noted how important activities in the catchment were to the fen, including groundwater abstraction and eutrophication. Also in the 1970s, Bryan Wheeler of Sheffield University became interested in the vegetation and hydrochemistry of the Ruskin Reserve and Parsonage Moor. He gathered vegetation assemblage quadrat data and environmental data from both sites over a number of years and still retains a research interest in the sites, which feature in many of his publications.[29]

[28] M. J. Crawley, *Flora of Berkshire*, Brambley Books, Herts.

[29] B. D. Wheeler, (2002) 'Controls on the composition of vegetation of valley-head fens in the Oxford region'. *Fritillary* 3: 37-46. *Fritillary* is published by The Ashmolean Natural History Society of Oxford as a joint venture with BBOWT. Edition 3 is not available to download from the website. https://anhso.org.uk/special-interest-groups/fritillary/fritillary-3/

HISTORY – SECTION IV 1970s TO 2000

Start of management by alder tree coppicing on land between Ruskin Reserve and Parsonage Moor. Reed advances in the pond. Purchase of land around the central Ruskin Reserve by English Nature. Important invertebrate studies. Further study of prehistory of the whole fen system via a new peat core.

Habitat management work on the land to the east of the Ruskin Reserve

The mid-1970s also saw the beginning of work by staff from the Nature Conservancy Council (later English Nature[30]) on the strip of privately-owned wetland between Ruskin Reserve and Parsonage Moor by agreement with the landowner. The aim was to prevent succession to woodland by some coppicing of the alder trees. This was an area of abundant greater tussock sedge *Carex paniculata*, which still retained good numbers of marsh helleborine orchid *Epipactis palustris* and broad-leaved cotton-grass *Eriophorum latifolium*. The initial work was undertaken by a BBONT Manpower Services Commission (MSC)[31] team and the coppicing of the area was then subsequently carried out by Nature Conservancy Council/English Nature staff.

Keeping this area as shorter scrub provided structural diversity and prevented isolation of populations of rare invertebrates of short fen, enabling the more mobile flying invertebrates to move freely between the Ruskin Reserve pool and similar breeding and feeding areas at Parsonage Moor, thus strengthening their populations on both sites.

An interesting observation of a county-level rare plant is noted. In September 1982 there was a sighting of great fen sedge *Cladium mariscus* on the south-west side of the Ruskin Reserve pond by R. J. Hornby, Deputy Regional Officer for the South Region of NCC. Unfortunately, more recent records are not available for this sedge in this area near the pond. This lime-loving large sedge was once very common at this site judging by its abundant remains in the peat cores from Morland's Meadow seen by the Claphams in 1939. It was present on one other Oxfordshire site but is now most likely extinct in the county.

The Ruskin Reserve pond in the 1980s

Two sets of fixed-point photos were taken by site warden Mike Cox from a point on the south side of the pond bank in the middle of the Ruskin Reserve. From 1983 to 1988 they show the steady invasion of the open water of the pond by marginal vegetation, especially reed from the west end.

Over the years, without any management (due to various factors including difficulty of safe access to that pond margin) natural hydroseral succession meant the reed subsequently advanced to fill virtually the whole of the pond area, except for the north-eastern corner, which remained open.

[30] **The Nature Conservancy** (NC), established by Royal Charter in 1949, was replaced by **The Nature Conservancy Council** (NCC) in 1973 and then by **English Nature** (EN) in 1991. English Nature was merged with the Countryside Agency and Rural Development Service in 2006 to form **Natural England** (NE), the Government's adviser for the natural environment in England, which now leases the Reserve from The National Trust.

[31] The Manpower Services Commission (MSC) was a non-departmental public body of the Department of Employment Group in the United Kingdom created by the Conservative Government in 1973. The MSC had a remit to co-ordinate employment and training services in the UK through a 10-member commission drawn from industry, trade unions, local authorities and education interests.
Source: Wikipedia

From the south bank margin of the pond, looking north-east, 1983, the beginning of reed creeping round the pond edge on the south side and into the pond, mats of shorter rush Juncus sp. visible in open fen in the distance. Note island with alder tree to the left of photo.

In 1988 the charity Pond Action, later known as Pond Conservation and now as the Freshwater Habitats Trust (FHT), became interested in the aquatic flora and fauna of the central pool in the Ruskin Reserve and carried out a survey that brought to light some uncommon aquatic invertebrates including the whirligig beetle *Gyrinus suffriani*.

In 1997 a student study of the central pond found both 3 and 10-spined stickleback and toad present. Whilst white-clawed crayfish were recorded in the early 1900s, the only crayfish found today is the alien invader known as signal crayfish *Pacifastacus leniusculus*.

First sand extraction in the fen catchment and formation of local action groups

For some years in the 1980s the extraction of sand from the fields to the west of the Ruskin Reserve had been on-going. Spring-fed fen sites depend on a large area outside the actual fen wetland for rainfall penetration into the underground water store (aquifer). This is the water catchment and it is possible for such mineral extraction in a catchment to affect spring flow in an adjacent wetland, if not done carefully with respect for the needs of the wetland. Planning conditions imposed on the extraction, and an agreed water management plan, should prevent any adverse effects from this activity on this site. In 1988 an application was submitted to extend this sand extraction by 27 acres over woodland of the nearby Hitch Copse, and through the fields behind the Ruskin Reserve, up to the edge of Parsonage Moor. Local residents who were concerned for wildlife in the area and against this extraction proposal banded together to oppose it, forming 'Cothill Action Group', and the application was refused by Oxfordshire County Council. The fact that Hitch Copse is ancient oak woodland with abundant bluebells was a significant factor in this refusal.

The strong community interest in all the BBOWT nature reserves in the Cothill region (Dry Sandford Pit, Lashford Lane Fen, Parsonage Moor and Hitchcopse Pit) resulted in the setting up of the ‘Friends of Cothill Reserves' group, who met for the first time in 1988. They are still active today, working closely with BBOWT and providing a focal point for bringing together all those interested in wildlife conservation in the Cothill region, as well as for education about the sites, practical volunteering and raising money for small projects. Sand extraction in the area continues.

Invertebrate studies - recognition of the importance of the Ruskin Reserve and wider SSSI fen area for rare insects

Many experts in various groups of invertebrates have visited the site over the years and a large number of historic records have accumulated; below are just a few examples.

In an ANHSO members' walk to the reserve, amongst a full butterfly list of 13 species, white-letter hairstreak butterflies (now very scarce) were reported as 'common' by leader Patrick Boston on 10th July 1976. English elms are still present today as scrub in Hurst Copse and along String Lane. There must once have been greater numbers of mature elm trees here before the effects of Dutch Elm Disease in the later 1970s.

A survey in 1978 by local fly expert John Ismay found a specimen of the large and extremely rare, yellow and black clubbed general soldierfly *Stratiomys chamaeleon* (RDB1[32]) first noted in 1940s at Cothill and still present today, here and at nearby Parsonage Moor and Dry Sandford Pit SSSI. Another very rare (RDB1) soldierfly present is the orange-horned green colonel *Odontomyia angulata.* Such soldierflies have aquatic larvae dependent on shallow, warm, pools in open short turf fen where they feed on unicellular algae and bacteria.

Male orange-horned green colonel soldierfly Odontomyia angulata (left) and male clubbed general soldierfly Stratiomys chamaeleon from the Ruskin Reserve Photos by J Webb

From the late 1980s to the early 1990s English Nature officer Keith Porter carried out an important flying-insect survey by malaise trapping (a tent-like trap) in a number of Oxfordshire SSSI alkaline fens, including the Ruskin Reserve.[33] A number of expert entomologists were needed for identifications. The information so generated showed how amazingly diverse the assemblage of flying insects was (particularly flies) in this rare habitat. The malaise trap at Cothill in 1988 was placed just inside the edge of the wet woodland to the north of the open fen and pond in the Ruskin Reserve. Of course, important insects found in this area would also be occupying the adjacent Parsonage Moor fen and probably suitable habitat in the rest of the SSSI/SAC. Experts at the Natural History Museum in London still intermittently study leaf litter invertebrates from the Hurst Copse woodland behind the fen in the Ruskin Reserve.

[32] Red Data Book species – coded 1: British RDB status has been coded as 1 = endangered, 2 = vulnerable, 3 = rare, 4 = notable and 5 = not in any of these categories.

[33] K. Porter, 'Fens of Oxfordshire: their importance for invertebrates'. *Fritillary* 3: 47-54. *Fritillary* is published by The Ashmolean Natural History Society of Oxford as a joint venture with BBOWT. Edition 3 is not available to download from the website. https://anhso.org.uk/special-interest-groups/fritillary/fritillary-3/

Management and land purchase of strips either side of the Ruskin Reserve

For a long time EN had nurtured a desire to achieve a larger reserve and extend conservation management to the wider fen area, thereby reaping many wildlife benefits, just one of which was gaining greater control over the hydrology influencing the central area pond and fen area. After much time and effort spent in negotiation with adjoining landowners, in 1999 EN was successful in purchasing two parcels of land, one on either side of the Ruskin Reserve. This brought the total land area owned or managed for conservation by EN up to 5.18ha.

Following the advice of experts in the needs of fen invertebrates, under a new management plan a proportion of alder stumps were removed yearly from the newly-acquired east strip. They were cut out with a chainsaw, then pulled out using a winch in order to create small pools whilst maintaining areas of woodland edge–fen transition. Cutting and raking of rush and sedge took place annually in autumn on part of this area, and the benefit of the effects of all this work was apparent in the increase of warm pools and wet runnels between tussocks – vital breeding areas for many species of important invertebrates identified in previous surveys. Over five years the area undergoing cutting and raking gradually increased in extent, maintaining tussock structure but preventing over-rank vegetation growth and consequent shading of pools and runnels.

The strong association of Cothill Fen NNR and Parsonage Moor with Oxford Brookes University continued in the 1990s with lecturer Peter Morris using the site regularly as a vegetation and hydrology case study with his students. An Oxford Brookes student's study of small mammal populations revealed the presence on site of large numbers of water shrew *Neomys fodiens*.

From 1989-1991 the prehistoric history of the whole Cothill fen system was further studied by Petra Day (now P. Dark) whilst studying for a D. Phil. (1986-1990) on the post-glacial vegetation history of the Oxford region at the University of Oxford's Department of Plant Sciences[34] (see pp 6-7 of this report).

HISTORY – SECTION V 2000 to 2019

Further knowledge of the ecology of the fen obtained in recent times through surveys and academic study. Education about the whole habitat importance. Conservation status of the whole SSSI raised to SAC. Restoration of more short-turf fen through involvement of volunteer work in the NNR. Mitigation measures for effects of some threats to the site. Recovery of open water and more biodiversity in the central pond. Regular grazing starts, in common with Parsonage Moor, by BBOWT's Welsh mountain ponies.

In 2001 recognition of the high ecological importance of the whole rare ecosystem of the valley-head fens of Oxfordshire was highlighted in a three-day course on this subject, which was a joint venture between the ANHSO and the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT)[35]. Papers based on presentations during this course were brought together in a special edition of the ANHSO journal *Fritillary* published in 2002[36]. Research at Cothill featured prominently, with papers on pollen analysis and vegetation history, plus the relationship between hydrology, water chemistry and plant communities at Cothill and the importance of the site for wetland invertebrates.

[34] S. P. Day, Post-glacial vegetational history of the Oxford region, *New Phytol.* (1991), 119, 445-470 and, as P. Dark, (2002), 'Mesolithic environmental change at Cothill Fen, Oxfordshire', *Fritillary* No 3, pp 8-13, Edition 3 is not available to download from the website.

[35] Previously known as Berkshire, Buckinghamshire and Oxfordshire Naturalists Trust

[36] 'The Unique Ecosystems of the Oxfordshire Valley-head Fens' https://anhso.org.uk/special-interest-groups/fritillary/fritillary-3/

SAC status achieved for whole Cothill Fen ecosystem

Another landmark was reached in early 2005**,** when the National and European importance of the whole Cothill Fen SSSI system was recognised by its designation as a Special Area of Conservation (SAC) under the EU Habitats Directive for the importance of its alkaline short-turf fen areas and alder-dominated wet woodlands. The SAC area includes the Cothill NNR/Ruskin Reserve, wet and drier woodland to the west, Parsonage Moor, Morland's Meadow and all areas of the Sandford Brook corridor as it continues to (and includes) Lashford Lane fen.

Sand extraction, further study and monitoring in the fens

Sand extraction by Hills Aggregates in the fen water catchment to the north-east at Upwood Quarry is on-going. Amongst other measures, it necessitates regular monitoring of dipwells for water levels and chemistry in the central pool of the Ruskin Reserve and Parsonage Moor to check that this extraction is not affecting the fen water levels or water chemistry. The arable field to the north-west of the Hurst Copse woodland part of the reserve will eventually be partially excavated for sand in a few years' time. BBOWT has installed its own dipwells all over the SSSI/SAC and water levels are currently monitored monthly in this network by BBOWT volunteers.

Academic study and survey of the Cothill NNR and Parsonage Moor vegetation and water quantity and quality have continued in recent years and the site continues to provide an opportunity for academic studies, the latest being the MSc study of Parsonage Moor vegetation and hydrology by Hayley Snowdon from Oxford Brookes University in 2017.

Species surveys continue and increase our knowledge of the site's value for wildlife. The NNR (along with Parsonage Moor) has been found to support good breeding populations of common frogs, common toads, viviparous lizards and grass snakes. Woodcock and snipe have been noted visiting and roe deer are regularly seen. The Keith Porter 1988 malaise trapping of flying insects in the NNR section was repeated in 2019 with results expected soon. Historic surveys have provided quite a lot of information on moths, butterflies, spiders, dragonflies, damselflies and Diptera (two-winged flies). However, many records are very old and little is known about groups such as ground-running invertebrates (e.g. beetles, harvestmen) pond invertebrates, and other flying insect groups such as bees, ants and wasps; further surveys for these are planned. Evidence of harvest mice has recently been found and it would be good to identify the site's bat species.

Larval glow worms (which are beetles) have been discovered only in the last few years and white-letter hairstreak butterflies were re-discovered on the edge of String Lane in 2019. Southern damselfly *Coenagrion mercuriale* (protected under Schedule 5 of the 1981 Wildlife and Countryside Act) breeds at the adjacent Parsonage Moor in the central base-rich runnel and visits the NNR, but breeding is not yet confirmed. However a big population of small red damselfly *Ceragrion tenellum* is to be found around the NNR pond and almost certainly breeds there.

Cothill NNR has an important population of the small red damselfly Ceriagrion tenellum.
This male was photographed there on 22.06.2018. J A Webb

Changes to the Reserve site, introduction of grazing in common with Parsonage Moor

A new information board has been installed alongside String Lane and two wooden bridges have been constructed across the leat in the Ruskin Reserve. There is now a boardwalk of recycled plastic and wood construction on the east side across a very wet swampy area of the path. In all this, Natural England staff had skilled help from the Oxford Conservation Volunteers (OCV). Some fen marginal alder tree felling is restoring a greater area of more open short fen.

In 2014 collaboration with BBOWT enabled extension of the Parsonage Moor grazing to the Cothill NNR by removal of a dividing fence – probably the first grazing this section has had in over 100 years. This change in management is being monitored and assessed. The Trust's hardy fen-trained Welsh mountain ponies are on site annually from summer to the end of autumn. Pony grazing has operated on Parsonage Moor for much longer (since 2002) and is especially helpful in maintaining biodiverse tussock structure in both fens.

New fences were installed in the NNR to keep the ponies within the open fen areas, as well as temporary electric fencing to keep them from the hazard of the central pond.

A stock-handling pen and a new site entrance were constructed on the String Lane side

BBOWT Welsh mountain ponies take their first bites of vegetation upon release to the Cothill NNR and Parsonage Moor on 12.08.2014 Photo J A Web

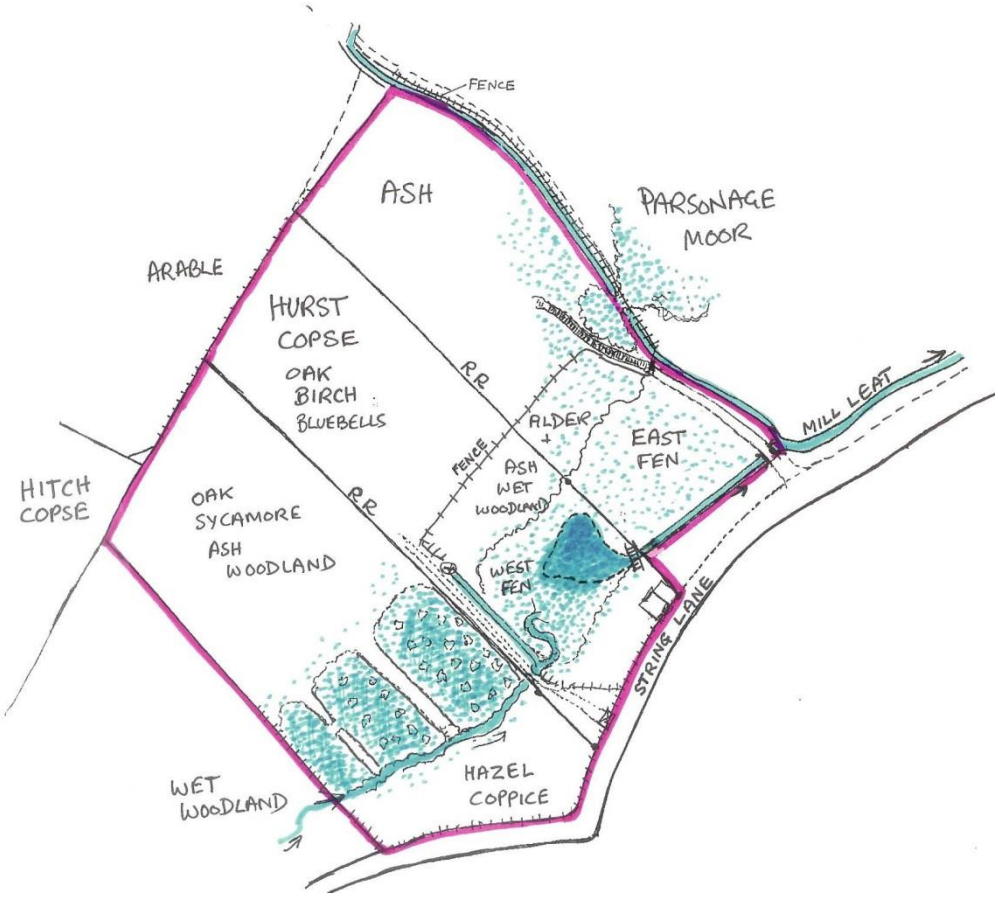


Figure 7: *Sketch showing the different areas of the Cothill NNR under direct management by Natural England (red outline). RR indicates the edges of the Ruskin Reserve. Wet fen and pools are shaded blue.*

Involvement of volunteers in conservation management and fen community changes

Now, in 2020, the habitat in the Ruskin Reserve/Cothill NNR benefits from the involvement of several volunteer conservation groups working with NE staff. Some years ago this started with Bicester Green Gym, then Sonning Common Green Gym and since 2003, Abingdon Green Gym[37], who visit the site to rake-up cut reed and rush and carry out light scrub work up to five times a year on Saturdays. Oxford Conservation Volunteers (OCV) have assisted with fen cutting, raking and boardwalk construction.

An arrangement with BBOWT for reciprocal volunteer work sessions has operated; there have been occasional visits from the BBOWT midweek conservation team. This kind of cooperative working has been very helpful in the restoration of the densely-reeded areas to more biodiverse shorter fen.

Volunteer from BBOWT midweek team scything reed with an Austrian scythe in the Ruskin Reserve section 14.08.2013. Photo J A Webb

Abingdon Green Gym volunteers at work fen raking cut reed in the western fen area, Ruskin Reserve, on 22.09.2018 Photo J A Webb

[37] https://www.abingdongreengym.org.uk/

By 2013 reed advancement had colonised nearly all the previously open central pond in the Ruskin Reserve. Only a small area at the north-eastern corner remained open, full of Chara stoneworts and edged by floating mats of blunt-flowered rush. Removal of reed from the pond would have been desirable, but the difficulty of working in deep water precluded this.

The Ruskin Reserve pond in the peat cut in August 2013 showing the remaining small area of open water - view looking to the west over the Reserve from the east fen. Most of the pond is to the left and is full of reed. Photo J. A. Webb

In early 2017 Adrian Thorn became volunteer Reserve Warden for NE at the Cothill NNR/Ruskin Reserve. Adrian took on the challenge of reed and scrub reduction in the difficult area of the site centre with the aim of trying to restore the pond from reed dominance to open water. His regular work started in January 2017. He also tackled the reed monoculture dominating the western half of the fen. All reed cutting was done by Austrian scythe, dealing with old dead reed stalks – a very challenging job at the start.

Volunteer Reserve Warden Adrian Thorn at work with his Austrian scythe on the first cut of tall, old, reed marginal to the pond, February 2017. Photo J. A. Webb.

Open water once again with greater tussock sedges and stonewort algae mats in the central Ruskin Reserve pond, thanks to Adrian's work reducing reed, 18.04.2019 Photo J. A. Webb

In January 2018 a new monthly conservation volunteer group working in the NNR and run by Natural England staff started up. Since then progress in fen restoration in the previously reed-dominated western fen section has been fast due to the cutting being combined with grazing by BBOWT's Welsh mountain ponies.

The eastern fen section does not have reed, being mostly black bog rush, blunt-flowered rush and greater tussock sedge communities. This has a partial cut-and-rake once in October, permitting completion of flowering and seeding of the marsh helleborine and narrow-leaved marsh orchids there.

Natural England monthly work party volunteers removing cut rush in the east fen area 04.10.2019 photo J. A. Webb

Spread and increase in flowering of many of the scarce to rare plants

Reduction in dominance of reed, greater pond sedge and rushes *Juncus* sp. has enabled a population increase, and much more abundant flowering, of important fen plant species rare in the county, such as fen pondweed, parsley water-dropwort, bladderwort, marsh helleborine orchid and marsh lousewort.

Fen pondweed Potamogeton coloratus and bladderwort Utricularia sp. Photos J. A. Webb

Marsh helleborine orchid Epipactis palustris and marsh lousewort Pedicularis palustris Photos J. A. Webb

Return of 'lost' plant species in recent years and a new plant discovery

Thanks to the extension of the area of short-turf fen that has been restored, fen plant species important in the county and thought lost have been re-found in the NNR. Flea sedge *Carex pulicaris*, distant sedge *Carex distans*, marsh arrow grass *Triglochin palustre* have re-appeared and are all increasing.

Removal of a shading alder tree revealed a surviving clump of the dark-leaved willow *Salix myrsinifolia* (a male and a new record for the county, the only one known). This individual had been first noted and mapped in a survey in the 1950s, but misidentified at that time as the very similar tea-leaved willow *Salix phylicifolia*.

The small, neat, rounded leaves and a male catkin of the dark-leaved willow Salix myrsinifolia from the Ruskin Reserve. April 2015. Photo J. A. Webb

Flea sedge Carex pulicaris in fruiting stage.

Its fruits were likened to fleas.

Photo J. A. Webb

Water quality and water quantity

In the last nine years investigations into water quality by the Environment Agency and most recently an investigation and report by C. Lamberth in 2017-18 (grant funded by the FHT) have shown that parts of the NNR and the whole Cothill fen SSSI/SAC have increased nitrate levels. Leaching of nitrate from fertilized arable fields in the fen rainwater catchment is the cause. The rare calcareous short-turf alkaline fen wetland ecosystem with its peat-cut pools thrives and is most biodiverse with really low nitrate levels – less than 0.5ppm. Nitrate levels much above this limit stimulate the growth of common and aggressive/dominating plants, such as duckweed, common reed, pond sedges, watercress and very common mosses, reducing biodiversity. Reed and sedges can become tall and thus outcompete and shade-out shorter, rare, fen plants that are adapted to lower nutrient levels. However, there are still fen areas and pools with the desirable low nitrate levels. For the higher-nitrate water areas, mitigation measures have been employed by NE staff and volunteers following advice from the Lamberth report. These measures involve placing cuttings of reed and rush, obtained from fen management, in pools or channels tested to have high nitrate values. As rotting proceeds in the waterlogged material, anaerobic conditions encourage denitrifying bacteria to turn nitrate to nitrogen gas, lowering nitrate levels to more beneficial ones. FHT citizen scientists test kits for nitrate indicated the success of this method during 2018 in the NNR/Ruskin Reserve (see photo p.39). A limitation of this approach is that it works in the warmer months when bacteria are active but not in the colder winter months.

Volunteers forking fen cuttings into a nitrate-rich channel from a spring in the west fen area of Ruskin Reserve to reduce nitrate levels. FHT citizen science test kits[38] show high nitrate levels above the cuttings (pink in left tube) and resulting low nitrate levels below cuttings (clear in right tube) 07.09.2018. Photo J. A. Webb.

A second threat to the Cothill Fen NNR and the whole fen SAC system comes from hotter and drier summer conditions associated with climate change. Water is life to a fen. Summer droughts and heat-waves have become more frequent and consequently water levels have been too low for months in parts of the fen as a result of increased water loss by evaporation and lack of groundwater to the spring/seepage zones.

Whilst it is not possible to generate more rain to feed the springs and keep up the flow, it is important that the rainwater catchment area of the whole SAC remains as green and freely permeable as possible to allow the rain that does fall to enter the aquifer in the limestone or sand with no restriction. Development could reduce infiltration. Action that can be taken to increase resilience to drought involves keeping the sites wet and retaining water by reversing some historic drainage.

Work has already taken place in the NNR/Ruskin Reserve using recommendations from the Lamberth report (2018). Volunteers from Abingdon Green Gym installed a specially designed, partially leaky, log dam in the outflow drain (old mill leat) in the approximate position of the historic wooden dam that lasted until 1938.

This log dam is now restricting water drainage from the fen but allowing flow through the system, maintaining oxygenation. Water is retained to a carefully calculated level, giving year-round wet fen and abundant water in the central open pond. The water level is checked regularly and the amount of water flowing past the log dam structures is adjusted as required. This work was carried out just in time to prevent the worst effects of the 2018 summer drought. The fen also remained wet throughout the 2019 drought, enabling good numbers of Odonata and other aquatic invertebrates to complete life cycles in the wet runnels and central pond.

Carefully positioned dams to restrict drainage and preserve wet-fen conditions through summer are planned soon for other sections of the Cothill fen SSSI/SAC.

[38] https://freshwaterhabitats.org.uk/citizen-science-reveals-clean-water-hotspots/

Drainage of a peat-rich wetland leads to drying and air exposure, speeding up peat oxidation and release of carbon dioxide into the atmosphere. Drying peat is thus a carbon source and adds to the concentration of this greenhouse gas, a major cause of climate change. Wet peat is an important long-term carbon store, better in this aspect than trees. Under ideal water-logged conditions, growing (photosynthesising) wetland plants remove carbon dioxide from the atmosphere to build their bodies, and their remains do not decompose but accumulate and create new peat, thus sequestering carbon. Wetlands are thus a natural solution, helping reduce damaging climate change. Keeping the Cothill fen site wet firstly preserves and enhances its exceptional biodiversity, but also ensures continual carbon dioxide removal and storage - a second vital role.

Reversing historic drainage: volunteers installing a partially leaky log dam in the outflow drain from the Ruskin Reserve in July 2018. Photo J. A. Webb.

Conclusion

This has been a long tale of the complicated history of a little portion of an astoundingly biodiverse and rare spring-fed wetland. At the end of the last ice age it was part of a lake but over thousands of years, whilst Mesolithic humans hunted in the surrounding landscape, it was gradually transformed into a fen. In its early stages its vegetation was influenced only by grazing from large wild herbivores. Later it was increasingly subjected to grazing by domestic stock and to reed, rush and sedge cutting by humans. It has survived human activities of channelling water to a mill, as well as the digging of peat or marl – an activity that created new pools, reversing succession and thereby establishing diverse aquatic habitats alongside old fen.

It was one of the earliest areas of biodiverse natural habitat to be purchased specifically for the protection of its important wildlife (in 1902, as the tiny, 0.71ha, first land parcel of the Ruskin Plot). Its conservation protection was later extended to cover the current, larger, area of fen wetland (over 43 ha) in Cothill Fen SAC.

Originally used merely as a source of materials or grazing for local people, it is now an important area of academic study and research.

Having survived the climate changes of the last 10,000 years, it now faces what is perhaps the biggest challenge of all – to continue to thrive in the human-produced climate change predicted for the near future.

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Facsimile: https://anhso.org.uk/wp-content/uploads/Fritillary/fritx-ruskfac.pdf

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