BEDFORD PURLIEUS:

its history, ecology and management

Monks Wood Symposium No. 7

Edited by

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FOREWORD

The 16th meeting of the Historical Ecology Discussion Group was held at Monks Wood on November 7th and 8th, 1974. It was devoted entirely to one wood, Bedford Purlieus in the Soke of Peterborough, a large, biologically-rich wood, with an exceptionally well documented historical background, many aspects of which had been surveyed in detail. Part of the meeting's purpose was to present the facts about a rich, interesting and well-known site, but the opportunity was also taken to consider the value or otherwise of the historical or developmental approach to woodland ecology and management through the example of Bedford Purlieus.

Contributions to previous meetings of the Historical Ecology Discussion Group have not been published, but an exception seemed justified in this instance for a variety of reasons. First, there was much unpublished material available which would best be published together, rather than dispersed through specialist journals. Second, though Rackham (1971) and Peterken (1974) have outlined the historical approach, we thought that a 'worked example' might usefully be made available. And, thirdly, at the time of the meeting, details of management were under active consideration by the Forestry Commission who welcomed the opportunity to consider in so much detail all the factors involved.

In the contributions which follow, we will be told that Bedford Purlieus lay in a centre of Roman activity which reached within its existing borders. Its existence is established at intervals through the last millenium, and for the last few hundred years we have a detailed knowledge of its extent and management. Overlying a range of rock types and superficial deposits, it has a rich variety of soils, some of which are rarely found in an uncultivated form. Though the stand structure is somewhat uniform as a result of 20th Century reforestation, the vegetation is shown to be rich and semi-natural, reflecting the inherent diversity of the site and historical factors. The flora and fauna, is generally rich and includes some rare species, but a few groups are poorly represented. Finally, having described the history, ecology and biology of the site, the implications of this information for future management are reviewed, and management policies and techniques are proposed.

This volume will inevitably be compared with two other recent publications concerning individual woods in the East Midlands - the National Nature Reserve of Monks Wood, Huntingdon (Steele & Welch, 1973) and the Cambridgeshire and Isle of Ely Naturalists' Trust reserve of Hayley Wood (Rackham, 1975) - and it may therefore be helpful to comment on the similarities and differences. All three woods have had a long history of coppice management and have long been recognised as important sites for wildlife, but whilst Monks and Hayley Woods are still predominantly coppice woods (albeit mostly unworked) managed exclusively for nature conservation, Bedford Purlieus has been largely converted to high forest and is managed primarily for timber production. All three publications attempt to range widely over the botany, zoology, history and management of the woods, but the emphasis on fauna in Monks Wood, and botany and history in Hayley Wood inevitably reflect the interest of the authors and editors, and the material available. The Monks Wood and Hayley Wood books represent the culmination of many years of study, whereas the present volume consists almost entirely of recent work, much of which was undertaken for presentation at the meeting from which this volume is derived.

Finally, the emphasis on management at Bedford Purlieus is a positive contribution to the evolution of a management plan there, whereas the management plans at Monks and Hayley Woods had long been determined and in operation.

Peterken, G.F. 1974. Developmental factors in the management of British woodland. Q. Jl. For., 68, 141-49.

Rackham, O. 1971. Historical studies and woodland conservation. Symp. Br. ecol. Soc., 11, 563-80.

Rackham, O. 1975. Hayley Wood. Its history and ecology. Cambridgeshire and Isle of Ely Naturalists' Trust, Cambridge.

Steele, R.C. & Welch, R.C. 1973. Editors. Monks Wood. A nature reserve record. Nature Conservancy, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, Cambs.

HISTORICAL APPROACH TO WOODLAND ECOLOGY AND MANAGEMENT

G.F. Peterken

The 'historical approach' is a somewhat grandiose term for a process of understanding which considers events in the past and the passage of time to be significant ecological factors. Its methodology consists essentially of discovering how a site came to be as it is from direct evidence, rather than from inference from the observed nature of the plant and animal communities on the site now. The sources for the historical ecology of woodlands have been summarised by Rackham (1971) and include palynology, archaeology, historical documentation, maps, woodland structure, vernacular architecture and topographical relationships.

The historical approach enables us to see beyond the existing condition of the woodland to other conditions which have, or may have existed : one ceases to regard the existing condition as unique or even special. It may indicate directly the rates and direction of any changes in the system. Furthermore, it clarifies the possibility that certain existing features may have survived on site from the time when the site carried natural woodland.

The specific kinds of information which may emerge from the study of the history and development of individual woodlands are:-

1. Status of site as woodland; primary or secondary.

2. Past silvicultural treatment and condition of stand; system, age structure.

3. Origin and past treatment of subsidiary habitats, notably rides and other non-woodland.

4. Other past uses of site; pasturage, quarries.

5. May clarify status of individual species; introduced or native; contracting or expanding.

Historical sources may provide evidence of past events, conditions and usages which would have been quite impossible to detect on the site today. More often, perhaps, it supplements and reinforces information and inferences from field survey, e.g. in determining which tree species have been introduced. Furthermore, it can help break the circular argument whereby field observations are held to suggest a certain sequence of development, which in turn enables certain present day features to be explained in historical terms.

Some limitations and problems of the historical approach should be mentioned:-

1. The evidence tends to be fragmentary, or at best incomplete. We are, in effect, peering into a dark tunnel which is illuminated at intervals, sometimes by a faint glow, but occasionally by a bright shaft of sunlight. It is only towards the mouth of the tunnel - the present day - that the light is consistently continuous and fairly strong.

2. Certain characteristics and events may be known with certainty because they leave positive evidence. Such might be the extensive ridge and furrow below a wood which proves that it is secondary; or the

documentary record that a species was planted at a particular date, and had not hitherto been present. Unfortunately, many of the features of most interest to ecologists cannot be positively established. We cannot prove with certainty that a particular wood has never been cleared. Likewise, the native status of a species cannot be assumed simply because one has failed to find direct evidence of introduction. For such features one can only amass evidence which places the primary status of a wood or the native status of a species beyond reasonable doubt.

The 'historical approach' is probably better judged when applied to a group of woods rather than a single site, for useful comparisons can be made and gaps in the historical record of single sites can often be filled by a knowledge of general trends in the group of which it is part. The latter difficulty hardly arises in the case of Bedford Purlieus, and its relationship with other woods in the neighbourhood is reasonably well known. It is one of a group of purlieu woods on the jurassic limestone along the northern margin of the former Rockingham Forest all of which are, or were, biologically rich, mixed-coppice woodlands in which lime coppice was present: these woods include Easton Hornstocks, Collyweston Great Wood and Wakerley Woods. They contrast with the coppice woods of Rockingham Forest, where the coppice composition and the flora are both less diverse, and lime coppice is not recorded.

Rackham, O. 1971. Historical studies and woodland conservation. Symp. Br. ecol. Soc., 11, 563-80.

BASIC SITE DETAILS

G.F. Peterken

Bedford Purlieus overlies Jurassic strata, including oolitic limestone, boulder clay and other recent deposits. It is sited on a gently undulating plateau between the rivers Welland and Nene. Two small streams, rising to the west of the present wood, drain through the site and thence into the Nene.

The woods, which lie at the southern extremity of Thornhaugh parish (Grid Reference, 52/040995), at the edge of the Soke of Peterborough, were once known as Thornhaugh woods. Saint John's Wood, now fully incorporated with the main portion of Bedford Purlieus, was a detached portion of Wansford parish until the late 19th Century.

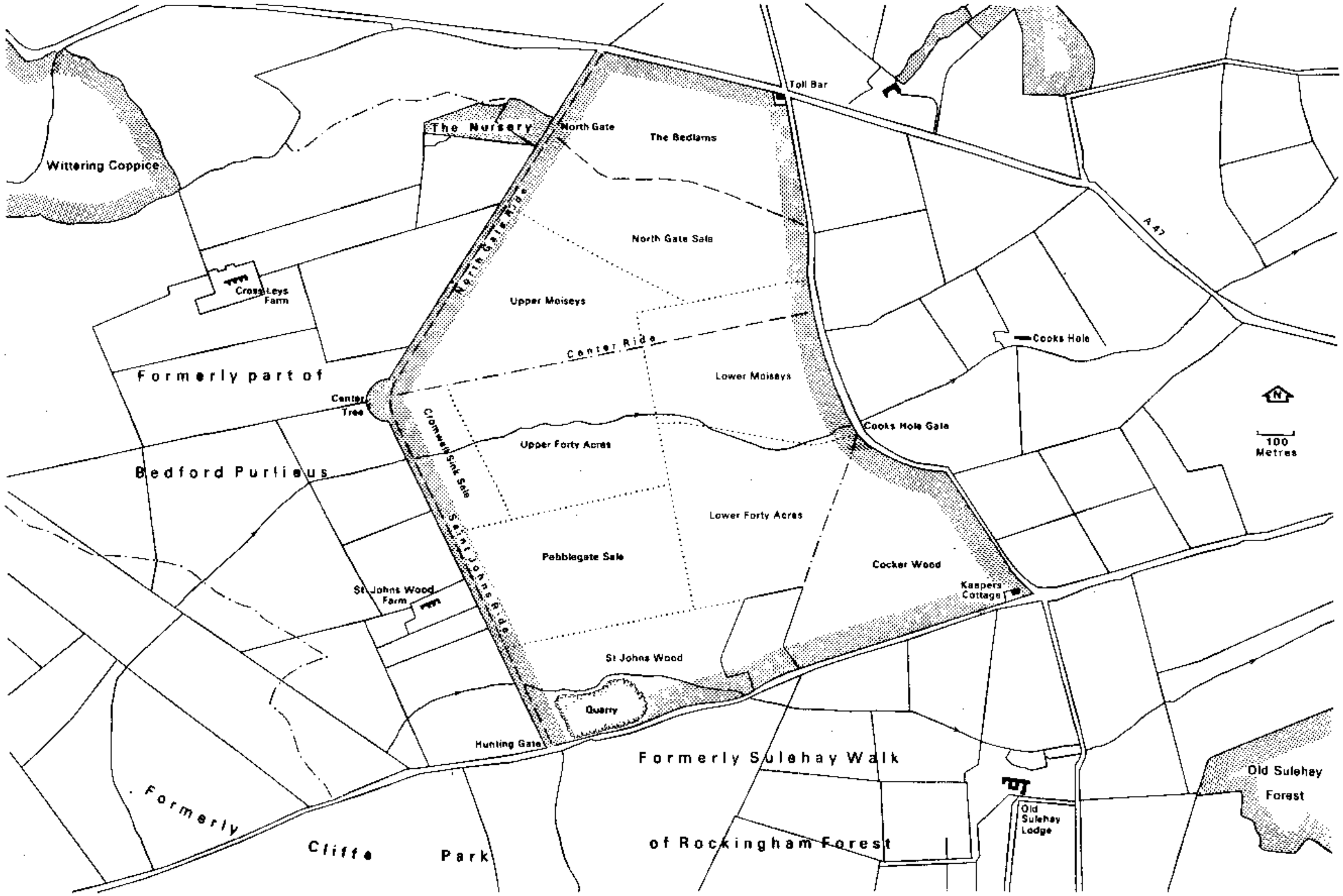
The existing Bedford Purlieus has a complex historical background. Most of the present woodland was part of a tract of purlieu woods ranged along the northern rim of Rockingham Forest. In the 17th Century these woods extended to 2066 acres, of which 1029 acres fell within the Duke of Bedford's purlieus, but they have since been much reduced by clearance. The surviving parts are Collyweston Great Wood, Easton Hornstocks, Vigo Wood, Rogue Sale, Wittering Coppice and Bedford Purlieus which together extend to c.872 acres. Bedford Purlieus, which includes c.440 acres of the surviving 17th Century woodland, is by far the largest remnant.

Bedford Purlieus today covers 524 acres. Apart from the woodland of 17th Century or earlier origin, there are c.84 acres which have originated on formerly unwooded land since the 17th Century. The Bedlams and the Nursery in the north form the major portion of this secondary woodland, but there is also a narrow strip along the southern margin, and small patches elsewhere. The wood is owned and managed by the Forestry Commission, apart from the Nursery and part of Johns Wood, which are privately owned.

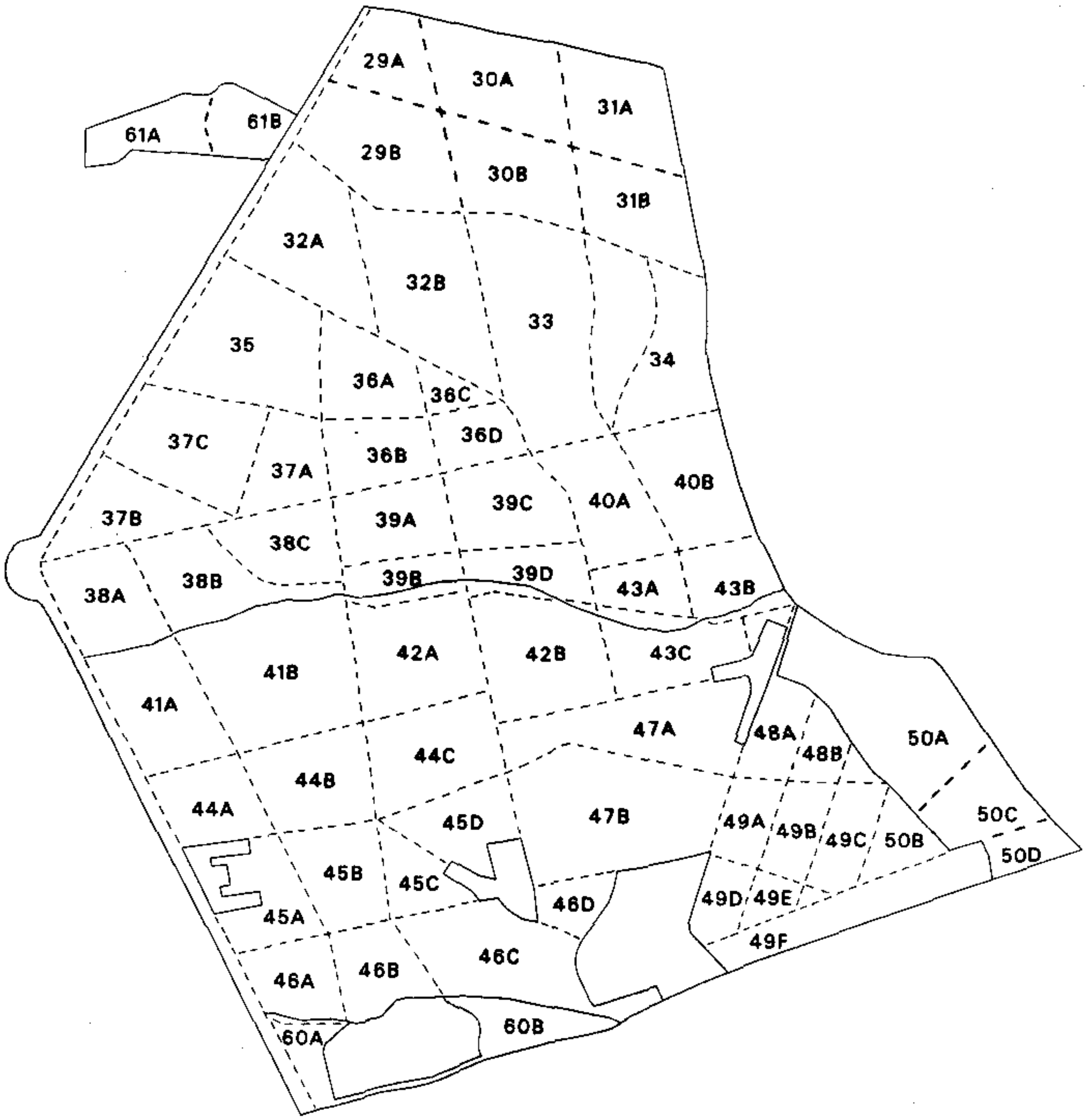
Like most, perhaps all, large woods, the separate compartments (or "sales") of Bedford Purlieus had individual names, some of which are still in use: the potential for nomenclatural confusion is considerable. Although it is incorrect historically, the term "Bedford Purlieus" will cover the whole site, whilst the Bedlams, the Nursery and the former Sale names will be used for parts thereof, as on Fig. 1. The woodland is clearly divided by rides, which form the boundaries of Forestry Commission compartments, as shown on Fig. 2.

Bedford Purlieus is largely woodland of various kinds, but within its borders are many small patches of grassland and scrub (Fig. 3). These originated as woodland rides, surviving patches of heathland, and wartime hutments since abandoned. Part of Johns Wood contains an actively worked quarry, and a large part of Cocker Wood was quarried and restored in the 1960s.

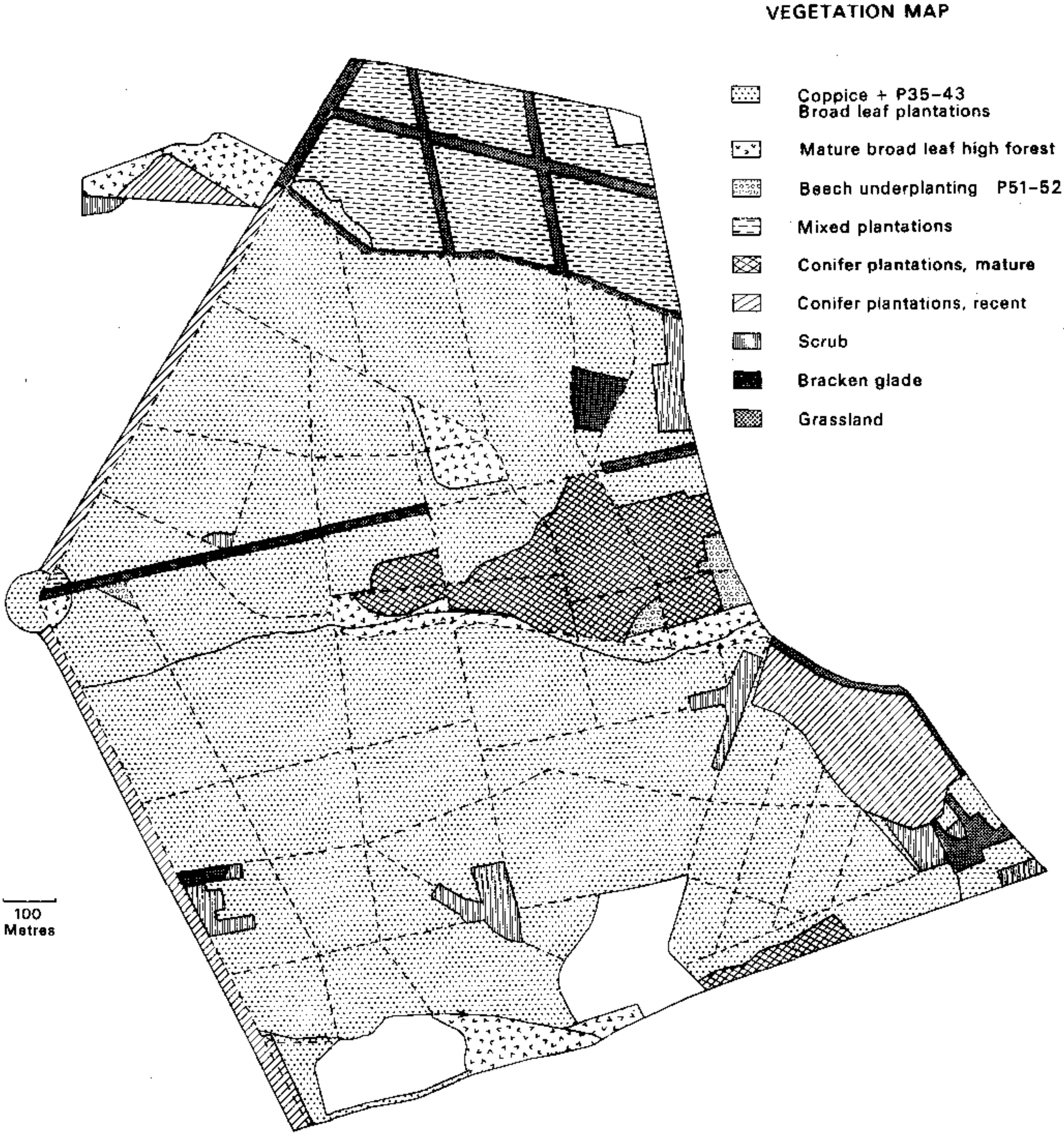
1. The existing woodland of Bedford Purlieus and surrounding land. Many field boundaries have been destroyed or modified in recent years by quarries and field enlargement.



2. Compartment numbers and boundaries. These are based mainly on rides. Numbers follow F.C. compartment numbers.



3. Vegetation Map, 1973. Many rides have since been widened, extending the area of ride grassland.



ARCHAEOLOGY OF THE BEDFORD PURLIEUS AREA UP TO 400 AD

J.A. Hadman

Introduction

Woodland is regarded as an enemy by many archaeologists. It masks the evidence he seeks and often destroys it by planting and continued root action. Bedford Purlieus, however, must be viewed in a different light; having such a long documented history, there is good reason to accept it as an archaeological feature itself, quite distinct from the artifacts and remains which lie beneath its surface and are revealed from time to time as quarrying or ditching eat away at its edges.

The object of this paper is to consider the likely impact of man, before the period for which documentation is available, on the area occupied by Bedford Purlieus, using archaeological sources. At that distance in time it is almost meaningless to consider only the evidence found on the site, for the influence of particular activities would have extended far beyond the physical limits of their evidence. In this case, the archaeology of the land surrounding Bedford Purlieus up to a distance of 2 miles is considered together with the archaeology of the site itself. Sites mentioned in the text are located on Fig. 4.

Pre-Roman Period

There have been many occasional finds of material from the prehistoric period in fields and villages within a few miles of Bedford Purlieus. Scrapers and other flint and stone implements have been reported from Yarwell, Wansford, Sutton, Thornhaugh and other parishes. Perhaps the most significant evidence of man's use of land in the region comes from Sacrewell Farm in Thornhaugh where Mr. D. Powell has assembled what is probably the largest collection of surface finds of Neolithic and Bronze Age material from any one site in Eastern England. The land is mainly on flaggy basal beds of Lower Lincolnshire Limestone and Lower Estuarine sands and slopes gently down to the river Nene. From the evidence of many fragments of flint and stone axes, scrapers, arrowheads and other implements, it seems that man was clearing and utilising the area quite intensively and over a long period of time within the three thousand years prior to the Roman conquest and the subsequent organisation of society.

Roman Period

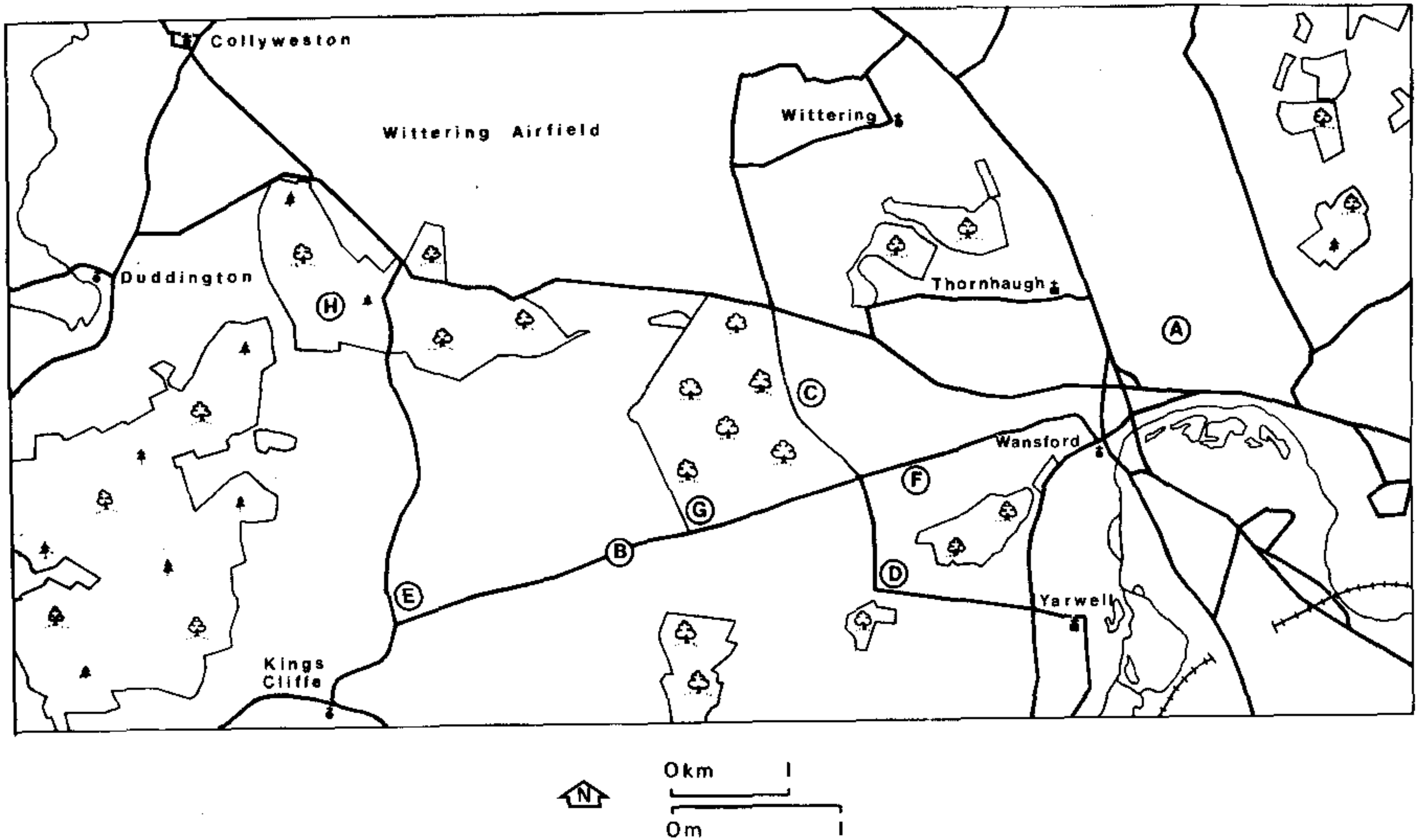
The Roman period has always provided a wealth of archaeological evidence in Great Britain, particularly in the fertile river valleys. The 'Middle' Nene Valley is no exception and for a variety of reasons the area between Peterborough and Bedford Purlieus is possibly one of the richest.

The number of military installations dating from the early years of the conquest suggests that this was an important strategic area. At least two forts are evident; one at Longthorpe with its own potteries (1), and the other near Waternewton, which probably gave rise to the establishment of the market town of Durobrivae.

The growth and prosperity of Durobrivae through the Roman period, particularly in the 2nd-4th Centuries was due mainly to the development of

(1) Durobrivae : I - 1973 - J.P. Wild

4. Location of archaeological sites in the Bedford Purlieus area.
   A Sacrewell Farm
   B Roman Road
   C Concentration of iron working sites found by Artis
   D Burial at Sulehay
   E Grave group (see note 8)
   F Kiln (see note 11)
   G Johns Wood, Roman finds
   H Collyweston Great Wood, Roman finds.



the natural resources of the area. From these came the potteries and the metal working industries, principally iron. The natural increase in population demanded more food and the area's rich agricultural potential was realised. The whole of the river valley came under the influence of the Roman town and as well as the spread of industry away from the immediate environs of Durobrivae the growth of farms into large estates can be traced from the evidence of large country houses or villas within several miles of the population centre. It seems that one such establishment existed in the Bedford Purlieus. This discovery was made by E.T. Artis, steward to the Fitzwilliam estate in the first half of the 19th Century. Artis excavated and recorded his work with drawings and maps (2), and apparently many of his finds came from Bedford Purlieus (C, Fig. 4). Apart from buildings, he recorded much evidence of ironworking, and from his drawings it is clear that he interpreted his furnaces as being used for smelting iron ore. Jurassic series of ore bearing rocks extend from the Corby area through to Bedford Purlieus and from the large amounts of slag found in surrounding fields primary iron production was certainly carried out. Other such sites have been noted at Kings Cliffe, Blatherwycke, Bulwick and through to Weldon, all dating from antiquity. Indeed at Sacrewell Farm just two miles to the West of Bedford Purlieus no less than eight Roman ironworking furnaces were located in 1973 (3). One of these was a shaft furnace while others were probably for roasting ore.

In 1965 similar furnaces were excavated in Bedford Purlieus by Peterborough Museum Society (4). These together with a slag dump were revealed by quarrying operations. It is also worth noting that the Peterborough Standard in 1932 reported 'tons of iron ore and slag lying about' in four fields immediately to the West of Bedford Purlieus where Artis recorded some of his 'iron works' sites.

Smithing was carried out on many of the Roman sites excavated in the Nene Valley and smiths' workshops have been identified at Lynch Farm (5) and at Ashton, Nr. Oundle (6). It is quite conceivable that iron blooms produced in furnaces such as those found in Bedford Purlieus were traded along the valley.

A Roman road runs from Durobrivae through Wansford to Kings Cliffe (B, Fig. 4) being the southern boundary of Bedford Purlieus and separating it from what used to be Sulehay forest. There was, therefore, direct access to the town, and although this was several miles distant there is plenty of evidence that this was a well used route if the Roman custom of placing graves and shrines to the dead by roadsides is any indication.

Amongst the wealth of archaeological evidence destroyed by quarrying on the Old Sulehay side of the road, several burials have been noticed including two in recent years in stone cysts (7). A grave group of 4th Century vessels was found close to the road near Kings Cliffe (8) and an

(2) The Durobrivae of Antoninus - E.T. Artis
(3) Durobrivae : 2 - 1974 - A. Challands
(4) Bulletin of the Historical Metallurgy Group 2 : 2 1968 - G.F. Dakin
(5) Northamptonshire Archaeology : 8 1973 - A. Challands, G.B. Dannell, J.P. Wild.
(6) Durobrivae : 3 - 1975 (forthcoming) S.G. Upex, J.A. Hadman
(7) Bulletin of the Northamptonshire Federation of Archaeological Societies No. 7 1972 A. Challands
(8) Northamptonshire Archaeology 8. 1973 J.A. Hadman

outstanding colour-coated 'hunt cup' of the late 2nd or early 3rd Century was found in 1841 in a cremation burial at Bedford Purlieus (9). This beaker is one of the largest of its kind and is described as being 'the most elaborate surviving instance of a 'vernatio' rendered 'en barbotine''. The discovery of this cremation burial in the St. John's Wood area of Bedford Purlieus was made by workmen cutting a drain. At the same time two small statues were unearthed. These were probably the flanking figures to a larger funeral monument. Both statues, 29" high, sculptured from Barnack rag, were headless and legless. Apart from the 'hunt cup' other vessels both in local fabric and imported Samian ware made up the 'grave group'.

In Collyweston Great Wood, less than two miles north of the road and the same distance north west of Bedford Purlieus, buildings with obvious religious connections were discovered by excavation in 1953 (10). As well as circular buildings, both a hexagonal and an octagonal structure were found. Similar buildings existed at Brigstock some 5½ miles distant and these have been interpreted as shrines. In recent years more circular buildings have been found in the Normangate Field area, lining roadsides in the industrial suburb of Durobrivae.

The natural resources of land for agriculture and ore for iron working have already been touched upon. The industry for which the area was best known in the Roman period is of course pottery making. Here in the middle reaches of the Nene were good sources of clay and fuel. The expertise was here and from the early 2nd Century pottery from the Castor area was one of the main ingredients of the prosperity which developed. Castor ware found its way to all parts of the province aided by trading routes including the roads passing through Durobrivae and radiating from it, and waterways including the river Nene leading to the Wash and the canal system, i.e. Car Dyke linking the Cambridge region with the Humber. The transitional phase when colour-coated vessels developed from local wares in the earlier part of the 2nd Century is reflected by the discovery in a quarry face at Sulehay, immediately across the 'Roman' road from Bedford Purlieus of a pottery kiln (11). Roman buildings are recorded in the immediate area by the Ordnance Survey and the kiln may be connected with these. The kiln was dug into shaley limestone and before being 'bitten' by the mechanical digger must have been almost intact. It was of the updraught type with clay and grass dome plates and fire bars which suggested that it was a typical 'Nene Valley' kiln. Most of the broken pottery in the surrounding debris was dated to the first quarter of the 2nd Century, but the inclusion of very early colour-coated pottery with almost experimental decoration makes this an important kiln and the earliest discovered example in the true Nene Valley tradition.

<u>The site of Bedford Purlieus</u>

Roman archaeological remains abound in and around Bedford Purlieus, but what of the area itself? Only a few glimpses of what was going on can be seen. Burials, iron working, pottery making and villas indicate that the area was well used even though some three miles from Durobrivae. Farming of course must have been important, but the needs of a large urban and rural population must also have included vast quantities of fuel and building material in the form of cut timber, large and small. The number of corn-

(9) Archaeologia XXXII 1847 - Rev. C.H. Hartshorne
(10) The Archaeological Journal CXXII 1966 - G.M. Knocker
(11) Durobrivae : 3 1975 (forthcoming) S.G. Upex, J.A. Hadman

driers excavated between Peterborough and Wansford in the last few years suggests that large areas were being cultivated for cereal growing. These areas were probably not just clearings in the woods although such areas could have accommodated cattle and sheep. The demands on the countryside for fuel not only for domestic use, but for iron working and an expanding pottery industry must have been immense from the early 2nd Century onwards. Results from experimental pottery kilns of Roman type fired at Boston and Barton on Humber (12) show that anything between 4 cwt and 40 cwt could have been needed for each firing of each of the kilns spreading from Castor through Sutton, Stibbington and Wansford to Bedford Purlieus. There are no records of woodland management in Britain during the Roman period, but it is known that in the Mediterranean area there was large scale destruction *of forests 'for fuel, shipbuilding and pastoral nomadism'.*

Is it possible that woodland could have survived on the present site of Bedford Purlieus during the period of intense Roman activity in the region? It seems logical that some woodland must have been available to provide fuel for the industrial activity, and likely that this was some form of coppice, which would have produced the type of fuel most convenient for domestic and industrial purposes. Certainly large tracts would have been clear of woodland, but mainly in river valleys, where some of the land was used for agriculture. Any surviving woodland is likely to have been on higher ground, but the archaeological record cannot prove or disprove the hypothesis that woodland was present on what later became Bedford Purlieus.

(12) C.B.A. Research Report 10. G.F. Bryant

HISTORY AND FORMER WOODLAND MANAGEMENT

Phyllida Rixon

The woodland now called Bedford Purlieus comprises more than half the area known for some centuries as Thornhaugh Woods, or the High Wood of Thornhaw. The most northerly section, known as the Bedlams, is secondary woodland, formerly part of Thornhaw Particular Heath, and not planted up until the beginning of the nineteenth century. Early historical references, therefore, apply to the southern nine-tenths of the wood, and I am making the change of name clear from the start because the woods near to Thornhaugh Manor are now known as Thornhaugh Woods. As other researchers will know, it is usually necessary to work backwards in finding out what has happened to an area, but when starting to recount it from the other end it is necessary to make assumptions which are proved halfway through the evidence.

Most of this account is based on records of the Bedford Estate deposited at the County Record Office in Bedford. These records are recently acquired and, due to re-organisation of the Office, have not yet been completely classified, labelled and catalogued. They have been kept in the Bloomsbury Estate Office of the Russell family until they were (and perhaps still are being) handed over to the Bedford Record Office. Confusion exists in the records and in the catalogues between two estates in the Soke, the Manor of Thornhaw and the Manor of Thorney, both of which were held by the Earls of Bedford. Although there is a wealth of information, I still feel that small gaps may yet be filled. I have abstracted from these documents all references which help to prove the continuity of the wood as a wood. "Woods and Underwoods of the Manor of Thornhaw" are referred to in the eleventh and twelfth centuries, and do not refer to the small parcels of woodland close to the manor itself because they are separately identified.

The monastery of Medehamstede - later Burgh - later Peterborough was founded in 655 by Peada, King of the Mercians (1). Various Anglo-Saxon charters confirm to it the land known as the Soke (or Liberty) of Peterborough. Bedford Purlieus lies on the western boundary of the Soke. The monastery was sacked and burned by the Danes, probably in 870, and rebuilt by St. Athelwold in the tenth century, when the Saxon Chronicle says that he found there nothing but "old walls and wild woods" (2). In 972 Adulphus Abbot is quoted as saying that the "Nasee or Soke was all a woody and solitary place". Clearing and cultivation were then taking place in the areas nearer to the abbey, e.g. Barnack, Helpston, Gunthorpe but had not penetrated further west.

The Domesday Survey 1086 (3)

"Anschitil tenet de Abbate Withringham . . . silva 2 leuva longa et una lata . . ." (Anschitil holds from the Abbot in Wittering a wood 2 leagues long and one league wide). Confirmation that the fief of Thornhaugh is included under Wittering is found in the Peterborough "Liber Niger" of the time of Henry I, when Anschitil's estate is set out in fuller detail. Anschitil de Sancto Medardo, later contracted to Semarc, was an early ancestor of the Duke of Bedford. A generation or so later, a Sancto

(1) Victoria County History; Northants. The Abbey of Peterborough
(2) Bridges, History of Northamptonshire, 1791
(3) Bridges, op. cit.

Medardo married Anabil of Folkesworth in Huntingdonshire (4). Her dowry included John of Folkesworth's Wood, contiguous to Thornhaw Woods and forming, thereafter, the south-western portion of these woods, although a separate tax was paid on it at least up to the eighteenth century. Another interesting change of name has been the way in which local nomenclature has canonised John of Folkesworth, because the recent name of this compartment is St. John's Wood.

In 1461 the whole of the Thornhaw property was in the hands of an heiress who married a Sapcote of Elton (5). A generation later one heiress again was married first to Sir John Boughton of Bedfordshire, and later, as a very rich widow, to John Russell, later created first Earl of Bedford. Members of the Russell family have generally been resident on the Bedfordshire estate and it has therefore been necessary for the stewards to send accounts of the property in the Soke to Chenies or Woburn.

The whole of the Soke was originally part of Rockingham Forest, i.e. subject to forest law, although not necessarily woodland. Disafforestation in this context means that the land was freed from the laws of the forest, not that the woodland was cut down. King John gave a Royal Charter deafforesting the part of the Soke east of the old A.1 (6), leaving Thornhaw still within the forest bounds, but although it was still within the forest perambulation of 1285-6, by 1299 (7) it is specifically excluded. "To Hornestok and so to the wood of John of Folkesworth, excluding the said wood, and then to Gibb's Cross . . ." A seventeenth century map in the Public Record Office (8) traces the Edwardian Perambulation of Cliffe Bailiwick and clearly identifies John of Folkesworth's Wood with part of Thornhaugh. This change in the boundary line of the royal forest follows the present boundary of the Soke, and was the old boundary of the extent of Thornhaw Woods and the property of the Semarc family. The reference is very useful in establishing that the area was actually woodland at the time.

Other medieval documents (all from the Russell Estate Papers at Bedford R.O.) prove the continued existence of the wood as a wood, at least one or two for every century.

There is a quitclaim of 1292 referring to the "wood of Sir Nicholas de Sancto Medardo to the west . . .". This must mean Thornhaw Wood because West Wood itself is separately mentioned in the same document.

An <u>indenture of 1340</u>, dividing the property between two members of the Semarc family allocates separately the small woods and meadows near to the manor, but gives part of the "high wood" to each. ". . . and in the high wood the quarters which are called the Esteddryn and the Westeddryn except 30 acres of the Westeddryn by 18 ft perch . . ." and to the other ". . . in the high wood all the south beginning from Thornhawe all that way which is called Moshalle . . . and 30 acres of the Westeddryn". Moshalle is presumably the earlier version of Moissas Corner. A number of the compartment names antedate the name of Bedford Purlieus and have been useful in confirming the correspondance of the former and present area of the woodland. A Plan of 1589, (Fig. 5) confirms actual points on the ground mentioned in these earlier documents by marking them as "ancient boundarios".

(4) V.C.H., op. cit. and Russell Estate Papers, Bedford R.O.
(5) V.C.H., op. cit.
(6) Simon Gunton, History of the Church of Peterborough
(7) P.R.O. Detail supplied by Dr. P.A.J. Pettit
(8) Map of Cliffe Bailiwick, 17th Century, PRO MPE 459

A definition of a messuage in 1377 says that it "abuts on to the Green Way to the High Wood of Thornhaw on one side". Even more important from an ecological point of view, in 1457 T. Semarke and Margaret his wife sold" . . . a plat of wood growing in Thornhaw Wood next the 40 acres called . . . (hole in the manuscript) . . . to Sibburston Slade to have and to hold the said plat of wood to the said T. Folkelyn and John Gibson to fell sell and cart at all times reasonable from the feast of St. Martin in winter next following after the date of this present writing until the end of the term of two years next after following. For the which plat of wood the said T. Folkelyn and John Gibson have paid . . . in hand to the said T. Semarke and Margaret his wife. The said T. Folkelyn and John to leave sets of Hooke reasonable as it oweth to be and to stand and leave with the tithe to heynd the said plat of wood with plasche edge round about . . .".

In 1589 a Plan (Fig. 5) in support of a petition by the tenants of the Thornhaw estate against a certain Stidolf who had enclosed the waste at Terristead, part of Wittering and Thornhaw Intercomon, and erected a cottage and cony burrows. The plan is an excellent large map of the area, eighteen inches to the mile, the proportions of which all check with the present day 1 inch Ordnance Survey map. The ancient boundaries described by natural features which still exist in very early documents, (e.g. "where the water runs under the land") are identified on this plan and leave no doubt that "the High Wood of Thornhawe" and "the wood of Sir Nicholas to the west" both refer to the area then known as Thornhawe Wood and now as Bedford Purlieus. The Bedlams, or northern sector of Bedford Purlieus was then part of Thornhawe Particular Heath. The road from Wansford to Collyweston ran along one of the present ridings where grassland species such as *Anacamptis pyramidalis* are now recorded.

The manorial rolls of 1597 provide Articles Exhibited against Nicholas Thorogood, part of which is quoted below. References to the names of different compartments of the wood and details of native species then growing there have remained the same.

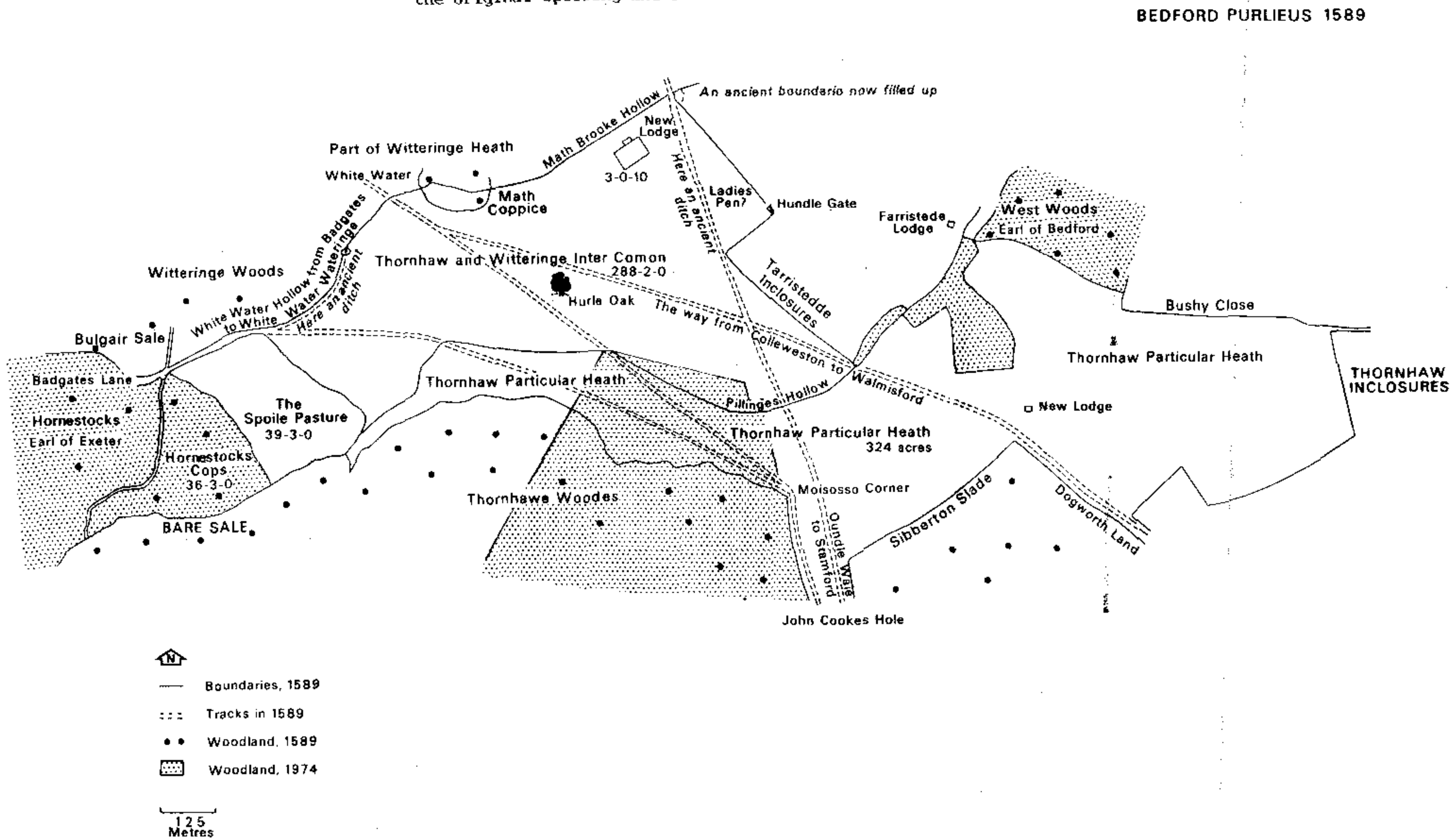
"1. Nicholas Thorogood doth commonly let his sheep go and feed in the woods and to the great hindrance to the growth of them and also that they do great spoil in the spring time by eating of the spring of the same woods . . .

2. He is charged that he put horses in the young springs being of but one or two year's growth as well of other men's as of his own and doth make then as if they were strays but not . . . or straymarked by the officers appointed by the court and manor of Thornhaugh and that 7 horses and mares did go in the spring by the space of 6 weeks or thereabouts and sometimes that he and his brother Thomas Thorogood will have in the spring 12 or 13 mares and colts . . .

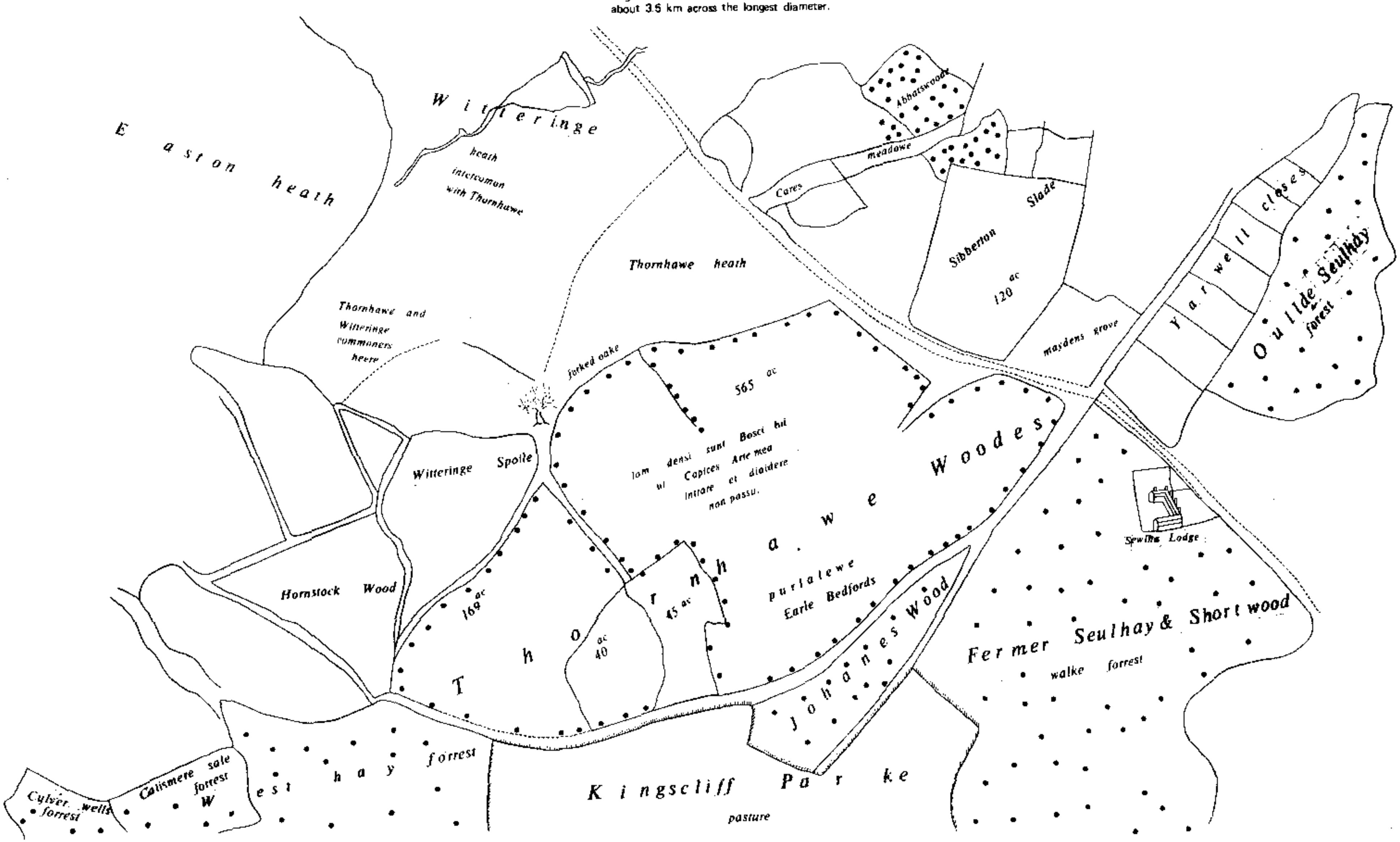
3. The said Nicholas Thorogood hath had 12 sett gatherers who did gather sets in the aforesaid woods of Thornhaw which setts were sent into the fields at Aylton in the County of Hunts . . . the said gatherers of setts being taken at divers times in the said woods and they did affirm that they were licensed to gather by the said Nicholas Thorogood . . .

4. That the said Nicholas Thorogood hath felled and razed 40 loads of thorns or thereabouts out of Sir William Russel his grounds and woods of Thornhaw for the fencing in . . . and that certain old maples, hazels and sallows which did grow among the said thorns were likewise felled by the said Nicholas Thorogood . . .

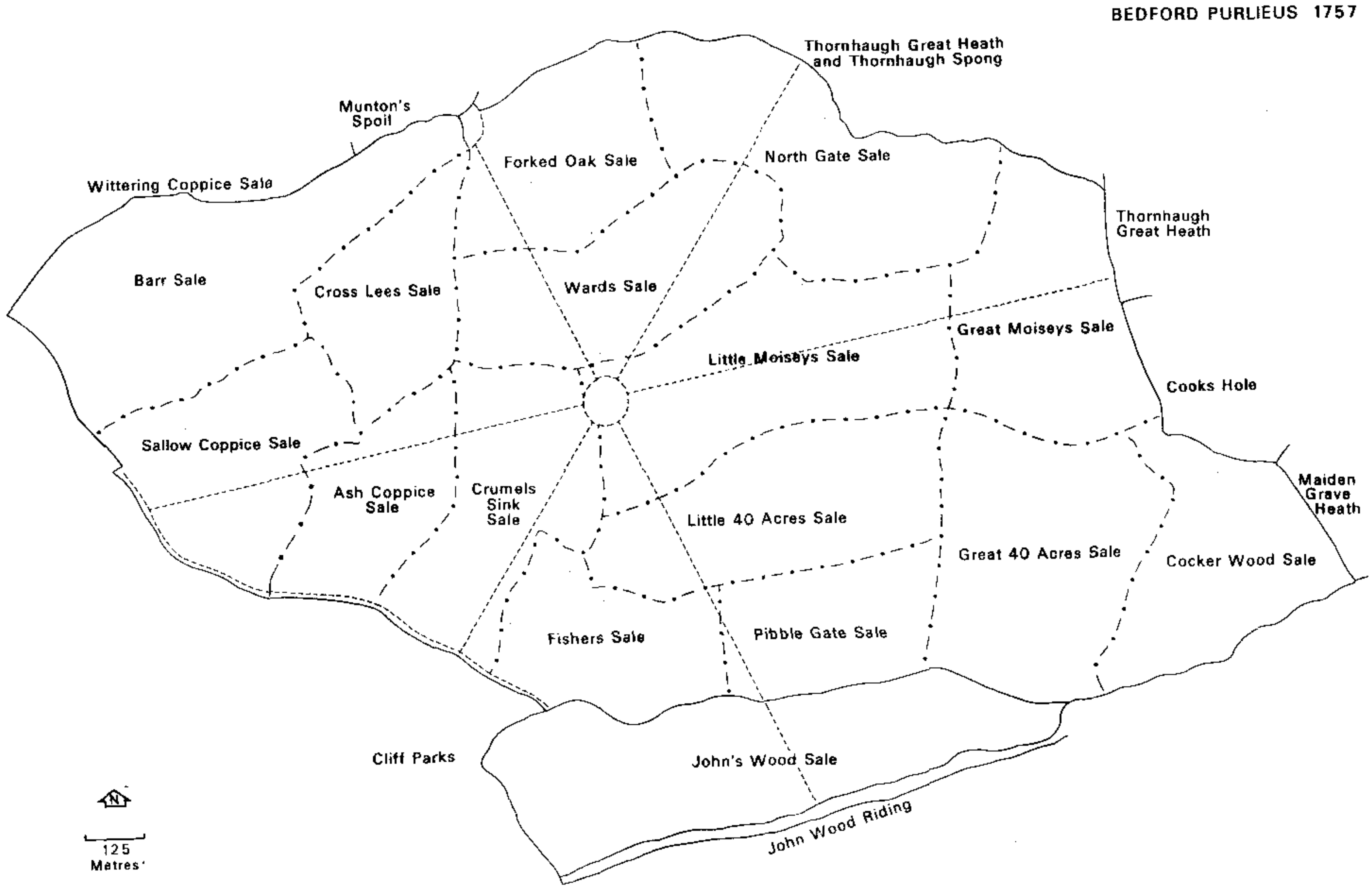
5. The plan of Thornhaw Commons, 1589, redrawn on a modern base, retaining the original spelling and location of names.



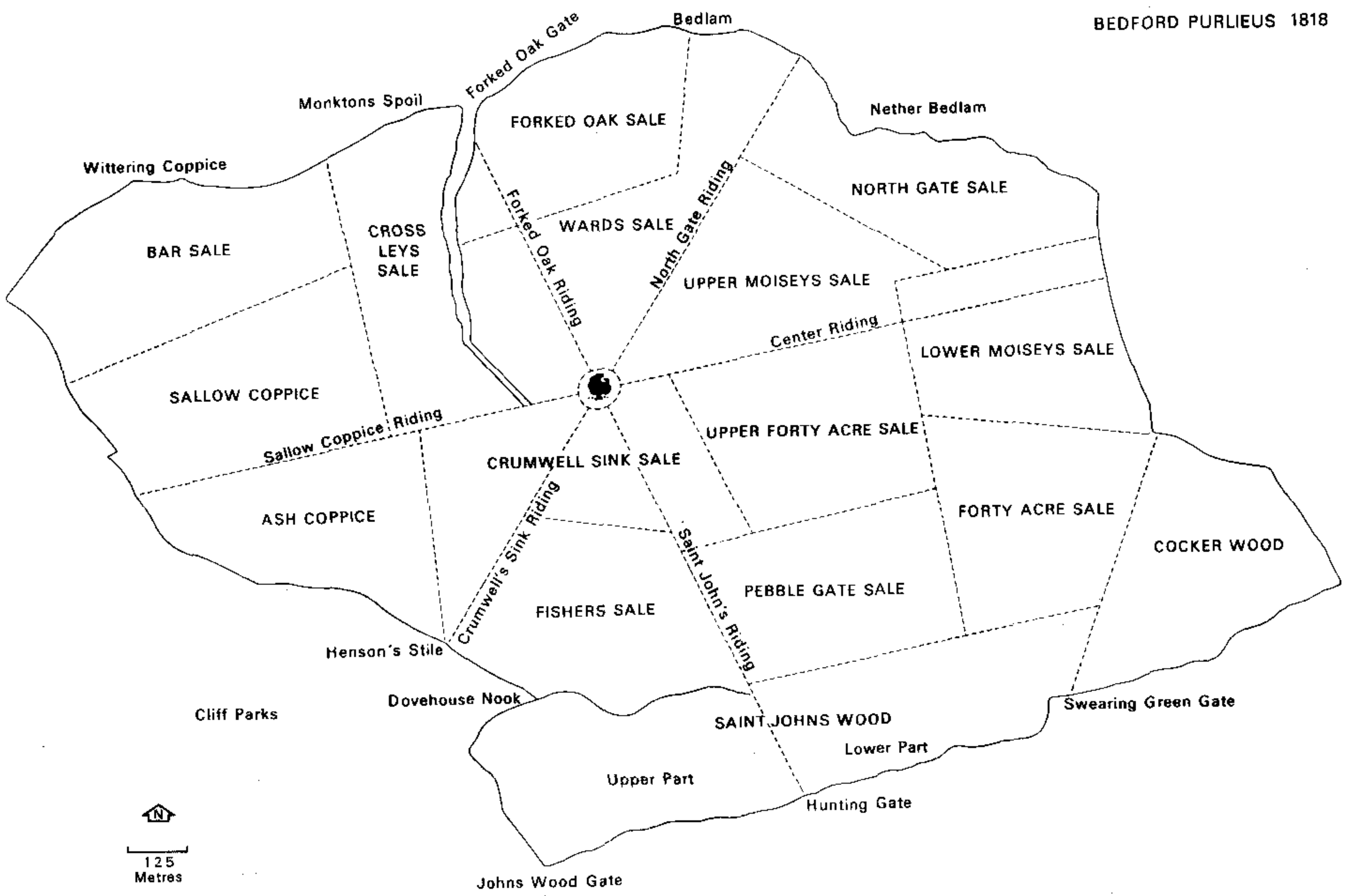
The estate map of Thornhaugh Woods and neighbouring land, 1635. Traced from the original, retaining location and spelling of names. Location of tree symbols on the original indicated by dots. Scale: Thornhawe Woodes were about 3.5 km across the longest diameter.



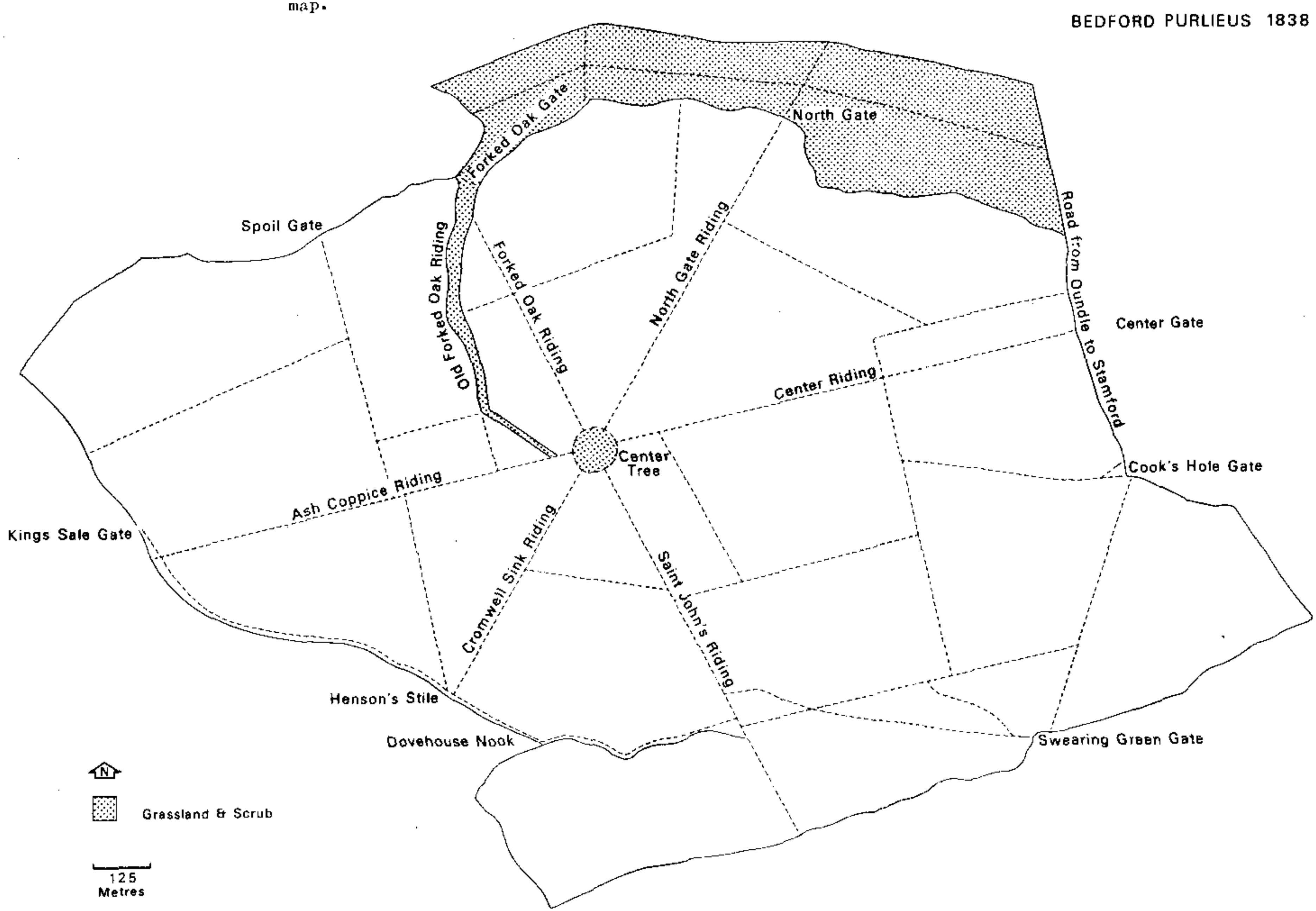
7. Bedford Purlieus, 1757, redrawn on modern base map from original estate map. Location of new, radial rides is superimposed on the former sale boundaries as on the original map.



8. Bedford Purlieus, 1818, redrawn on modern base map from original estate map, showing re-organised sale boundaries.



9. Bedford Purlieus, 1838, redrawn on modern base map from original estate map.



10. Location of conifer (traingles) and broadleaf trees (dots) as indicated by Ordinance Survey symbols.

5. then the said Nicholas Thorogood hath plashed one hedge and hath cut down the great wood that did grow therein and two great crab trees, one servis tree 2 ashes and divers old sallows . . . one brindled heifer . . . 2 fillies one bay and the other gray which did go in a young spring called Cockrode as strays all the winter.

. . . certain wood cut down by R. Baxter and by him carried away out of Fisher's Sale and a sale called 40 Acre and Cockrode . . .

. . . for cutting of oak spires in a wood called Moyzas . . .".

Cockrode, i.e. Cockerwood, 40 Acres and Moyzas are still the names of various compartments of the wood. One could have assumed that crabs, ashes, sallows, etc would have been present, but I find the reference to the servis tree more interesting. Country people today might well know the old maples, hazels and so on, but the present distribution of the servis tree is so restricted that many people would not see it until they visit Bedford Purlieus, and only a small percentage of the population would know what it was. I judge from this that service trees were probably far commoner at that time.

Fines were levied in 1614 because ". . . certain tenants have been cutting down certain trees called in English ash poles . . . others have been cutting spinas called in English great thorns at Sale Coppice hedge . . . breaking down hedges at Ash Coppice, Sale Coppice and Cockerood".

A 1614 Survey of Thornhaugh Manor gives the economic basis for the whole operation and establishes the rota principle on which the coppices were to be cut and the number of larger trees to grow on for timber per acre.

"The Lord holdeth also in his own hands all the cops woods viz. one great wood divided into two parts with a littel lane contening divers sundry sales severally felled at their sundry ages as appeareth and one other cops wood called West Wood contening in all; after the measure of 18 ft to the pole; (after which measure the same are usually sold) 760 acres et al. per annis. If the same number be divided into 18 equal sales the same to be felled at 18 years' growth each sale will contain 42 acres 33 poles which after the rate of 20d the pole one pole with another will yearly amount unto £362.15.6d. Besides the sale of trees whereof by common presumption (according to the rate of leaving wandes by the statute) there should be in every acre to cut yearly 12". I shall comment further on this in the management section.

The Estate map of 1635 (Fig. 6) shows the whole of Thornhawe Woods in relation to all surrounding properties. It gives the line of the forest perambulation excluding the Earl of Bedford's property with other interesting notes. I translate the inscription within Thornhawe Woods "Here now are thick woods and coppices by my skill I have not found it possible to enter and divide them". Only a sketchy attempt or so has been made at the main rides and entrances, although John's Wood is clearly separated.

The revival of forest law and reversion to early medieval perambulations of 1637 was a blatant attempt to raise money for the Treasury at that time (9).

(9) Pettit, Royal Forests of Northamptonshire, Northants Rec. Soc.

This map may well have been prepared to prove the Earl of Bedford's case. He did in fact pay a composition fee of £200 for disafforestation and pardon, but the price compares very favourably with that extorted from other local landlords. In return he received a charter which made the wood a free warren or purlieu wood. The following is a translation.

"Charter of Aug. 8th 1639 from King Charles I to Francis Earl of Bedford to Disafforest Thornhaugh and make the same a Free Warren

Henry Earl of Holland Chief Justice and Justice in Eyre for £200 of lawful money of England well and truly paid, . . . all that seize of the manner of Thornhaugh houses and cottages at Thornhaugh and Walmesford . . . and also all those woods called Bear Sale, Sallow Coppice, Overthwart Leys, Ash Coppice, Cromwell Sink, Fisher Sale, Pibblegate, Great Forty Acre, Little Forty Acre, Cockerood, Great Moyses Sale, Little Moyses Sale, Ward's Sale, Northerman's Sale, Forty Oak Sale, and West Wood abutting north on lands called or known by the several names of Thornhaugh Heath and Wittering Heath, on the south and west on lands called or known by the names of Hornstock Wood, West Hay, Cliffe Park, John's Wood and Seulhay. On the east on lands called or known by the names of Walmesford Heath and Thornhaugh Heath . . . 1464 acres, altogether desforrested which formerly were reputed to be within our Forest of Rockingham . . . Discharged from all vert and venison . . . (Here follows a list of forest law terms with their definitions) . . . The Earl of Bedford can keep dogs not expeditated, hounds, greyhounds and beagles, Netts guns Bows and arrows and all other engines to take chase and drive away wild beasts and birds of any kind and at all times of year hereafter for ever to fell and cut down all and all manner of woods underwoods coppices and trees as well oaks as other trees great and small whether green or dry of what nature or kind whatsoever being or to be within or upon".

It was from this date that the woods became officially the Earl of Bedford's Purlieus and may be referred to by that name although the wood accounts are labelled Thornhaugh Woods until the end of the eighteenth century. From 1640 to the end of the nineteenth century there is an almost complete set of wood accounts, the longest gap being from 1720-1726. This is sufficient to establish the historical continuity of the wood and the identification of Thornhawe Woods with the Bedford Purlieus of today. Other changes emerge in the Woodland Management section but the rest of the paper is concerned with evidence I have found of former woodland management practices which I thought might have had an ecological effect on the wood.

WOODLAND MANAGEMENT

The first record of management is from 1212. In the wood of Sir Nicholas ". . . saving to himself common of pasture in said wood with his hogs in time of pannage and with other cattle in time of herbage". This, of course, confirms a known practice, drawing a distinction between pannage and herbage and their suitability for different animals. It is well known that the Royal Forests were used for grazing purposes although the vert and herbage was supposed to be reserved strictly for the venison which means deer and other game, according to the forest law. There is an edict of 1587 "That no man shall put his hogges, horses or other cattel into the Lord's several coppices . . .", but the practice may well have changed long before this. The Articles Exhibited against Nicholas Thorogood 1597 quoted above, make it obvious that by then it was a great offence to allow grazing animals in Thornhawe Woods. Occasional trespasses of this kind occur even in the eighteenth century when an anonymous letter writer sent to tell the Duke that . . . "20 or 30 beese had made very bad work in the woods and that 300 sheep lay in the woods for 7 or 8 weeks and did a great deal of dammidge". The first reference to muzzling horses when working in the woods is in 1739, and in 1848 eighteen wicker muzzles were bought for the use of horses going into the woods, which indicates a complete change of policy from the grazing of earlier days.

The conditions of sale of the plat of wood in 1457 show that by this date at least the recently felled compartment was fenced to protect the young spring. Underwood growth would have been lush, more so than today, when deer have access. Shading of the ground flora would presumably have been more intense than it is now, and one must recognise the selective effects of this on all species.

Although one might assume that oak was always the dominant standard tree, it is only in 1457 that it is specifically stated to have been favoured, although how many oaks to the acre is meant by "reasonable as it oweth to be", is unfortunately not made clear. By 1614 the survey of the estate lays the number down as twelve and this may well always have been the approximate number. This survey indicates a far more systematic management of the woods for timber than was taking place in the Royal Forests at the same date. Generally, the latter were cut sporadically or the timber left to grow over-mature, while the timber was often better from private woodlands, where the main aim of this date was to produce a crop (10). Certainly from 1640 onwards man's influence on Bedford Purlieus was very considerable.

A number of regular practices took place every year. The coppices were felled in rotation although the eighteen year cycle was not strictly adhered to until the nineteenth century. There is an eighteenth century list running from "New cutt" to "19 years growth". It gives seventeen names but two years for some coppices e.g. Great Forty Acres 9 and 10 years old. Occasional gaps in the sequence of cutting probably mean that one sale took two years to cut, but there is considerable irregularity, especially in the early years. The variations do not amount to more than the occasional sale being cut at 14 years or left to about 22.

Modern forestry operations, involving churning up of the rides by heavy tractors, cutting of undergrowth, soil disturbance, drainage operations, etc., may seem a threat to the rarer species. However, they would not be there at all unless they were well able to exist under such conditions, because from 1640-1870 such operations were taking place in part of the wood every year. The underwood was cut, the timber was felled and taken out on heavy wagons which necessitated continuous making up of the wood roads. Saw pits were dug and these were no small trenches, but holes big enough to stand up in below ground. Ruts in the wood roads were made up with faggots and later with stone, sometimes from pits within the wood itself, but at least once from the nearby Stibbington Pits. Ridings were levelled, ditches were "scowered", sales were trenched about, and hedges were made up, layered, planted with quick (i.e. hawthorn), which in turn might be protected by a dead hedge. Some plants respond well to this treatment. For example, <u>Isolepis setacea</u> appeared in the mud on the main ride after the Forestry Commission had churned it up by taking out some "Instant trees" in 1968, but since the ride has dried up and become grass-grown it is no longer to be seen: renewed operations will no doubt cause it to emerge again. <u>Euphorbia lathyrus</u>, one of the rarities of the wood, springs up when the undergrowth is cleared but can hardly be found after

(10) Pettit, op. cit.

a few years growth.

Cabins were made in the current sale where the occupant would perhaps have a little fire because they were used at night for watching the woods - not only when felling was taking place but always on the eve of Mayday. The natives of Northamptonshire seem always to have been ready to snatch a little extra underwood either on the pretext of Mayday celebrations which are properly solemnised by going round to all the houses singing "A Branch of May, my dear I say," or for coronation poles. They were in fact prosecuted for taking coronation poles from Whittlebury Forest which were evidently substantial trees (11). Payments were made for watching against wood stealers until the end of the nineteenth century. Entries occur such as "stealing acorns" or "catching nutters": evidently nothing was then free and public access to the woods must have been negligible. This would account for Morton knowing nothing about them in 1712 (12).

There is only one entry which indicates that charcoal was ever made in these woods. This is in 1730 when "making charcoal 8 day's work . . . making the harth fit for burning" is recorded. This may have happened more often, but concealed under payments for so many days work. I mention the possibility of fires at cabins, and the one instance of charcoal burning because fire might well affect some species, and it would seem that it was very little used.

A copy of the <u>Conditions of the Oak Timber Sale for 1755</u> survives:-

"The timber to be sold standing by the load of 50 feet in lots, each lot to contain 3 Trees and to be measured when they are felled.

All trees to be accounted Timber and to be measured as such so far as they hold 6 inches square in the body.

And all arms to be accounted Timber that square 6 inches.

If any timber proves Rotten or Decay'd, if valued as sound an allowance to be made for the same in the woods when measured.

The buyer to have no part of the bark or Tops except such Arms as shall be accounted Timber and Measured as aforesaid.

The Buyer to be at no expence of felling of the timber or of cutting off the tops.

The Timber to be carried out of the Wood before the 12th day of August next or otherwise the same to be sold again.

The Buyer to pay Ten Shillings a lot etc.".

Timber is defined by size, and trees with timber potential were "saplings", as in references elsewhere to crying the underwood (i.e. advertising for sale) in December and the Sayplings in May.

<u>The Directions left with Mr. Pope Relative to the Woods at Thornhaugh January 5th 1762</u>

(11) Northants Rec. Soc. Northamptonshire Notes and Queries, 1st Series.
(12) John Morton, Natural History of Northamptonshire.

These also give clear instructions on the actual operations to be carried out, and are as follows:-

"The faggots that are in the wood to be immediately sold and carted out into the fields adjoining to the Woodward's house - the offal wood and roots the same.

The south fence of St. John's Wood to be made from the one end of the other in the like manner with the part already done.

The underwood is to be cut down in furlongs and poles as usual, and the roots are afterwards to be cut down as close to the ground as possible without cutting them within the ground and stacked up and sold.

The underwood to be sold to the best advantage, either by the pole after the poles are taken out, or in faggots and hedgewood.

The bark is to be stripped and set up by his Grace, and advertisement published in the Northampton Stamford and Cambridge papers each one time in the 3 weeks preceding, mentioning the day of sale and quantity as near as can be guessed.

The tops to be cut out to the best advantage into crooks posts rails etc and the brushwood faggoted up and sold.

The Timber to be numbered Numerically and measured before it is carted and the contents marked upon the butt. The timber is to be carried out of the wood before it be sold. The larger timber is to be carted down to the water side upon the ground lately held by Mr. King and put into such lots as they shall size best to be sold together.

The smaller timber to be carted out into the riding next to Lord Westmorelands'.

No faggots or wood to be suffered to lie in the woods after Michaelmas.

The water must be let off the Riding and the Ruts put in that was made by carting the wood of last years Sale.

The Great Beech Tree at the North East Corner of the last years fall to be taken down and Ashes and Sallows to be planted in the ground where the underwood has been destroyed by that tree."

This is presumably the standard procedure. Particularly interesting is the instruction to cut as close to the ground as possible without cutting within the ground. The Great Beech Tree must have been a considerable size for ashes and sallows to have been planted in the space left. The timber, incidentally, fetched £4.0.6d and the 94 faggots from the tops £1.0.0d. The actual buildings in Wansford for which oak felled in this year was used are mentioned. The great beech tree would have been in Little Moyses Sale, a part of the wood where coppiced beech is found today.

In 1733 even more extensive operations started. The Royal Forests were first established for sport - because William I (the first conservationist) "loved the deer as if it were his brother". Surveys of the seventeenth century regard the woods strictly as an economic proposition for the production of timber. In 1733 big upheavals started to take place because of the sporting interest. Sport and gamekeeping are discussed below, but this new development involved so much in the way of earthworks and general alteration of the wood that it affected the management. His Grace, The Duke of that time, had decided to take more interest in hunting in the Thornhaugh woods. A trench was made, 3 ft deep and 4 ft wide a top casting the earth all on one side to make a banke in order to sett a hedge thereon at 9s per acre to keep his Grace's deer out of Rockingham Forest. This was followed by cutting of stakes and making of drawers for the hedge, and cutting faggots and mending the hedge against Cliff Parks to keep the deer within his Grace's woods. Hounds were bought and a large dog kennel erected in the wood. The Sibson Quick hedge was plashed, layed and ditched, "throwing the brush in it and making a dead hedge on the other side". There is an account for faggots in the ridings, "which said ridings was made by the keeper's order for the better riding and hunting in the woods for his Grace". Other ridings were cut and inlayed. "Sewelling" and "cutting real pads for suelling" now becomes an expense: this means fastening a line of feathers on twine 1-2 feet above the ground in order to keep the deer within bounds (13).

The map of 1757 (Fig. 7) shows the new straight rides radiating from the centre of the wood. None of these follow the lines of the old compartment boundaries, but a few of the old rides still exist, e.g. the division between the main wood and John's wood, and the division between Cockerwood and the rest. These are certainly solid roads which have been made up many times with stone. This making of new roads obviously involved extensive grubbing, stubbing, levelling, ditching, making drains and hedging operations. Payment was also made for carrying away the stone in the ridings, carrying stone and earth to the ridings, and by 1739 further operations were embarked upon in "cutting shooting racks in the woods". The paths one treads today are mostly not the age-old tracks. This great work of realignment started in 1733, but it was not until 1753 that Vincent Wing was paid for "surveying and planning the several sales in Bedford Purlieus", and work was still being carried out in 1759, 1763 and 1764 on the new ridings. It was considered necessary to dig up roots as well in Cross Leys and Great Moyses. One wonders how much was altered and how much left undisturbed by the end of this 30 year stretch.

"Planning part of the woods" was still mentioned in 1780 but does not seem to have resulted in the same kind of upheavals. Shooting paths were made for the keeper, with shooting stands, more grubbing and clearing went on but on a minor scale, and twentyfive stones "for ascertaining the boundaries" were "got, cut, lettered and laid". I have not yet seen any of these but it might be a useful exercise to look for them in the winter.

One aspect of the ride reorganisation, which has considerable ecological significance, and which was only recorded as a record of payment, was the sowing of rides. In 1778 three sacks of grass seeds were bought to sow in the ridings and again in 1785 "Hay seeds to sow in the wood ridings" were bought from Richard Collins of Thornhaugh. These seeds probably came from within a mile of the wood. These activities may explain the presence of species such as Gentianella amarella, Polygala vulgaris etc on some of the rides.

I have so far dealt mainly with management from the angle of how the timber was produced and marketed, and the effects this would have had on the vegetation and topsoil of the woods. The realignment of the rides, although motivated by sport rather than timber management, resulted in an even greater extension of the same kind of activity.

CROP SPECIES

The wood accounts vary in the amount of information they supply on crop

(13) Miss Baker, Northamptonshire Words and Phrases

species. In some years timber and underwood are the only terms used; in others, oak, ash and underwood. Occasionally, really noticeable trees such as the very large beech may be mentioned, but it is not until whole compartments were felled in the nineteenth century that underwood species are consistently recorded.

Table 1 shows the first mention of all species, and all the entries of planting of any kind. There is the 1720-26 gap, but plantings must obviously involve expense both in buying trees and in labour and it seems a reasonable assumption that these are, in fact, all the plantings.

I have already commented that oak was obviously the main crop from 1457 onwards. It always fetched about 80% of the total value of the sales, and has been planted continuously over the years. One wonders how old the "Decayed oaks" felled in 1699 may have been. Warrants were taken out against acorn stealers in 1732, a far cry from letting the pigs in to eat them. Payment for planting acorns in the woods was made in 1752, and in 1760 for "Planting young oaks out of the ridings in vacant places in the wood". Acorns were sown in 1770, 1778 and 1782; young oak planted in 1796; acorns gathered for the woods in 1784 and 1805, acorns set in 1806; young oak were collected from off Maidengrave and planting in Little Forty Acres in 1810; acorns planted in the Bedlams (formerly heathland) in 1819; and so on throughout the first half of the nineteenth century.

Minority crops

Ash was nearly always a significant component of the timber crop, but it seems to have grown better in some compartments than in others. The first mention is by implication in the name of Ash Coppice, but we cannot see whether much more ash grew here than in the rest of the wood because it was in the part that was cleared. Old ash are mentioned in 1597 and 1598 and it occurs regularly thereafter whenever the timber crop is specified. Six ash setts were bought in 1701 although decayed ash were felled in 1709, and one wonders how it was ever necessary to buy young ash. Ash was also brought over from Thorney to Thornhaugh to plant in the woods in 1766. Ash was bought from Newark in 1807, and some were brought in from Maidensgrave with the young oak. It was evidently considered well worth growing, and has been favoured more than anything else except oak.

Elm is first mentioned in 1753 as decayed elm in Cockerwood. It was felled in John's Wood in 1762 and 'wyches', which may or may not have been the same species of elm were taken from Pebblegate in 1766 and 1784. It is again mentioned as a crop in 1808, in Lower Forty Acres in 1844, and in Forked Oak in 1860. Elm is a constant component of the crops described in 1862-1868 when half the woodland was grubbed out, and in all the detailed mentions of late nineteenth century fellings. Planting of elm is not mentioned specifically but it could have been included in the 'other sets' of 1752 or the planting of trees in 1763, when the species were unfortunately not recorded. Both elm, 1735, and wyches, 1766, were already present (Table 1) before this mysterious planting of trees.

Lime poles are first mentioned in 1759, again in 1762 but not again until 1843 when lime trees are recorded in Moiseys and Ward's Sale. Records of the nineteenth century grubbing however, and later detailed sales of timber, show that lime occurred in Ash Coppice, Cromwells Sink, North Gate Sale, Upper Moiseys, Lower Moiseys and Ward's Sale. Like elm, it was recorded as cut before the first recorded planting.

Beech. Five beech trees were felled in Cromwell Sink Sale in 1758, even before the very large beech tree mentioned in 1762. Both records

Table 1. Species Table for whole Woodland

Cut - First Mention		Planted - all mentions
oak (implied)	1457	oak
thorns, crab, ash, maple, hazel, sallow, servis	1597	
quickthorn	1598	
furze	1606	
	1663	quickthorn
	1701	ash setts
willow, elm	1735	
lime	1747	
	1752	2 pecks crab kernels
	1752	sallows, acorns, water sallows and other setts, sloes, withes
decayed beech	1758	
	1760	young oaks
	1763	planting trees
wyches	1766	ash and beech from Thorney
	1778	acorns, grass seeds
ivy	1781	
poplar	1784	
	1785	sloes, hayseed
briers	1787	
	1796	young oak
Old man's Beard	1799	
	1801	larch in Bedlams
	1806	500 Spanish chestnut
	1810	young oak, ash
thistles	1818	
	1819	acorns
larch	1832	
	1839	white thorn
	1840	forest and other trees
	1843	seed from fir balls
fir, sycamore	1844	
alder	1851	
	1857	young forest trees
Scotch, spruce	1864	
Spanish chestnut	1875	

antedate the first recorded planting in 1766, when beech was brought to Bedford Purlieus from Thorney. This sort of evidence does not, of course, prove conclusively that no planting occurred earlier, but the long run without serious plantings except of oak and ash from 1640 to 1763 gives a strong presumption that it did not take place earlier.

Salix sp. Sallows, Water sallows, and withes were cut from time to time, twenty old willows being taken out in 1809. Sallows, water sallows and withes were all mentioned separately in the same year in the plantings of 1752.

Popple or Poplar, possibly aspen first appears as a crop in 1784 but was later mentioned in a number of compartments, i.e. Cockerwood, Forked Oak, Cross Leys, Bar Sale, Upper Moiseys and Ward's Sale.

Quickset or Hawthorn has been planted continuously as hedging material rather than a crop, although it was certainly considered to be produce of the woods when Nicholas Thorogood had the twelve sett gatherers taking loads of quick to Elton in 1597. It was used in the plashed hedges around the coppice, in the new ridings and on the boundaries. It was still being stolen in 1772. The most enormous planting of all were made in 1839, when 20,000 whitethorn quicksets and 29,000 two year old quicksets were bought and planted, presumably to protect the young forest trees which were planted at the same time.

Crab Apple. There was a fuss when crab trees were cut in 1597. Two pecks of kernels were bought to sow in the woods in 1762 and there are occasional mentions of the cutting of crabs up to the early nineteenth century. It was obviously a more valued tree in earlier times.

The Service Tree of 1597 is an isolated example until the early nineteenth century when it is mentioned several times.

Loads of thorns were stolen in 1597 and 1606, presumably valued as hedging material. The sloes of 1752 were collected to plant on Bar Sale Bank which was being strengthened to keep his Grace's deer within his woods, but the sloes of 1785 were simply to plant in the woods.

Hazel was mentioned early as stolen both in 1597 and 1606 - the precautions taken to catch nutters make me wonder if the crab apples, sloes, and nuts were all valued for their fruits by the workers on the estate.

Furze - Five loads of furze were stolen in 1606. Furze was cut for making faggots for mending the wood roads and for clearing purposes. One cannot tell whether it was much more plentiful in the part of the Purlieus that was cut down, or whether the war against the plant has been particularly successful but it is now a rare component of the flora of the Nursery part of the present wood and now one would have a job to make one good faggot for mending a road.

Planting of Aliens

I have dealt first with the species which one can consider to be indigenous, even though stocks may have been brought in from other sites. All were cut before they could have grown either from the "other Setts" of 1752 or the 1763 planting of trees. There are no gaps in the accounts between that time and the 1840s when fir and sycamore are being cut. It seems a reasonable assumption that they were planted at that date. Larch was planted in the Bedlams in 1801 and from that date onwards it seems to have been used for larch poles and as a tree nursery. In 1806 five hundred

Spanish Chestnut were bought and planted in the woods. Forest and other trees were bought in 1840 and curiously enough about the largest purchase of "young forest trees" in 1857 was just five years before the decision to grub up half the Purlieus. Larch is continuously planted from 1832 onwards. Alder is mentioned only once in 1851. Spruce and fir were planted throughout the wood as can be seen on the 1871 map (Fig. 10) but very much mixed with the deciduous crops. The fellings of the late nineteenth century were recorded every five years and in 1895 for example Cromwell Sink Sale had yielded underwood, oak, lime, birch, ash, and maple; Upper Forty Acres - underwood, oak, lime, birch, larch, ash, poplar, one Spanish chestnut and maple; Lower Moiseys - oak, sycamore, larch, spruce and ash; Upper Moiseys - ash, birch, maple, lime and oak. Curiously enough, birch is not mentioned in the main wood until this date.

These introductions of alien species brought with them new management practices. There are now payments for "cleaning the rubbish from the young trees", "thinning the plantings", weeding, mowing thistles, pruning and sprittling out of larch poles. Some of this was doubtless due to cultivation taking place on the Bedlams which had not been woodland before but in recent years we have seen many examples of the necessity for this kind of work when conifers are introduced into deciduous woodland and I was very interested to note that these payments started at this particular period. In 1805, too, is the first record of the underwood being injured by rabbits, although it is not the first mention of rabbits.

Some strange transactions were made not long after this. Payment was made to the Trustees of the Peterborough and Leicester Road in 1845 and later for the hire of road scrapings. This was horse manure for use as fertiliser around the young trees, a rich source indeed for possible introductions: one or two of the most curious plant records probably came in in this way - Lepidium smithii and Valerianella dentata. When the Forestry Commission graded the rides a few years ago the Valerianella immediately reappeared.

ECONOMICS

I have tried to abstract satisfactory information about the economics of the woodland but many difficulties were encountered. Early accounts are mixed in with the whole manor of Thornhaugh and cross-transactions are always occurring with other parts of the estate. A bad steward in the first half of the eighteenth century allowed enormous arrears to accumulate so that it is impossible to tell what was the net income in one particular year. In any case it was not until 1862 that the economic position actually affected the fate of the wood.

The 1614 survey has been referred to above, giving the income from the woods as £362 p.a. Later in the seventeenth century this had risen to £430 and as far as I can gather this continued until about the middle of the eighteenth century. Variations between £1045 and £2208 occur in the 1770s.

A Report on the Wansford Estate of 1803 says:-

"The woods containing in the whole about 1045 acres it is imagined will produce comm. annis £1000 p.a. and as they are on that part of the estate where the land is of an inferior quality if it will produce annually to his Grace £1 per acre on the general average as wood it is far more than it would do under any other mode of cultivation."

I have mentioned the planting of larch in the Bedlams, where much work was undertaken every year. An 1818 list of the coppices with acreages does not include the Bedlams, but the 1838 map (Fig. 9) shows it as small trees, and larch poles were, in fact already being cut there in 1832. The tree nursery, fertilising, weeding, growing or new species, purchases of "forest trees" all indicate a higher degree of interest in the intensive cultivation of the woods. In 1857 a profit of £1453 was made although the expenses of all the new trees, planting etc came to £807.

Suddenly, from 1862-1868 half the Purlieus is grubbed up. Two articles from the Peterborough Advertiser give accounts for this:- The first, on January 9th 1904, is under the headline The Wansford Estate sold by the Duke of Bedford to Earl Fitzwilliam "The estate, including Thornhaugh, comprises 4,500 acres, 600 acres being woodland and the remainder agriculture . . . The estate has been conducted on the most scientific principles, the woods being laid out in such a way that in a few years they will produce a most profitable return, care being taken to plant in sections such timbers as are most suitable to the soil, thus securing a crop of well grown trees, principally oak ash and larch. The drainage is good, and the ridings wide and well kept with some very pretty bits of scenery. No game is preserved, although the woods are shot over; and the Purlieus is one of the most famous coverts in the Fitzwilliam country and is a safe find. There are over 500 acres in the Purlieus, which a few decades ago, joined the great Cliffe Forest. From 1862 to 1866 about 600 acres were grubbed up at the following cost as shown by the Duke of Bedford in "The History of a Great Agricultural Estate"

Grubbing	£8139.16.11
Fencing	£1207.12.11
Draining	£1226. 5. 8
Bridges	£5229.17. 9
	£18897.18.11

The receipts amounted to £13496.17.10 so that there was a deficiency of £5401.1.1. Wheat was then 60s a quarter. It was sown with oats and as long as the vegetable humours remained, the crops were excellent; but when they were used up, the crops went to pieces. Now the land has to a very large extent been allowed to revert to the old forest grass. Within the last 50 years about fourfifths of the whole block has been cleared of all old timber and replanted between the underwood stools. The young trees are very healthy and the wood promises to be a very valuable one in a few years. The members of the English Agricultural Society were greatly delighted with it on their last visit two years ago."

Peterborough Advertiser December 7th 1912

"Although the Bedford Purlieus is a name very familiar as a household word throughout north Northants yet it is surprising how very little is known about it. The prevailing idea is that it is a large wood between Wansford and Kingscliffe which is an excellent fox cover and game preserve. No doubt it is but that is saying just the very least that can be said about it.

What is not known is that only half a century ago it was an enormous forest covering about a thousand acres of land and that today it is only about half that area; that men are still living in the villages of Wansford, Kingscliffe, Nassington and all around who were employed as foresters, woodmen, and oakers; that others are still living who helped to grub up nearly half that thousand acres of forest and make it into farmlands; and that all these men can tell stories and incidents of the Purlieus that will come as a surprise to most. Two of these, Mr. H. Reedman, timber merchant, and Mr. W. Scotney, both hale and hearty octogenarians of Nassington, are perfect encyclopedias of Purlieu lore.

If the Duke of Bedford who ordered the clearance could have forseen how much cheaper wheat would have become, it is probable the old Purlieus would never have been interfered with, for they yielded a good harvest of timber and underwood every year for which there was a ready market, and a large number of woodmen were constantly employed. There were probably never fewer than ten woodmen and others employed in keeping the ridings clear and the grips open.

Centre Tree - great landmark of the forest and still standing - in a clearance of about an acre in extent in the centre of this open space stood centre tree - all ridings led up to it as all roads lead to Rome. Opening out of the clear space surrounding the tree were about ten or twelve ridings branching off into the forest in all directions and as they penetrated into the depths of the wood, branching again and again into intersecting glades and highways.

To quote the old men: "We got £10 an acre for grubbing - getting up the roots and undergrowth. In an acre there would not be very many of these great trees - oaks, ashes, elms and lime, but the bulk would be the roots of the underwood. We should dig all round . . .

Some of the great trees were so large that it was impossible for men to climb up them with the rope which it was necessary to fix in the upper branches in order to pull the tree in the direction it was required to fall when the axe and the saw were applied to the roots. A rope was thereupon thrown over and through the branches of the trees for the felling always took place about April when the sap began to rise and before there would be much or any foliage and then a noose would be formed at one end. One of the woodmen would fasten this round his waist and clasping the rope over his head with his hands would be drawn up into the boughs by the other end of the rope . . .

When grubbing up around these roots we would often come upon strange things which had made their homes under the trees. In the first place we should dig up whole colonies of newts which had made their nests there. Snakes too, in abundance would be found curled up in cavities lined with leaves. Occasionally we should unearth hedgehogs in this way, but not often; we generally found them on the outside of the wood in hedgerows. A few dormice too we should find, but not many. And while they were engaged in the Purlieus they would be surrounded with swarms of foxes and squirrels and in the early morning and evening the air would be filled with the hooting of owls. There was never very much game. Pheasants were fairly abundant, but not so many hares and rabbits . . . An old lady used to wander all night in the Purlieus . . . foxes and badgers running round her. Mr. Reedman says it would be hardly possible fifty years ago to walk down any of the ridings without seeing one or more foxes cross it especially if the hounds were anywhere near. He says he has been in the purlieus when he has heard foxes yapping around in all directions. One day, hearing an unusual noise of this sort he went gently in the direction and there in the opening he saw four or five foxes playing like so many young cats. Foxes practically swarmed in the Purlieus.

There is no "going oaking" now as there used to be. This gave employment to large numbers. It would start in April when the trees were felled. The Forester would go through a particular part of the wood with a "blazer". With this he would select which trees, mostly oaks, were to be felled. The Blazer was a sharp edged tool which drawn down the bark of the tree removed the outer surface leaving a smooth patch. An attendant with a paint brush marked this and then when the tree fellers came they knew which of the forest giants to chop down. As soon as the trees were felled a number of men would commence to strip off the bark. This was done with tools specially made for the purpose. Mr. Reedman still has some of them in his possession although as there is little or no barking or oaking as it was called . . . done now . . . The trees being felled in April when the rising sap was flowing between the trunk and the bark, made this process of stripping off the bark comparatively easy.

"Horses" were made of some of the loppings of the trees and the strips were piled against these to dry. With good winds this would sometimes be achieved in a few days but often it would take longer. The bark was "ripe" when it was so dry that it would easily break. It was then carried into the timber merchant's yards and stacked, being thatched down like a corn rick. The chief use for tanning - 119 tons sold at 6 guineas a ton to Yorkshire. The tree fellers used to get 1s in the pound for what the trees made. A good sized oak tree which would measure out at 100 ft oak would generally make out £15 and the tree fellers 15s for felling it . . . Oak is very much the same price just now as it was in the palmy days of the Purlieus but the trees were then purchased by an estimate of their value by the purchaser.

Ash trees now sell for a great deal more than they did then and are distinctly scarcer everywhere. Lime trees do not sell so well as formerly because they were largely used in the making of pianos."

I have quoted the above articles in full because they contain a variety of interesting information. One or two points are not strictly accurate. The grubbed up Purlieus were first planted with beans, then with seed corn, mustard and cole seed. The fashionable fertiliser of the day, guano, was used. It is no real consolation to us today that despite all this it was not a success.

Bark was recorded as a separate crop before this, but the above article explains the drying arrangements well. On occasion the weather was so bad that the bark crop was spoiled doubtless depositing a considerable amount of tannic acid on the particular patch of ground beneath.

A new crop for sale appears in 1870 - grass from the rides; - proof of a considerable amount of mowing to make this worth while.

The splendid state of the woods as described in 1904 evidently did not last, because the Fitzwilliam estate sold the woods in 1913 to a timber merchant and one can only assume that practically everything saleable was felled. Dr. Peterken and the Forestry Commission take up the story from 1930.

SPORT AND GAMEKEEPING

The effects of this have already entered the picture in the big changes in the rides and coppice boundaries in the eighteenth century, but there is a considerable amount of additional information of use to those interested in particular species. The earliest of these are letters about the deer. The Earl of Westmoreland to the Earl of Bedford 19th July 1690

". . . to satisfy yourself of what you were informed by that notorious person was false and that prejudice he pretends done by my servants and hounds to your woods wholly retorts upon himself: I got yesterday four of my neighbours justices of the peace to gather with the Archdeacon's servant Mr. Banks and the tenant Mr. White to vew and see whether the woods had suffered by my hunting; which was under your leave if you have not forgot it. They all judge that the breaking against could not amount to much prejudice but the breaking down the hedges in several places and making creeps for the deer to come into the young coppices was judged by all noe service to your lordship however if you like it I have nothing to say against it . . ."

The Deposition by the four Justices of the Peace was as follows:-

". . . the damage done by the Earl's servants and hounds could not amount to a few groats . . . being only some few gaps . . . ash in several of the young sales is much cropped which we conceive to be by the deer that have by beating down the hedge and making of creeps a fair opportunity and invitation of doing the woods hurt and when once in by way of sewelling we perceive they are kept in . . ."

A few years later Lord Westmoreland wrote again 1713: "I troubled your lordship when I was in town about a proposall for liberty to hunt in the purlieus called Bedford Purlieus adjoining to the Walk of Sulehay, this favour has been formerly granted me . . . he (your Father) told me that as he would take no venison for composition, so he desired I would not go into the woods to find a deer because of driving them out after they had gotten their feed in the woods. For that he esteemed this country venison beyond all the deer in his park, but at the same time told me that if I hunted a deer out of the forest into the Purlieus I should not stop my hounds but hunt him till I forced him home or killed him there . . . of which leave he promised to give notice to his servants . . . for liberty to enter my hounds at the beginning of the year or to give me leave to keep the deer hunted out of the woods I shall be engaged to furnish, at such times as her Grace shall order the same quantity she has ever had out of the Purlieus".

Her Grace's underkeeper was consulted and replied " . . . if her Grace permits my Ld W. to follow his game thru my Lord's woods his Grace cannot expect much venison for his Lordship doth not desire this so much for sport sake as out of a desire to affright all the deer out of his Grace's woods the deer there being not used to be disturbed by hunting and shooting which his lordship's keepers and many others along with them will take occasion to do on purpose in all parts of the forest and when there they will take care to sewell them in and to hinder them from returning if possible this they will do as often as they hunt in that part of the forest near us those deer being pursued will naturally come to his Grace's woods where they are used to feed att quabe so that his Grace will suffer an unspeakable damage in keeping of them and when in season my lord W. will have the benefit of them and that is his Lordship's desire as plainly for about 10 days ago I seeing his lordship following the game into his Grace's woods I desired his lordship to leave off to which he replied it was perleu and so pertended a right already and indeed it is my opinion leave will make it so however I replied that his Lordship was mistaken and that it cost his Grace's ancestors £7000 to make the woods a free hay and at the same time I complained that it was very unreasonable of his lordship should desire to follow his game into his Grace's wood if chance to relle over into his Lordship's pound for which he gave me no answer . . .".

There are a number of entries for carrying venison to Woburn, the quantity being mentioned in 1761 i.e. eight does and one buck and in 1750 eight bucks and two does.

The letters show that the keeper was jealously guarding his master's rights in the area although the Duke was at that time a minor. "A box trap for the keeper to catch vermin" heralds the renewed interest in sport

1731 and in that year there was also a payment for "killing partridges". A record of all game sent from Thornhaugh to Woburn and London in 1742 can be compared with figures given at the end of the nineteenth century (Table 2) but unfortunately there is nothing in between to show how populations rose and fell.

Table 2. Game sent from Thornhaugh

	1742	1860	1875	1880	1890	1895
Pheasants	82	55	38	60	36	84
Partridges	268	1	-	1	-	-
Woodcock	141	-	-	1	1	4
Quail	7	-	-	-	-	-
Snipe	13	-	-	-	-	-
Hares	-	55	47	24	21	13
Rabbits	-	358	148	128	174	not given

There are some rather dramatic differences. The absence of hares from the 1742 figures was perhaps because they were not considered worth shooting at that time. The deer population is hard to guess and I have no information at present on the results of all the efforts expended on changing the rides for better hunting for his Grace. The keeper's cottage, the large dog kennel and the pond for scouring the dogs were all inside the wood. In 1734 red deer were carried from Ravesby Abbey to Thornhaugh, another unsuspected introduction which seems to have vanished without trace.

A copy of the new gamekeeper's terms of service of 1761 is of interest:-

"I do agree 26th October 1761 to serve his Grace the Duke of Bedford as keeper at Thornhaugh and Wansford and to take care of the Game and kill such as his Grace shall direct and no more likewise to kill and account for all the rabbits upon his Grace's Estates there also to kill and account for all venison in his Grace's woods being allowed six shilling a week wages the keepers fees for the deer killed a coat waistcoat and breeches . . . such offal wood as I can get up out of the woode . . . a reasonable allowance for powder and shot".

Payments were made at various times for killing the vermin - never specified - but the whole interest in sport seems to have faded away by the end of the eighteenth century. A history of the Russell family probably accounts for this as well as for the disastrous decision to grub up half the Purlieus by the very agricultural Duke. The "swarms of foxes" described in the 1860s would not accord with any form of sport, even hunting, and they may have had as much effect on the earlier table of species shot as anything else.

Moles. I do not understand the motive for employing a mole catcher in a wood:- were they thought to damage the roots of the trees, or were they simply dangerous vermin? Were many men employed about the Thornhaugh Estate and paid out of the wood accounts like the schoolmaster at Wansford? A mole catcher received 15s a year for a good part of the eighteenth and nineteenth centuries.

CONCLUSIONS

The historical evidence suggests that a major part of the existing woodland has been in existence continuously through the last 7000 years. The influence of man has been considerable, and the long sustained dominance of oak and ash has been a deliberate policy of management. The wildlife now present has survived through this management, and through the substantial changes which have happened at intervals.

ACKNOWLEDGEMENTS

I would like to thank many people who have assisted my researches, the Bedford Record Office, Dr. G.F. Peterken, Mr. A.N. Groome, Mr. J. Gilbert, and members of the Historical Ecology Discussion Group.

EARTHWORKS

G. F. Peterken

Mapping of banks, ditches, cultivation remains and other artefacts within woods may provide valuable information on site history. Events which have left no trace in the documentary and cartographic record may come to light, and the area affected by known events may be defined more accurately. As Rackham (1971) has pointed out, bank and ditch maps give precision to events on the ground which complements the documentary evidence, which tends to be precise on time, but not on place.

The artefacts of Bedford Purlieus (Fig. 11) include the relicts of activities not connected with woodland management, which have intruded within the woodland boundaries. These include the quarries and pits, as well as the remains of wartime military occupation. Earthworks connected with woodland management are also present as boundary banks and drainage grips, but some have been destroyed by the "non-woodland activities".

Quarries

British Steel Corporation quarried minerals from the Cocker Wood area between 1964 and 1966, stopping when the ore became relatively uneconomic to work. The surface was restored in 1967-8, and has since continued to settle and erode locally.

The southern part of St. Johns Wood is currently being quarried, but little land now remains available for more extensive quarrying.

Small quarries are located in C29, C42 and C48 from which the Lincolnshire Limestone has been taken for building purposes. They appear to be contemporary, but the exact period when they were worked is not known. The quarry in Cocker Wood cuts the old wood bank (see below) and must therefore date from the period after the enclosure of Johns Wood Riding (about 1800). Certainly it is not shown on the 1838 map, when part of the Riding remained unenclosed, but is present on the 1871 map.

Numerous, irregular pits are present in the northern part of the old wood which follow the sands and silt of the Upper Estuarine Series. Scattered pits of a similar form occur in the southern parts. Their origin and purpose is not known, although various explanations have been advanced, including marl pits and a source of road metal or refractory material. They continued through the Nursery into the area cleared in the 19th Century, where they remain conspicuous as soil marks on air photographs.

Services Installations

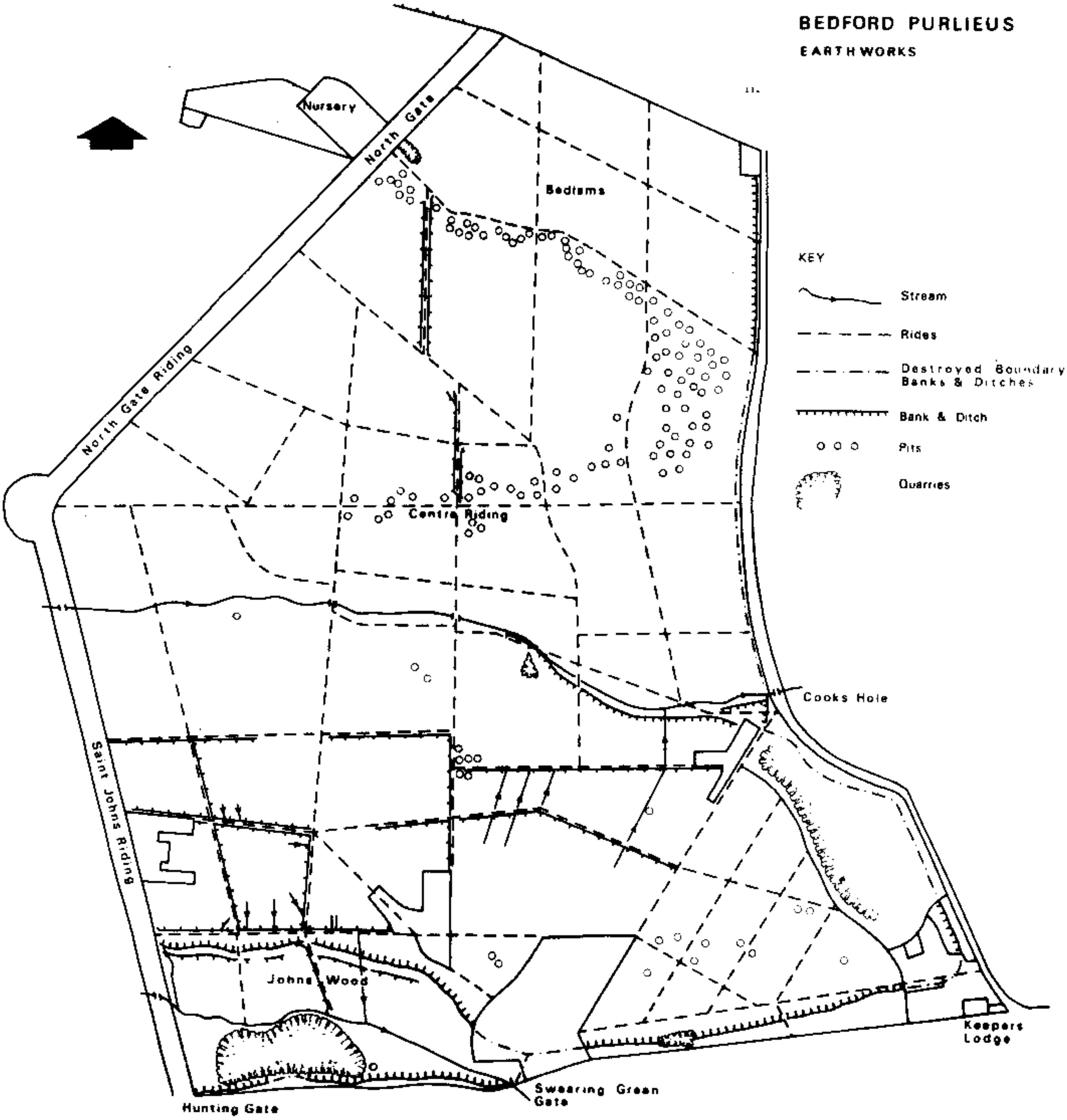
The R.A.F. built groups of huts in the southern part of the wood during World War II. The foundations and some shelters remain, together with some concrete water tanks (which may have been formed from pre-existing ponds). Considerable ground disturbance occurred in the immediate vicinity.

Banks and Ditches

A massive, spread wood bank and external ditch may once have surrounded the entire wood, but much has been lost by woodland clearance, deliberate levelling, and the recent activities of the armed services and British Steel.

EARTHWORKS

Earthworks, 1974. Banks, ditches and pits within the existing woodland. All boundary banks and ride-margin ditches are shown, but only parts of the course of drainage grips within compartments have been surveyed. The presumed line of the medieval boundary banks is indicated by ═ • ═ • ═ where they have been destroyed, except along the portion seperating the Bedlams from Bedford Purlieus proper: this was more or less coincident with the present ride.


BEDFORD PURLIEUS
EARTHWORKS
Nursery
North Gate
North Gate Riding
Bedlams
Centre Riding
Saint Johns Riding
Cooks Hole
Johns Wood
Hunting Gate
Swearing Green Gate
Keepers Lodge
KEY
Stream
Rides
Destroyed Boundary Banks & Ditches
Bank & Ditch
Pits
Quarries

The only substantial fragments remaining mark the old southern edge of Cocker Wood, and the eastern half of the boundary with St. Johns Wood. In addition, a substantial length of the old southern edge of Johns Wood survives as a similarly substantial bank and ditch, running just inside the present wood. The Russell Estate papers for 1839 contain a reference to the removal of the northern bank of the wood, which had become useless: the slightly sinuous ride, which now marks the southern edge of the Bedlams, originally ran close to the bank just inside the Bedlams.

A shallow, fragmentary bank within the present Johns Wood appears to be the margin of a lane which once ran immediately outside Thornhaw Wood between Dovehouse Nook and Swearing Gren Gate. It suggests that Johns Wood was once completely seperate, but since the points where the Johns Wood bank meets the Thornhaugh Wood bank are both destroyed, this possibility cannot be tested on the ground.

The former boundaries of coppice sales before the 18th Century re-organisation are not detectable on the ground. That they were once marked by banks, however, is suggested by a length running immediately south of the stream from a surviving fragment of boundary bank at Cooks Hole. This appears to mark the boundary between Great Moiseys Sale and Great 40 Acres Sale, one of the dominant internal boundaries of the 1757 map (Fig. 7). Its existence suggests that some, at least, of the Sale boundaries were sufficiently stable to be worth bounding by a bank and ditch, which could originally have been surmounted by a hedge. On the other hand, clear evidence of evolution and change is presented by the pattern of Sale boundaries before re-organisation (Fig. 7), which can be considered as an inclosure system. Wards Sale, for example, has clearly encroached into North Gate Sale. The irrational boundary between Sallow Coppice Sale and Ash Coppice Sale suggests the relic line of an inclosure system which has been re-arranged.

These older banks are manifestly unrelated to the existing divisions and boundaries of the wood, which date from the 18th Century re-organisation. Riverside banks and ditches occur in part, but these appear to be part of a drainage system rather than boundary markers. They occur on the clay plateaux, providing a channel for any water draining along the small network of grips, which would otherwise be almost totally ineffective.

Finally, two banks occur near the present wood which are more closely related to the old wood banks. The wasted remains of a bank runs south from the Toll Bar between the Bedlams and the old lane; this apparently post-dates the 1589 map. Running west from the point where the North Gate Riding joins the present A47 main road is a much disturbed bank and hedge which appears originally to have had a ditch to the south, and to have borne a mixed hedge composed of tree and shrub species characteristic of the wood (including _Tilia cordata_). This is an old boundary between Thornhaw and Wittering Intercommon to the north and Thornhaw Particular Heath to the south. If, as Pollard (1973) suggests, it is an old woodland boundary, then Thornhaw Particular Heath may be a former part of Thornhaw Wood cleared at a relatively late date, _before_ 1589. Some support for this suggestion is provided by a loose, undated (but probably pre 1589) paper on which was written "Assarts in Thornhaw Wood" (P. Rixon pers. coom.).

Pollard, E. 1973. Hedges VII. Woodland relic hedges in Huntingdon and Peterborough. _J. Ecol._, 61, 343-52.

Rackham, O. 1971. Historical studies and woodland conservation. _Symp. Br. ecol. Soc._, 11, 563-80.

GEOLOGY AND SOILS

P. Stevens

Bedford Purlieus is situated on the edge of a dissected plateau which slopes gently eastwards towards the River Nene at Wansford. Two tributaries of the Nene run west-to-east through the site and the associated valleys together with a dry valley in the north dominate the geomorphology. Plateaux of limited size occur between these valleys but the majority of Bedford Purlieus is composed of extensive gently sloping (1^o-8^o) valley sides. The lowest and highest points are at about 160 ft. (49 m) and 230 ft. (70 m) O.D.

Geology

Fig. 12 is based upon the 1" geological map for Stamford (Sheet 157). A few alterations have been made from field observations to the drift geology, and mapping units termed Calcareous Tufa and Clay Colluvium have been added.

The solid geology is composed of the Jurassic Inferior Oolite and Great Oolite Series, dipping at less than half a degree to the east or east-south-east, causing the sequence of beds to crop out along the valley sides as bands running roughly parallel with the contours. In general, the lowest beds are exposed in the east, the highest in the west.

The geological succession represented within Bedford Purlieus is shown in Table 3.

Table 3. Geological succession within Bedford Purlieus

		Estimated thickness (metres)
Recent and Pleistocene	(Clay Colluvium	1-2
	(Calcareous Tufa	1-2
	(Glacial Sand and Gravel	<1.5
	(Chalky Boulder Clay	1-2
Jurassic Great Oolite Series	(Cornbrash	negligible
	(Blisworth Clay	3-4
	(Blisworth Limestone	3-4
	(Upper Estuarine Series	6-12
Jurassic Inferior Oolite Series	(Upper Lincolnshire Limestone	0-6
	(Lower Lincolnshire Limestone	4+

Horton, Lake, Bisson and Coppack (1974) describe the mode of formation of these beds. The Lincolnshire Limestone was deposited under turbulent conditions in shallow warm water. The Upper Lincolnshire Limestone fills channels cut into the underlying strata of the Lower Lincolnshire Limestone, thus accounting for the discontinuous nature of the former and possibly its absence in the south of Bedford Purlieus. The Lower Lincolnshire Limestone is a shelly, shell debris oolite limestone, forming hard, thick, grey beds when fresh, but weathering to

12. Geology

Glacial Sand & Gravel

Chalky Boulder Clay

Calcareous Tufa

Clay Colluvium

Cornbrash

Blisworth Clay (Great Oolite Clay)

Blisworth Limestone (Great Oolite Limestone)

Upper Estuarine Series

Upper Lincolnshire Limestone

Lower Lincolnshire Limestone

pale buff and cream flaggy limestone. The Upper Lincolnshire Limestone contains a much higher proportion of shell debris, but both limestones yield rich fossil faunas.

The period of carbonate deposition represented by the Lincolnshire Limestones was followed by a shallowing of the sea and the establishment of lagoonal marshes and coastal swamps. Deposition of the Upper Estuarine Series occurred, the boundary with the Lincolnshire Limestone being marked by an abrupt change from limestone to the sand of the thin basal ironstone bed of the Upper Estuarine Series. This Series shows very rapid vertical variations in lithology. The basal sand is succeeded by white silt stone, followed locally by a thin limestone band, then grey and green clays, the clays often being calcareous in nature.

The succeeding blue-hearted shelly, shell-detrital Blisworth (Great Oolite) Limestone marks a return to marine calcareous sedimentation. This limestone is fairly massive and hard, but is marked by the absence of oolitic particles.

Carbonate deposition gave way to the accumulation of mud, now forming the Blisworth (Great Oolite) Clay. This is predominantly a grey-green clay which separates, with abrupt boundaries, the Blisworth Limestone from the Cornbrash Limestone. The latter is a grey, hard shell-debris limestone weathering to yellowish brown and is only represented by a small tongue at the highest point of the wood.

Glacial deposits of two types are found in Bedford Purlieus. The Chalky Boulder Clay is generally accepted to be a drift deposited during the penultimate (Wolstonian or Gipping) glaciation. It is composed of olive green or brown clay with abundant stones, the latter being mainly sub-angular chalk, limestone and ironstone. Angular flints and rounded quartz, quartzite and sandstone pebbles also occur, the pebbles' characteristics suggesting derivation from the Triassic Bunter Beds. Chalky Boulder Clay occurs mainly on the higher ground in the south-west of the wood on the clays of the Blisworth Clay and Upper Estuarine Series and it appears to rest less commonly on the intervening Blisworth Limestone. Occasionally on slopes, decalcification has removed the chalk, causing the Chalky Boulder Clay to resemble the Jurassic clays, making characterization difficult.

The Glacial Sand and Gravel is of uncertain origin, but the similarity of the stones to those found in the Chalky Boulder Clay suggests a similar source. The Sand and Gravel is composed of brown loam or clay loam with characteristically abundant small fragments of ironstone, probably from a local source such as the Northampton Sand Ironstone, together with rarer flints and Bunter pebbles. It occurs as small patches mainly around the edge of the Chalky Boulder Clay.

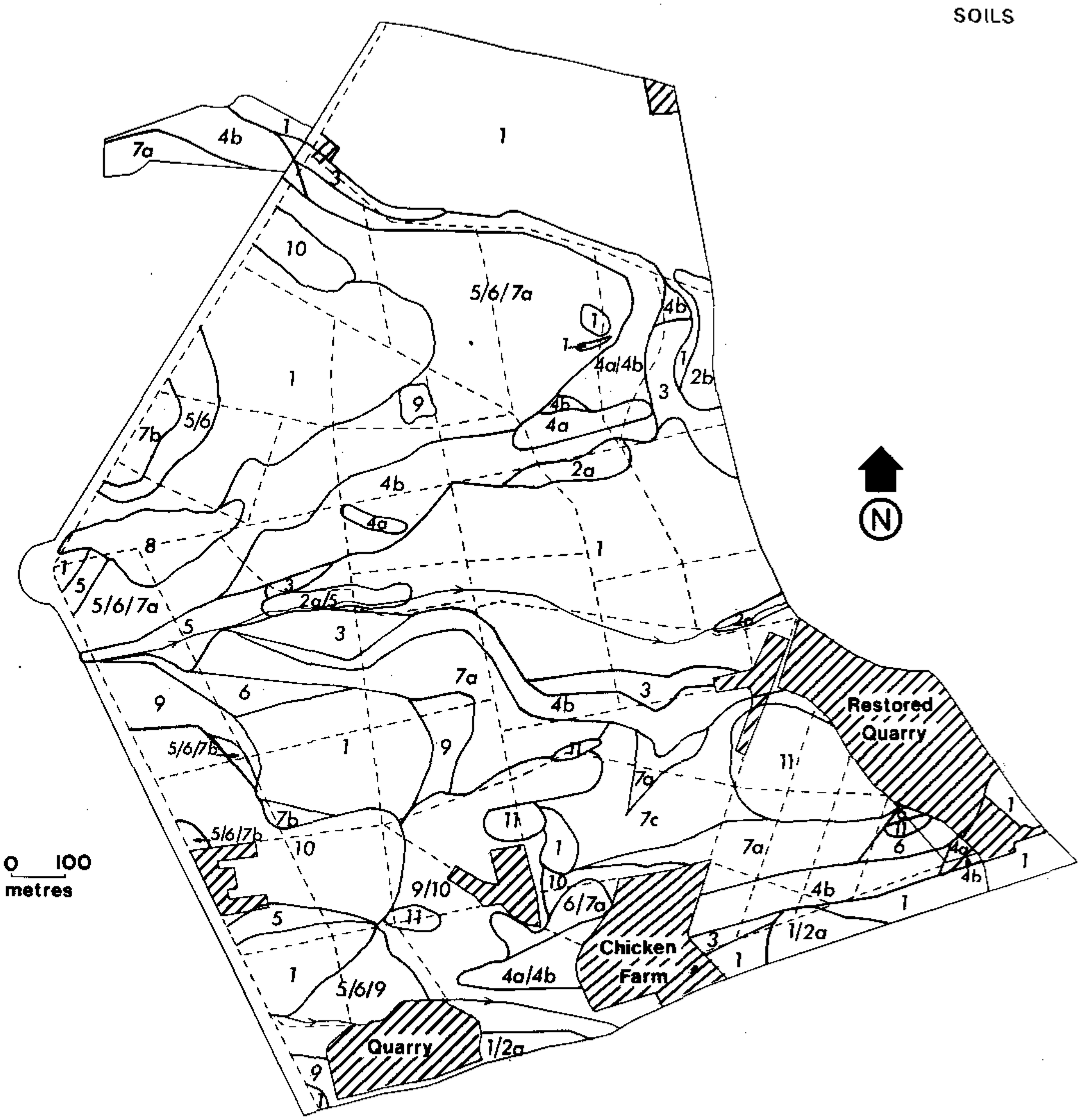
The Calcareous Tufa remnant was probably deposited post-glacially as a small patch at the base of the Blisworth Limestone outcrop and rests mainly on the upper argillaceous beds of the Upper Estuarine Series. It is described by Horton (1974) (pers. comm.) as consisting of 'small grains of structureless calcium carbonate in an extremely porous, almost uncemented material. Traces of plant fragments are present. It has probably accumulated as a deposit in a small lake below a spring.'

Clay Colluvium occurs on the western end of the main valley floor which runs W-E through the wood and is also found as isolated patches on valley sides. It is composed of uniformly coloured brown clay derived

Table 4. Soils of Bedford Purlieus

Soil Group	Classification according to Avery (1973)	Conventional British Classification	Texture and Parent Material
Soils on Lower Lincolnshire, Upper Lincolnshire, Blisworth and Upper Estuarine Limestone			
1.	Brown rendzina	Rendzina	Fine loamy; Lower Lincolnshire, Upper Lincolnshire, Blisworth and Upper Estuarine Limestones
2.	(a) Typical brown earth: uncultivated phase (b) Typical brown calcareous earth: cultivated phase	Brown earth - high base status Brown calcareous soil	)Fine loamy over clayey;)Lower Lincolnshire and)Upper Lincolnshire)Limestones))
Soils on Upper Estuarine Series Sand and Silt			
3.	Typical brown earth	Brown earth - low base status	Coarse loamy; Upper Estuarine Series basal ironstone bed sand
4.	Typical stagnogley soil: (a) Mor phase (b) Mull phase	Non-calcareous surface water gley: (a) Mor phase (b) Mull phase	Thin mor humus over fine silty; Upper Estuarine Series silt Fine silty; Upper Estuarine Series silt
Soils on Upper Estuarine Series and Blisworth Clays; and Clay Colluvium			
5.	Typical brown earth	Brown earth - high base status	Clayey; Clay Colluvium
6.	Stagnogleyic (typical) non-calcareous pelosol	Gleyed brown earth	Clayey; Upper Estuarine Series and Blisworth Clays
7.	Pelo-stagnogley soil: (a) Upper Estuarine Clay phase (b) Blisworth Clay phase (c) Thin drift over Upper Estuarine Clay phase	Non-calcareous surface water gley: (a) Upper Estuarine Clay phase (b) Blisworth Clay phase (c) Thin drift over Upper Estuarine Clay phase	Clayey; Upper Estuarine Series Clay Clayey; Blisworth Clay
Soil on Calcareous Tufa			
8.	Grey (non-humic) rendzina	Rendzina	Fine loamy; Calcareous Tufa
Soils on Glacial Drift			
9.	Stagnogleyic (typical) non-calcareous pelosol	Gleyed brown earth	Clayey: Chalky Boulder Clay
10.	Pelo-stagnogley soil	Non-calcareous surface water gley	Clayey; Chalky Boulder Clay
11.	Typical brown earth	Brown earth - high base status	Coarse loamy over fine loamy; Glacial Sand and Gravel

13. Soil map. For explanation see Table (4).



from the Blisworth and Upper Estuarine Series clays, together with a few pebbles throughout its depth, suggesting mixing of the clay with drift.

A very thin drift cover is noticeable in the top few centimetres of most soils. Pebbles of Bunter origin occur widely on the surface and loamy A horizons are commonly found in many clay soils in Bedford Purlieus. This may indicate either that drift was deposited over the entire area, or it may represent the remnants of a thicker drift removed by erosion. In compartments 47A, 47B, 48A and 49A this thin drift is considerably more conspicuous creating a "bridge" between the deeper drifts of Chalky Boulder Clay and Glacial Sand and Gravel in the west, and Glacial Sand and Gravel in the east.

Soils

No systematic soil survey has previously been undertaken. D.F. Fourt (pers. comm.) gave a brief general description of the soils present (1954). He identified a rendzina on limestone, good base status gleys and gleyed brown earths on Boulder Clay, and degraded brown earths on sandy deposits suggested as being fluvioglacial in origin. During the present work soils were mapped by free survey, involving observations with an auger at 850 sites (c. 4 observations per hectare) arranged as transects to cover the entire wood. The relatively high intensity of observations in relation to normal site soil surveys was considered necessary due to the rapid and marked changes in soils associated with the various geological outcrops. It also, it is hoped, allowed a relatively accurate mapping of the unpredictable but important patches of drift despite some difficulties in identification of decalcified Boulder Clay.

Eleven soil types were distinguished, of which three were further split into phases. Table 4 lists these soils and classifies them in terms of parent material and drainage according to the new system of Avery (1973) developed for use in the Soil Survey of England and Wales. The detailed criteria for classification in this system are unavailable at the time of writing and so slight alterations in nomenclature may be necessary eventually. Equivalent soil sub-group names from more conventional past British usage are also given. Table 4a shows how these different soils may be grouped according to drainage characteristics.

Table 4a

Drainage Class	Soil Groups
Free	1, 2(a), 2(b), 3, 5, 8, 11
Imperfect	6, 9
Poor	4(a), 4(b), 7(a), 7(b), 7(c), 10

When plotted on a map areas showing little variation in the soil characteristics, i.e. with only one soil type present, can be separated as simple mapping units. Areas with two or more soils become complex mapping units. Fig. 13 shows the distribution of soils in Bedford Purlieus.

The main characteristics of the soils identified are explained below, together with variations and profile descriptions of "typical" soils. Analytical data for samples taken from these "typical" soils are listed in Table 5.

Soils on Limestone

The various limestones support freely drained neutral to alkaline soils, mainly of fine loamy texture, and generally with very shallow profiles over solid or rubbly limestone. Plant litter is rapidly and completely incorporated into the mineral soil. Although two soils with deeper profiles are described, these are very limited in area.

1. Brown Rendzina

This soil is by far the most extensive limestone soil. The profiles are shallow and limestone is reached within 40 cm of the surface. They are dominated by fine loamy textures except where minor patches of sandy, silty or clayey drift are added. Soils on the Lincolnshire Limestone are extensively disturbed by relatively high populations of moles and earthworms, thus contributing to a well-developed structure and maintaining a high pH by mixing of limestone fragments with the soil materials. Lincolnshire Limestone soils are generally relatively brightly coloured - yellowish brown or strong brown - whereas Blisworth Limestone (and Upper Estuarine Series Limestone) soils tend to be dark brown or dark grey brown and shallower, with limestone often reached within 20 cm of the surface and with a pronounced fine crumb structure. A small but significant difference in the organic matter content may account for the colour variation. Intimate mixing of limestone with soil materials on the Blisworth and Upper Estuarine Series Limestone results in the whole soil matrix reacting vigourously with acid, whereas Lincolnshire Limestone soils differ in that distinct limestone fragments react with the acid, the soil matrix remaining inert.

This soil can be correlated with the Sherborne Series of the Soil Survey of England and Wales, first described in Somerset and Gloucestershire by A.J. Low (1939) but first mapped in Dorset by K.L. Robinson (1948). Locally, Sherborne Series soils have been mapped by Thomasson (1971) on Inferior Oolite in East Leicestershire and by Burton (pers. comm.) a few miles North East of Bedford Purlieus for the Soil Survey Barnack Record (Sheet TFOOE/10W).

A characteristic profile formed on Lower Lincolnshire Limestone shows:-

Depth (cm)	Horizon	
0-15	A	Yellowish brown (10YR 5/4) friable silty clay loam with weak subangular structure breaking to medium crumb; few subangular limestone fragments and rounded (Bunter) pebbles; earthworms seen; narrow undulating boundary.
15-26	B	Yellowish brown (10YR 5/8) firm silty clay with angular structure associated with common subangular limestone fragments; earthworms seen; sharp tongued boundary.
26-34+	B/C	Strong brown (7.5YR 5/8) clay filling spaces in limestone rubble.

Table 5 - Analytical Results for Bedford Purlieus Soils

Soil Number	Horizon	Horizon Depth (cm)	pH Soil/Water 2.5/1	Loss-on-ignition (%)	Organic Carbon (%) (From L.O.I.)	Total Nitrogen (%)	C/N	Textural Analysis (Avery 1973) % Clay <0.002 (mm)	% Silt 0.002-0.06 (mm)	% Sand >0.06 (mm)	Texture	Wet Bulk Density ($g\ cm^{-3}$)	Exchangeable Cations (me/100 g) Ca	Mg	K	Mn	Cation Exchange Capacity (me/100g)	Extractable Iron Oxides (%) Potassium Pyrophosphate	Oxalic Acid	"Available" P_2O_5 (mg/100 g)**
1	A	0-15	7.65	9.5	3.9	0.39	10.1	24	70	6	silty clay loam	1.4	*	1.2	0.5	0.8	34	N.D.	N.D.	2.4
	B	15-26	7.80	4.9	1.9	0.18	10.3	35	55	10	silty clay	1.6	*	0.7	0.2	0.7	23	N.D.	N.D.	1.0
	B/C	26-34+	8.00	2.9	0.9	0.08	11.6	28	41	31	clay loam	1.9	*	0.8	0.2	1.0	21	N.D.	N.D.	0.7
2(a)	A	0-7	6.75	10.5	4.4	0.47	9.4	28	52	21	humose clay loam	1.3	18.4	0.9	0.9	0.7	38	N.D.	N.D.	1.0
	A/B	7-30	7.05	5.3	2.0	0.23	8.7	28	49	23	clay loam	1.5	*	0.5	0.4	0.8	28	N.D.	N.D.	0.2
	B	30-65	6.95	2.7	0.9	0.12	7.1	28	42	30	clay loam	1.8	14.2	0.5	0.3	0.7	18	N.D.	N.D.	0.1
3	A	4-22	5.65	4.5	1.7	0.17	9.7	13	45	42	sandy silt loam	1.6	3.8	0.5	0.3	0.4	14	N.D.	N.D.	0.5
	B1	22-44	5.15	1.2	0.1	0.04	3.3	12	46	42	sandy silt loam	1.6	1.6	0.1	0.1	0.5	8	N.D.	N.D.	0.1
	B2	44-50	4.70	0.8	0.0	0.02	-	7	13	70	sandy loam	1.7	0.8	0.1	0.0	0.4	3	N.D.	N.D.	0
	C	50-60+	4.90	0.5	0.0	0.01	-	18	27	55	sandy clay loam	2.1	3.1	0.4	0.1	0.5	8	N.D.	N.D.	0
4(a)	Oh/Ah	8-10	3.65	27.4	12.2	0.75	16.2	3	58	39	organic sandy silt loam	<1.0	3.4	0.6	0.8	0.7	69	0.14	0.18	0.5
	A	10-22	3.90	3.6	1.2	0.12	10.2	2	64	33	sandy silt loam	1.5	0.7	0.1	0.1	0.4	15	0.00	0.01	0.4
	Bg	22-34	4.00	0.3	0	0.02	-	3	83	14	silt loam	1.8	0.3	0.0	0.0	0.4	5	0.00	0.01	0.4
	Cg	34-50+	3.95	1.1	0.1	0.03	4.7	6	77	16	silt loam	>2.1	0.3	0.0	0.0	0.4	8	0.15	0.47	0.1
4(b)	A	0-15	4.00	12.0	5.1	0.42	12.2	17	67	16	humose silt loam	1.5	2.1	0.6	0.5	0.5	35	0.22	0.32	0.9
	Bg	15-35	4.00	3.7	1.3	0.13	9.9	18	72	10	silt loam	1.7	1.0	0.2	0.2	0.4	17	0.32	0.48	0.1
	Cg	35-80+	4.10	0.8	0.0	0.02	-	32	60	8	silty clay loam	2.0	0.7	0.1	0.1	0.4	8	0.03	0.26	0.1
5	Ah	0-2	7.15	13.6	5.8	0.66	8.8	44	48	8	humose silty clay	1.6	34.4	1.5	0.9	1.0	58	N.D.	N.D.	2.5
	A	2-18	7.05	8.9	3.7	0.34	10.8	51	41	7	clay	1.9	25.8	1.0	0.7	0.9	49	N.D.	N.D.	1.0
	B1	18-48	6.95	4.0	1.4	0.15	9.6	46	47	7	silty clay	1.9	17.2	0.7	0.6	0.8	33	N.D.	N.D.	0.7
	B/C	48-70+	6.70	4.1	1.5	0.14	10.6	53	39	8	clay	1.8	20.0	0.6	0.7	0.8	35	N.D.	N.D.	0.3
6	A	3-13	6.25	11.0	4.7	0.47	9.9	41	55	4	silty clay	1.9	19.2	1.2	1.0	0.9	45	N.D.	N.D.	1.6
	B	13-38	6.15	5.4	2.1	0.23	9.1	42	50	8	silty clay	1.9	16.0	0.8	0.6	0.8	35	N.D.	N.D.	0.4
	B/C	38-48	5.95	4.6	1.7	0.20	8.5	44	58	8	silty clay	2.1	16.0	0.8	0.6	0.9	33	N.D.	N.D.	0.3
	Cg	48-60+	6.20	2.2	0.6	0.07	8.9	53	39	8	clay	2.1	16.6	0.9	0.8	1.0	28	N.D.	N.D.	0.3
7(a)	Ag/Bg	2-12	6.20	11.2	4.7	0.45	10.5	34	58	8	humose sandy silt loam	1.5	18.8	0.8	0.9	0.8	39	N.D.	N.D.	1.0
	Bg	12-22	5.50	6.2	2.4	0.29	8.4	40	60	1	silty clay	1.8	13.6	1.1	0.5	0.7	31	N.D.	N.D.	0.2
	Bgz	22-52	6.70	3.0	1.0	0.10	9.5	31	59	10	sandy silt loam	2.1	18.4	0.7	0.6	0.8	24	N.D.	N.D.	0.7
	Cgz	52-72+	7.80	1.0	0.1	0.03	4.7	58	37	5	clay	2.0	28.8	7.0	0.6	1.1	28	N.D.	N.D.	0.2
7(b)	Oh/Ah	0-2	4.60	42.3	18.9	1.41	13.5	N.D.	N.D.	N.D.	organic	<1.0	14.4	2.2	1.7	1.1	71	N.D.	N.D.	6.7
	Bg	2-9	4.20	10.6	4.5	0.35	12.7	53	42	5	clay	1.7	6.4	1.3	0.8	0.7	40	N.D.	N.D.	0
	C1gg	9-30	4.30	3.5	1.2	0.08	14.9	84	16	0	clay	1.7	14.1	3.3	1.5	1.0	N.D.	N.D.	N.D.	0
	C2gg	30-60+	4.40	3.2	1.1	0.04	27.0	86	14	0	clay	1.9	19.7	4.7	1.5	0.9	24	N.D.	N.D.	0
8	A1	0-25	8.00	10.6	4.5	0.59	7.6	18	54	28	humose sandy silt loam	1.2	*	0.6	0.4	1.1	38	N.D.	N.D.	9.1
	A2	25-42	8.30	7.8	3.2	0.45	7.0	21	53	27	clay loam	1.6	*	0.5	0.2	1.1	32	N.D.	N.D.	12.4
	C	42-52+	8.40	2.5	0.7	0.10	7.2	N.D.	N.D.	N.D.	-	<1.0	*	0.3	0.0	1.2	28	N.D.	N.D.	≫15.0
9	A	0-15	6.00	13.3	5.7	0.51	11.1	45	44	11	humose clay	1.7	29.6	1.2	0.9	1.0	52	N.D.	N.D.	0.7
	B	15-42	6.80	4.9	1.8	0.16	11.4	59	31	9	silty clay	1.9	*	0.9	0.9	1.1	40	N.D.	N.D.	1.0
	Cg	42-50+	7.80	2.0	0.5	0.06	8.2	42	37	22	clay	2.1	*	0.7	0.5	1.2	23	N.D.	N.D.	1.9
10	Ag	0-15	5.35	8.5	3.5	0.32	10.9	32	51	17	silty clay loam	1.7	10.8	1.4	0.8	0.7	29	N.D.	N.D.	0.5
	Bg	15-35	5.85	3.5	1.2	0.11	11.1	48	32	21	clay	2.1	16.8	1.4	0.6	0.8	28	N.D.	N.D.	0.4
	Cg	35-65+	7.90	3.7	0.4	0.05	8.6	53	32	15	clay	2.1	*	1.5	0.6	1.2	23	N.D.	N.D.	9.7
11	A	0-14	5.80	9.7	4.0	0.33	12.2	32	41	27	clay loam	1.7	10.7	1.1	0.5	0.6	28	0.21	1.37	2.9
	B	14-38	5.70	5.1	2.0	0.13	15.0	29	36	36	clay loam	>2.1	47.0	1.1	0.3	0.5	19	0.12	1.23	4.4
	B/C	38-50+	6.90	4.0	1.4	0.06	23.5	52	31	17	clay	1.9	16.8	0.9	0.4	0.7	29	0.01	1.21	0.4

N.D. Not determined

*Free $CaCO_3$ present.

**Interpretation of phosphate results is rather difficult due to uncertainty in the accuracy of this method. It is doubtful whether a truly satisfactory method exists.

2. (a) Typical brown earth - uncultivated

This deeper soil (with limestone reached at between 40 and 120 cm depth) occurs in some valley bottoms and valley side benches and probably results from accumulation of material derived from limestone soils upslope. However, decalcification of the upper horizons results in the absence of effervescence with acid, despite neutral pH values throughout. The profile is freely drained, but in the deepest profiles a hint of grey mottling in the generally bright brown B horizons may indicate slight drainage impedence, especially as clay textures prevail in the lower horizons of this soil.

Courtney and Webster (1973) summarise soil series associated with the Sherborne Series in Gloucestershire and Wiltshire. The Didmarton Series applies to the valley bottom site of one of the mapped areas, but the Shippon and Haselor Series might also be applied to some of the more extreme profiles occurring at this site.

The freely drained profile found in the valley bottom site is:-

Depth (cm)	Horizon	
0-7	A	Yellowish brown (10YR 5/4) friable stoneless clay loam with fine crumb structure; earthworms seen; diffuse even boundary.
7-30	A/B	Yellowish brown (10YR 5/6) friable stoneless clay loam with coarse angular structure breaking to weak crumb; earthworms seen; diffuse even boundary.
30-65	B	Strong brown (7.5YR 5/8) firm clay with a few angular limestone fragments; manganese concretions present in small clusters.
65+	C	Compact limestone rubble.

(b) Typical brown calcareous earth - cultivated

A small area of Bedford Purlieus is bare of trees and appears to have been cultivated in the recent past. It now supports rough grassland and a few shrubs. The soil profile in this area displays features which support the evidence of cultivation. The upper 25-40 cm is a uniformly brown, well structured material containing drift, pebbles and large angular limestone fragments from beneath. This cultivation horizon is continuous over this area, but the depth of the B horizon and limestone varies considerably. In places at the base of the B horizon limestone has weathered to form a layer up to 50 cm deep of loose oolith "sand".

The profile is calcareous throughout due to mixing during cultivation.

Depth (cm)	Horizon	
0-4	Ah	Grass root mat with dark brown (10YR 4/3) friable fine crumb-structured matrix; sharp undulating boundary.

Depth (cm)	Horizon	
4-35	Ap	Yellowish brown (10YR 5/6) friable slightly stony loam with loose fine subangular structure and common angular oolitic limestone fragments and Bunter pebbles; noticeable proportion of yellow coarse sand-sized ooliths; earthworms seen; diffuse even boundary.
35-70	B/C	Brownish yellow (10YR 6/6) tongues of friable stony loam similar to Ap horizon tonguing down into yellow (2.5Y 7/8) oolith sand; Bunter pebbles and angular limestone fragments in tongues; angular limestone fragments in the oolith sand; earthworms seen; diffuse even boundary.
70-90+	C	Yellow (2.5Y 9/8) stony oolith sand with a few angular limestone fragments.

Soils on Upper Estuarine Series Sand and Silt

3. Typical Brown Earth

The sand of the ironstone bed sand in Bedford Purlieus actually contains little ironstone. A few nodules occur at the extreme base close to the zone of contact with the Lincolnshire Limestone. The degree of iron-staining in the sand varies, causing a patchy appearance similar to the mottling characteristic of gley soils. However, this soil is freely drained and the coloration which varies from white through orange to black is not significant of present drainage conditions.

The depth of this sand bed is not sufficient for the development of a complete soil profile within sand or sandy loam material so that silt from the overlying silt beds or clay derived from the underlying limestone occur at the top and bottom respectively of most profiles. This accounts for the variety of textures - mainly sandy loam but also with sandy silt loams and sandy clay or sandy clay loams - within each profile. Soil structure is poorly developed. The soil is moderately acid (pH 4.5 to 5.5 throughout the profile) leading to a limited fauna and poorly developed soil structure. Litter accumulation results from the poor faunal population.

The boundary between this sandy soil and the more calcareous soils of the underlying limestone is often marked by the change from absence to presence of dog's mercury. Litter accumulation on this sandy soil contrasts with rapid incorporation into the limestone soils which also assists soil identification.

Depth (cm)	Horizon	
0-4	Ol	Litter of sweet chestnut leaves.
4-22	A	Yellowish brown (10YR 5/4) stoneless friable sandy silt loam; coarse weak angular structure breaking to coarse weak crumb; earthworms seen.
22-44	B1	Brownish yellow (10YR 6/6) firm slightly stony sandy silt loam; few platy yellow sandstone fragments; single grain structure; earthworms seen; merging undulating boundary.

Depth (cm)	Horizon	
44-50	B2	Brownish yellow (10YR 6/6) firm slightly stony sandy loam; few platy yellow sandstone fragments; single grain structure; sharp broken boundary.
50-60+	C	Light grey (2.5Y 7/2) stoneless sandy clay loam with very pale brown (10YR 7/4) and reddish yellow (7.5YR 6/8) patches; massive structure.

4. Typical Stagnogley Soil

The Upper Estuarine silt occurs as a relatively hard massive pale grey or white siltstone. The massive nature appears to impede drainage in the soils formed on this material, causing extensive strong brown mottling. However, the latter seems too intensive for the degree of water saturation which might be expected even under the wettest conditions in this profile. The soils are strongly acid (pH <4.5) throughout, and have exceptionally low levels of most plant nutrients due, it seems, to initially low levels in the parent material and not to leaching. Two phases have been identified, depending upon the degree of accumulation or incorporation of surface organic matter, the volume of which is related mainly to the density of bracken. Until recently there was no published information about soils on the Upper Estuarine silt. Burton, 1974 (pers. comm.) has recently mapped such soils for the Barnack sheet (TF 00E/10W) and a Soil Survey Record will appear in the near future.

(a) Mor phase

Certain areas of Bedford Purlieus support very dense, vigorous bracken beneath oak and sweet chestnut woodland and upon a cleared area in C 33. An accumulation of between 2 to 30 cm of bracken litter, humified at its base to a black amorphous material, characterises this soil. The only evidence of incorporation of this organic debris into the mineral soil below is the black staining of the otherwise pale grey-brown structure faces in the upper mineral horizons. The upper contrasting black organic and pale grey mineral horizon of this soil give the appearance of a classic podzol profile. However, no significant humus or iron accumulation in the B horizons has been observed or discovered using analytical methods. The grey coloration is due to parent material, and the ochreous mottling due to drainage impedence, gleying being the main process operating.

Depth (cm)	Horizon	
0-4	Ol	Matted litter of bracken fronds.
4-8	Of	Mat of decomposing bracken fronds.
8-10	Oh/Ah	Very dark greyish brown (10YR 3/2) loose stoneless sandy silt loam composed of distinct small patches of organic and mineral material; single grain structure; sharp smooth boundary.
10-22	A	Pinkish grey (10YR 6/2) stoneless sandy silt loam with brown (7.5YR 5/2) structure faces due to humus staining; very firm, structures large and ill-defined - almost massive; merging smooth boundary.

Depth (cm)	Horizon	
22-34	Bg	Light orange (10YR 7/1) silt loam with large distinct brownish yellow (10YR 6/6) mottles; extremely firm massive structure with hard stone-like grey silt stones; merging smooth boundary.
34-50+	Cg	Light grey/grey (10YR 6/1) silt loam with large distinct brown/dark brown (7.5YR 4/4) and very dark grey brown (10YR 3/2) mottles; extremely firm massive structure becoming hard at depth.

(b) Mull Phase

Incorporation of organic matter into the soil forming a mull humus type results in a finer structured soil A horizon. Soil pH remains extremely acid even in the A horizon, and mottling characteristics indicate similar drainage conditions to the mor phase.

Depth (cm)	Horizon	
0	O1	Few birch leaves.
0-15	A	Very dark brown (10YR 2/2) loose slightly stony silt loam with yellow (2.5Y 8/8) inclusions from Bg horizon: few Bunter pebbles; medium weak angular structure breaking to fine moderate crumb; merging tongued boundary.
15-35	Bg	Yellow (2.5Y 8/8) very firm silt loam with common large light grey (2.5Y 7/0) mottles; coarse strong angular structure; merging smooth boundary.
35-80+	Cg	Light grey (2.5Y 7/0) very firm silt loam with common large brownish yellow (10YR 6/8) mottles; coarse strong prismatic structure with thin silt cutans between structures due to translocation.

Soils on Upper Estuarine Series and Blisworth Clays ; and Clay Colluvium

5. Typical Brown Earth

This freely drained soil in clay displays remarkably uniform profiles. The heavy textured parent material and nature of the sites at which this soil occurs suggest that the profiles should be poorly drained. The reason for the free drainage, despite the receiving site in the main stream valley, is considered to be the underlying limestone, but this reason cannot be applied to those freely drained profiles encountered higher up the valley sides.

Colour, structure and stone content are relatively constant throughout, even in the deepest profiles ($>$120 cm). The inclusion of Bunter pebbles and other erratics indicates considerable mixing of the clay during movement and/or deposition, thus creating a uniform parent material, which has been little altered by soil profile development. The soil reaction is slightly acid to neutral, possibly as a result of flushing or by mixing of limestone with the clay at some stage. This soil has not been correlated with any established Soil Series.

Depth (cm)	Horizon	
0	O1	Few elm leaves; moss growing on soil surface.
0-2	Ah	Very dark grey brown (10YR 3/2) friable slightly stony humose silty clay; few Bunter pebbles; coarse moderate angular structure breaking to medium moderate crumb; earthworms seen; narrow undulating boundary.
2-18	A	Dark brown (10YR 3/3) firm slightly stony clay; few Bunter pebbles; coarse moderate angular structure breaking to medium moderate angular; earthworms seen; diffuse even boundary.
18-48	B1	Yellowish brown (10YR 5/4) firm slightly stony silty clay; few Bunter pebbles; coarse moderate angular structure breaking to fine moderate angular; earthworms seen; diffuse even boundary.
48-70+	B/C	Dark yellowish brown (10YR 4/4) firm slightly stony clay with few Bunter pebbles; coarse moderate angular structure breaking to fine moderate angular.

6. Stagnogleyic (typical) non-calcareous pelosol

This imperfectly drained soil represents the least poorly drained of a range of soils with impeded drainage formed in Upper Estuarine clay and Blisworth Clay or silty clay. Imperfect drainage is indicated by extreme mottling at between 40-80 cm depth, mottling being absent in the top 40 cm. The cracking characteristics of the clay contribute to the strongly developed but coarse structure with prismatic units prevailing in the lower B horizon. The soil is typically non-calcareous, with pH values between 5.5 and 6.5, but calcareous bands occur in the Upper Estuarine Series clay leading to some profiles producing a calcareous reaction, especially at depth. A calcareous reaction is occasionally encountered at the surface where lime-rich water runs down from limestone outcrops immediately upslope.

Depth (cm)	Horizon	
0-3	O1	Loose litter of oak, hazel, hawthorn leaves overlying moss.
3-13	A	Very dark grey brown (2.5Y 3/2) friable slightly stony silty clay with a few ironstone fragments; medium moderate subangular structure; white fungal mycelium between structures; earthworms seen; merging even boundary.
13-38	B	Brown/dark brown (10YR 4/3) firm slightly stony silty clay with a few ironstone fragments; coarse strong angular structure; white fungal mycelium between structures; earthworms seen; merging even boundary.
38-48	B/C	Brown (10YR 5/3) very firm silty clay with a very coarse strong prismatic structure; earthworms seen; merging even boundary.

Depth (cm)	Horizon	
48-60+	Cg	Greenish grey (5GY 5/1) extremely firm clay with abundant large distinct yellowish brown (10YR 5/8) mottles; very coarse strong prismatic structure; earthworms seen.

7. Pelo-stagnogley soil

This is a poorly drained, intensively mottled soil. Shrinkage of the clay when dry causes cracking and a well developed structure in B horizon. Three phases have been identified. The Blisworth Clay poorly drained soils have a noticeably higher clay content (roughly 80%), moderate to extremely acid reaction (pH 4-5), and poor incorporation of litter into the mineral soil, whereas the Upper Estuarine Clay has between 50 and 65% clay, neutral to slightly acid reaction (pH 5.5-7.0) and normally rapid complete litter incorporation.

(a) Upper Estuarine Clay phase

Organic material is relatively deeply incorporated into the mineral horizons, resulting in a dark brown A horizon with small rusty mottles. Below this, there is strongly mottled brown, blue, grey or greenish clay to silty clay, normally with prismatic structure. The profile is slightly acid throughout, but calcareous bands in the clay account for high pH values and effervescence with acid in some B and C horizons. Surface horizons are also occasionally flushed by lime-rich water from limestone outcrops upslope. Small amounts of drift are incorporated into the upper horizons, tending to lighten the texture.

This soil can be correlated with the Denchworth Series mapped originally by Kay (1934) and now recorded from Jurassic clays in many parts of England. Denchworth Series includes soils which are non-calcareous throughout or calcareous only in the C horizon. Profiles which are calcareous in both the B and C horizons, and occasionally throughout the profile correspond to the Evesham Series. These two Series occur in a random manner and as such cannot be separated for mapping purposes.

Depth (cm)	Horizon	
0-2	O1	Oak leaves.
2-12	Ag/Bg	Dark brown (10YR 3/3) greasy stoneless sandy silt loam with common fine distinct rusty mottles; coarse moderate angular structure breaking to medium moderate subangular; earthworms seen; merging undulating boundary.
12-22	Bg	Dark brown (10YR 3/3) sticky stoneless silty clay with common medium distinct yellowish brown (10YR 5/8) mottles; coarse moderate angular structure; earthworms seen; merging undulating boundary.
22-52	Bgg	Olive (5Y 5/3) sticky stoneless silty clay with common medium distinct greenish grey (5BG 5/1) and common large distinct yellowish brown (10YR 5/8) mottles; coarse moderate angular structure; merging undulating boundary.

Depth (cm)	Horizon	
52-72+	Cgg	Olive (5Y 4/3) plastic clay with common medium faint dark bluish grey (5B 4/1) mottles; large prismatic structure with a hint of slickensiding on some structure surfaces.

(b) Blisworth Clay phase

This phase is very similar to the Upper Estuarine clay phase. The main difference is the higher clay percentage (c. 80%) leading to even poorer drainage conditions with extensive, very bright mottling to within a few centimetres of the surface. The soil was not found to be calcareous in any profiles examined. This soil again corresponds with the Denchworth Series.

Depth (cm)	Horizon	
0-2	Oh/Ah	Very dark grey brown (2.5Y 3/2) partially decomposed organic debris mixed with mineral material and a few Bunter pebbles; very friable; very fine weak crumb structure; earthworms seen; sharp wavy boundary.
2-9	Bg	Dark greyish brown (10YR 4/2) firm clay with brownish yellow (10YR 6/6) ped faces and a few medium distinct reddish yellow (7.5YR 7/8) mottles; medium moderate angular structure; earthworms seen; sharp wavy boundary.
9-30	C1gg	Light olive grey (5Y 6/2) very firm clay with olive grey (5Y 5/2) ped faces and abundant large prominent strong brown (7.5YR 5/8) mottles; very coarse strong angular structure; earthworms seen; merging wavy boundary.
30-60+	C2gg	Light grey/grey very firm clay with abundant large distinct reddish eyllow (7.5YR 6/8) mottles; coarse prismatic structure.

(c) Thin drift over Upper Estuarine Clay phase

There is a significant contribution of coarse loamy pebbly drift to the upper 30 cm of this soil formed in Upper Estuarine Clay. Drainage is poor and mottling occurs to within about 10 cm of the surface. At about 50 cm depth unmottled blue-grey clay occurs. This is parent material colouring and indicates reducing conditions for a considerable proportion of the year as mottling would otherwise be expected. This addition of drift to the surface may improve the surface drainage compared with 7(a), but the significance of this is doubtful. Analytical data for this soil is not available.

Depth (cm)	Horizon	
0	Ol	Few oak leaves.
0-12	A	Dark grey brown (10YR 4/2) sandy clay loam with a few Bunter pebbles and angular flints; sticky, medium subangular structure; merging wavy boundary.

Depth (cm)	Horizon	
12-50	Bg	Light yellowish brown (10YR 6/4) sandy silt loam with abundant greenish grey (5BG 6/1) mottles, a few Bunter pebbles and angular flints; sticky, medium subangular structure; merging wavy boundary.
50-70+	C	Bluish grey (5B 6/1) sticky clay with a few Bunter pebbles at top of horizon; massive structure but with abundant roots.

Soil on Calcareous Tufa

8. Grey (non-humic) rendzina

The porous calcareous tufa provides an extremely well drained parent material, despite the receiving site below the outcrop of the Blisworth Limestone. The profile is deep and remarkably uniform with dark brown friable crumb-structured fine loamy A horizon, highly porous with organic matter intimately incorporated throughout. Small lumps of white tufa are included throughout, especially in the lower half of the A horizon resulting in a slightly lighter coloration. The whole profile is highly calcareous with pH values higher than 8.0. Moles and earthworms are abundant, the large number of mole hills and the nature of the material which they bring to the surface providing an accurate method of mapping this soil. A striking feature is the large number of empty snail shells to be found scattered on the ground surface and throughout the A horizon. Occasional shells were observed in the tufa itself. Investigation would decide whether the snails have been living recently in the soil or are fossils of snails contemporary with the deposition of the tufa in a freshwater environment.

At the base of the A horizon, there is an abrupt boundary with the tufa. There is surprisingly little mixing of the A horizon with the tufa below.

Soils on calcareous tufa have been mapped under different series names in other parts of the country but have not yet been described from the region around Bedford Purlieus.

Depth (cm)	Horizon	
0-25	A1	Dark brown (10YR 3/3) friable humose sandy silt loam; medium weak subangular structure breaking to fine moderate crumb; few small fragments of soft tufa; common snail shells present; earthworms seen; merging smooth boundary.
25-42	A2	Brown (10YR 5/3) friable clay loam; medium weak subangular structure breaking to fine moderate crumb; common small fragments of soft tufa; common snail shells; earthworms seen; sharp wavy boundary.
42-52+	C	White (10YR 8/2) firm porous calcareous tufa with a few small dark brown A horizon inclusions; massive structure but readily broken into fine crumb structure; few snail shells.

Soils on Glacial Drift

Drainage in the heavy textured Chalky Boulder Clay soils is impeded, especially on plateaux areas where the bulk of this deposit occurs, due to poor lateral and vertical water movement in the soil profile. On slopes, lateral drainage is relatively significant and the Chalky Boulder Clay thinner, resulting in imperfect rather than poor drainage. Well developed structure in the upper horizons has helped leaching and decalcification. Chalk fragments are usually found within 4.0 cm of the surface in the poorly drained profiles, but at greater depth in the imperfectly drained equivalents. Flint and Bunter pebbles remain scattered throughout the profiles.

9. Stagnogleyic (typical) non-calcareous pelosol

This imperfectly drained soil is restricted to the edges of the Chalky Boulder Clay deposit or on slopes. Chalk is restricted to depths greater than 40 cm in the profile, the upper 40 cm being non-calcareous, despite pH values between 6 and 7, and thus justifying the "non-calcareous" qualification in the name. The soil has freely drained A and B horizons, but the C horizon is extremely mottled.

This soil corresponds to the chief variant of the Ragdale Series described by Thamasson (1971) in Leicestershire.

Depth (cm)	Horizon	
0	O1	Few oak leaves.
0-15	A	Very dark grey brown (2.5Y 3/2) firm slightly stony clay; few small and medium angular and rounded flints; medium weak angular structure breaking to fine weak angular structure; earthworms seen; merging even boundary.
15-42	B	Yellowish brown (10YR 5/4) firm slightly stony silty clay; few small and medium angular flint and rounded flint and ironstone fragments; coarse weak angular structure breaking to medium weak subangular; earthworms seen; merging even boundary.
42-50+	Cg	Light olive brown (2.5Y 5/6) sticky gritty clay with common medium faint ochreous mottles; small rounded chalk fragments, small angular flint, ironstone and oolitic limestone fragments; massive structure; earthworms seen; water running into bottom of pit.

10. Pelo-stagnogley soil

In the poorly drained Chalky Boulder Clay soils, chalk is encountered between 30 and 80 cm depth from the surface, and the A and B horizons are less deep. There is mottling throughout the profile. The profile is slightly acid in the A and B horizons, but neutral in the C where chalk occurs.

The Ragdale Series (Thomasson 1971) corresponds closely to the majority of profiles with $CaCO_3$ below 40 cm depth, and a mixed variant of the Ragdale Series applies to the profiles with $CaCO_3$ within 40 cm of the surface.

Depth (cm)	Horizon	
0	Oh	Few oak leaves.
0-15	Ag	Brown/dark brown (10YR 4/3) plastic slightly stony silty clay loam; few very fine faint ochreous mottles

Depth (cm)	Horizon	
		and a few medium rounded Bunter pebbles; medium moderate subangular structure breaking to fine weak crumb; earthworms seen; merging even boundary.
15-35	Bg	Olive grey (5Y 5/2) plastic slightly stony clay with common medium distinct yellowish brown (10YR 5/8) mottles; small rounded Bunter pebbles and shelly limestone fragments, and small angular flints; coarse moderate angular structure; earthworms seen; merging even boundary.
35-65+	Cg	Light brownish grey (2.5Y 6/2) plastic slightly stony clay with light grey/grey (5Y 6/1) ped faces and common medium distinct reddish yellow (7.5YR 6/8) mottles; small subangular and rounded chalk fragments, small angular flints, and small angular and subangular oolitic limestone fragments; massive structure; earthworms seen.

11. Typical Brown Earth

This freely drained, well structured friable soil is characterised by the abundance of fine gravel-sized ironstone in a clay loam matrix. The parent material is Glacial Sand and Gravel and the soil occupies an area capping a low hill in the south east of Bedford Purlieus. The ironstone is considered to contribute to the strong brown "rusty" coloration of the crumb-structured soil matrix. Coloration and structure are relatively uniform throughout the profile, although where the drift thins over Upper Estuarine Limestone or Clay, a lithological boundary occurs at depth.

This soil has not been correlated with any existing published soil series.

Depth (cm)	Horizon	
0	Oh	Few oak leaves.
0-14	A	Dark yellowish brown (10YR 4/4) very stony friable clay loam with abundant subangular, rounded and platy ironstone fine gravel with a few medium and large rounded Bunter pebbles; fine moderate crumb structure; earthworms seen; diffuse even boundary.
14-38	B	Strong brown (7.5YR 5/8) very stony friable clay loam with stones as above; medium weak angular structure breaking to medium weak crumb; earthworms seen; diffuse even boundary.
38-50+	B/C	Strong brown (7.5YR 5/8) massive very stony plastic clay with ironstone gravel as above but no Bunter pebbles.

Discussion

A wide variety of lowland soils is represented in Bedford Purlieus. The main influence is that of geology, contributing parent materials with a range from highly calcareous limestones and tufa through to highly acid silt and sand. Textures and drainage characteristics range from poorly drained heavy clays to freely drained sandy loams. Local relief and porosity of underlying strata act on the clay soils resulting in a spectrum of drainage classes from poor to free. As can be seen from Figures 12 and 13, geological and some soil boundaries follow a similar trend, reflecting the geological influence on the soils. Other soil boundaries do not correspond with geological boundaries. These reflect drainage differences, textural variation within the Upper Estuarine Series outcrop, effects of cultivation, depth of profile and they also separate complex mapping units from simple units.

During field mapping it was observed that certain plant species were associated with specific soil types or groups of soil types, and that some species were correspondingly absent. As might be expected ash and lime are generally confined to limestone soils, whereas sweet chestnut and bracken occur mainly on the acid silt and sand doils of the Upper Estuarine Series. Dense bracken and a deep litter is associated with certain areas of the silt outcrop. Dog's mercury is widespread and abundant on soils of high base status. It is absent from the Blisworth Clay and acid silt and sand soils but is found in isolated clumps on the flushed imperfectly and poorly drained Upper Estuarine Series clays, sparsely scattered on Chalky Boulder Clay soils and abundant on the soils formed on limestone, Clay Colluvium, Calcareous Tufa and Glacial Sand and Gravel.

As might be expected Deschampsia cespitosa is restricted mainly to soils with imperfect or poor drainage either due to preference or exclusion from more freely drained sites. The main exception is the freely drained brown earth formed on Clay Colluvium in the valley bottom site which supports a large population of this plant. The receiving site ensures an influx of water which passes readily through the soil. However, seasonal waterlogging is conceivable, thus explaining the occurrence of this species in this site. The imperfectly and poorly drained Upper Estuarine Clay and Chalky Boulder Clay soils support Deschampsia cespitosa at varying densities, but the poorly drained Blisworth Clay supports only scattered tufts of the grass.

Although some generalisations can be made relating plant species with soil types from direct observation, it was considered possible that a map showing the distribution of pH values for these soils would be of greater use for these relationships. A soil core sampling programme was therefore undertaken utilising a rough grid system based upon ride intersections. At about 250 points, 0-10 cm and 10-20 cm samples were taken for pH testing. The resulting values were plotted and two maps produced (Figs. 14 and 15), one of each depth of sample. These maps again generally reflect parent material, but minor variations between the two pH maps, the geology and soils maps may reflect the influence of vegetation, land-use history or thin surface drift.

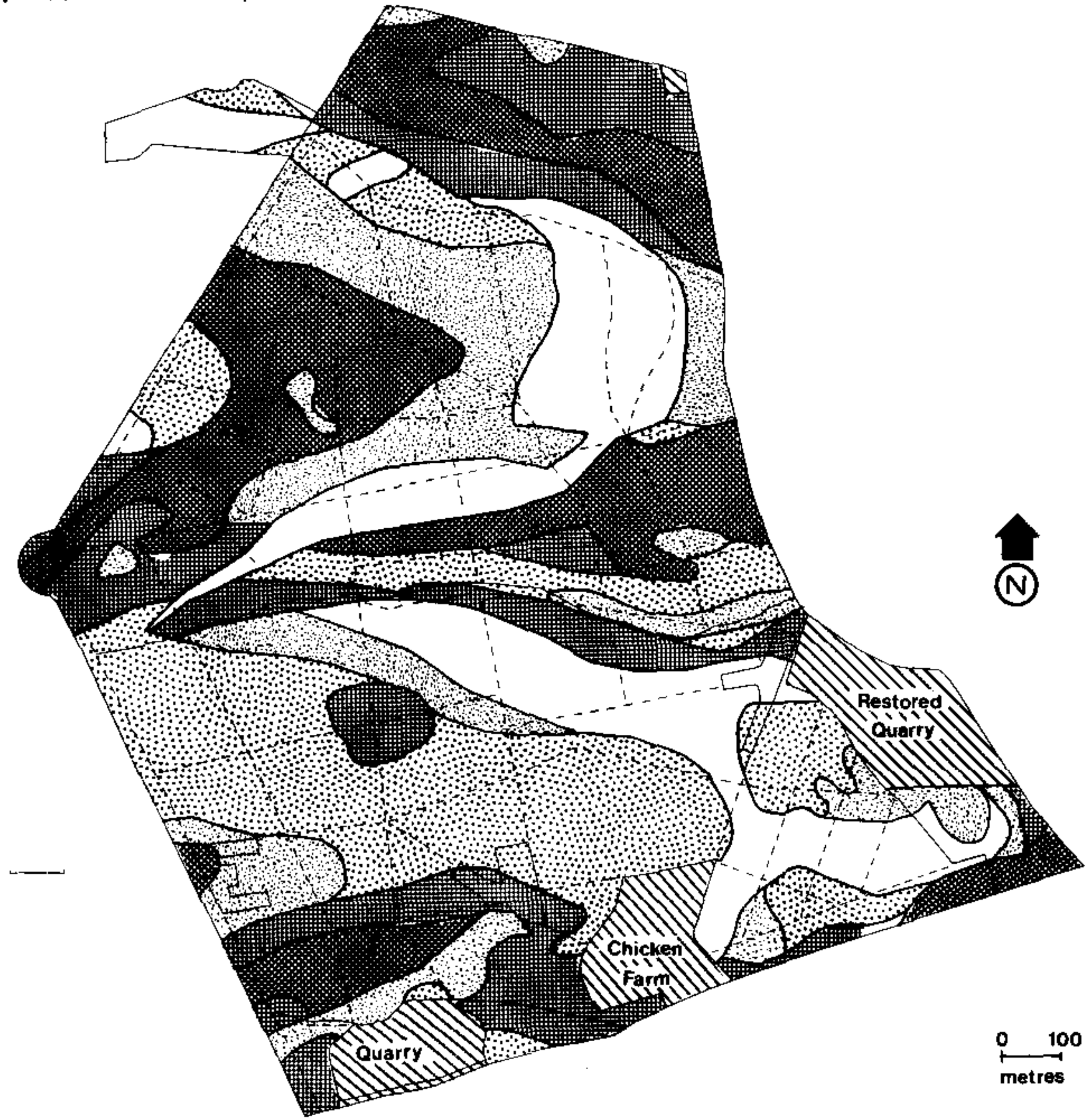
Conservation and Management Requirements

The mineral resources of the wood are relatively valuable. Lincolnshire Limestone has been quarried extensively adjacent to Bedford Purlieus and the reconstituted land of Compartment 50A is a restored limestone quarry. Considerable areas within Bedford Purlieus would probably be considered suitable for limestone extraction. At the recently closed quarry near Hunting Gate, Upper Estuarine Series silt was removed for use as a refractory material. The silt band crops out in Bedford Purlieus and can be traced by the incidence of small pits, obviously man-made and not of recent origin, for extraction of the silt. This product is probably still of economic value.

14. Distribution of pH at 0-10 cm depth.

Soil pH 0-10cm

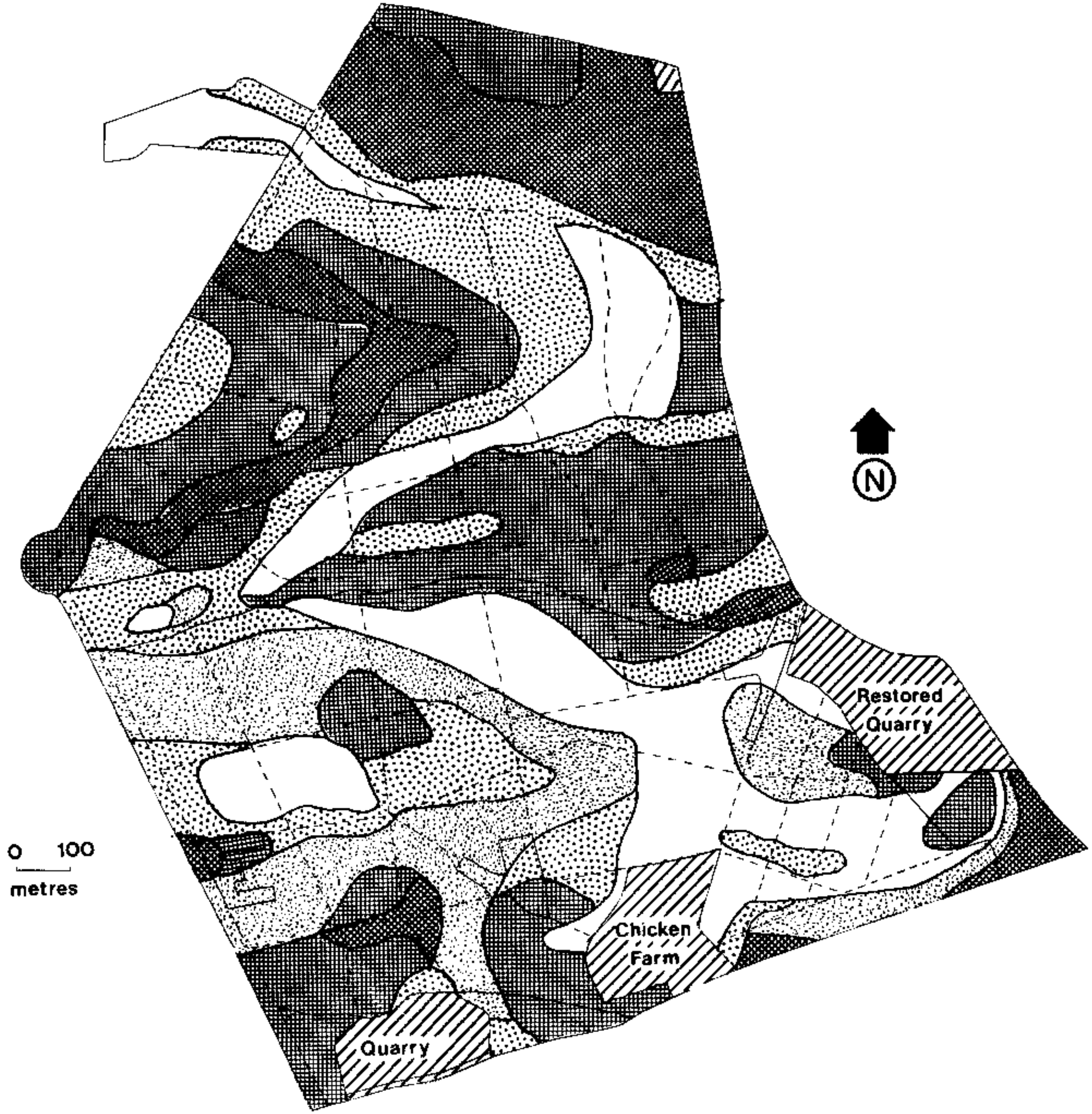
Soil Reaction	pH (in water)
Strongly Acid	< 4·5
Moderately Acid	4·5 - 5·5
Slightly Acid	5·5 - 6·5
Neutral	6·5 - 7·5
Alkaline	> 7·5
Areas not sampled	



15. Distribution of pH at 10-20 cm depth.

Soil pH 10 - 20cm

Soil Reaction	pH (in water)
Strongly Acid	< 4·5
Moderately Acid	4·5 - 5·5
Slightly Acid	5·5 - 6·5
Neutral	6·5 - 7·5
Alkaline	> 7·5
Areas not sampled	



The whole of Bedford Purlieus may be considered as a valuable site for soil conservation. The soils present are now only rarely found in an uncultivated form, especially in this area of eastern England but should be compared to those of Castor Hanglands N.N.R., five miles to the ENE, which is situated mainly on the same geological formations so that similar soils might be expected there.

Bedford Purlieus displays a considerable variety of soils for such a small area, obviously a factor explaining the diversity of the wood's flora. Observations suggest that only one small area has been cultivated in the past. On a national basis, the limestone, Chalky Boulder Clay and Upper Estuarine clay soils are relatively common and widely distributed. However, the Upper Estuarine silt, Glacial Sand and Gravel and Calcareous Tufa soils are more localised and rare, especially the latter two. The silt soils present several opportunities for research, including assessment of the drainage status throughout the year, and investigation of any tendency towards podzolisation.

The age of the Calcareous Tufa is believed to be post-glacial, but further work to confirm this could be undertaken. The site of this deposit has obviously provided a popular habitat for snails, judging by the numbers of empty shells above and below the soil surface.

The very high ironstone content of Glacial Sand and Gravel is unusual. Further work could be done to decide the age of this drift in relation to the Chalky Boulder Clay and other drifts in the region.

The uncultivated nature of the soils should be preserved. The present management of opening-up rides and some compartments appears to have little lasting effect on the soils, although use of heavy machinery on the clay soils might cause structural deterioration leading to compaction and drainage problems of a more permanent nature.

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FIELD LAYER COMMUNITIES

G.F. Peterken

Introduction

A casual visitor will most readily appreciate the great natural variety of Bedford Purlieus through the field layer. Along the ride between C33 and C34 into C40 one can pass in less than 30 m from a community dominated by Rubus fruticosus and Deschampsia cespitosa, through a belt of Pteridium aquilinum with Convallaria majalis, Luzula sylvatica and Holcus mollis, into a community dominated by Mercurialis perennis. Distinct though they are, with no species in common, these communities do not have sharp boundaries. They merge into each other through narrow transition zones where the species of adjacent communities are mixed together, and where detached patches of one community occur surrounded by the other. The same communities can be recognised elsewhere in the wood, but they tend to lose their distinct identity as the dominant species occur in different combinations (such as M. perennis with D. cespitosa), as other apparently distinct communities are found, and as a multiplicity of transitional communities appear to cover more ground than the apparently distinct types one recognised initially.

The field layer thus appears to be a multidimensional continuum, with few or no homogeneous communities retaining their characteristics throughout the site. They have been described by two means, (i) sample plots placed at intervals throughout the wood in which a number of features were recorded in detail, and (ii) maps of six community dominants. Sample plots have been grouped on the basis of common soil and floristic characteristics to produce four broad ground flora types. Finally, the occurrence of each "type" elsewhere in Britain is examined.

Sample Sites

The original purpose of the sample plots was to obtain as quickly as possible an understanding of the range of ecological variation and precise observations of particular points in the wood which would provide the basis of management proposals and the descriptive material to support these. Completed two years before Stevens' soil survey, samples were subjectively located to include the entire range of ecological variation. They were deliberately placed more or less evenly throughout those parts which had not been reforested with conifers (Fig. 16).

In each of the square, 30 m x 30 m plots various features of the vegetation and site were recorded. These included a complete list of vascular plants, and the soil characteristics revealed in a pit dug in the centre. The soil characteristics and flora of sample plots are summarised in Tables 6 and 7.

Grouping of Sample Sites

As an aid to description, sample sites have been grouped on the basis of soil and floristic features. Display of three soil features (Fig. 17) demonstrates one homogeneous group of calcareous, freely drained, relatively light soils (Group A). No clear groups are revealed within the remaining samples by soil characteristics, but floristic features (Tables 7 and 8) show that samples 10 and 12 are sufficiently alike, but distinct from all others to form a small Group D. The remaining samples are predominantly on poorly drained, heavy soils with a wide pH range. The three most acid of these, the most closely related to Group D (Table 9), are well separated on pH from the rest, and form Group C. The remainder have been left undivided as Group B.

Two samples fit uneasily into this pattern. Sample 5 was apparently a brown rendzina overlain with a thin stratum of light, acid drift. Floristically, it was most closely related to Groups A and B, but as a freely-drained soil seemed best placed with Group A. Sample 13, in the "pivotal" position of Fig. 17, appears to have a fairly close relationship with all groups, though closer to B and C than the others. Though it has been placed with Group B, it seems naturally intermediate. (Indeed, in the field, before the last 11 samples had been recorded and before any grouping took place, I described it as "a curious type, transitional to many others"!)

Soil Characteristics of Sample Groups

Group A (10 samples)

A distinct, homogeneous group on freely drained, calcareous loams, developed over limestone and material derived from limestone. Classified as brown rendzinas, with some brown earth and grey rendzina. Occupy all topographical positions. Surface litter accumulates only in response to excessive drainage in surface horizons.

Group B (9 samples)

Mainly poor or very poorly drained, heavy soils of neutral and mildly acid reaction, all classified as stagnogleys. Developed on a variety of strata on predominantly plateau and flushed situations.

Group C (3 samples)

Poorly drained, strongly acid clay loams, all stagnogleys on Upper Estuarine silt. Moderate litter accumulation in response to acid conditions. All samples had a shallow surface horizon of freely-drained loams, unlike Group B in which the texture remained heavy to the surface.

Group D (2 samples)

Light, strongly acid soils developed on Upper Estuarine Silt, with freely drained surface horizons. Subsoil heavier, and slightly mottled. Slight podsolic characters in Sample 10.

Field Layer Communities in Samples

The vascular plant species present in each sample are listed in Table 7, in broad quantitative categories. The degree of similarity between any one sample and all others (Table 8) demonstrates the complex relationships, and the absence of really sharp differences between the flora on different soil types. Only Group D is distinct, for sample 10 would have been as dissimilar to other samples as sample 12 if *Carex remota*, *Luzula pilosa* and *Primula vulgaris* had not been recorded in a damp depression penetrating to heavier soils.

The field layer community corresponding with the four site classes can be characterised by three features summarised in Table 9. Constant species are those present in all or nearly all samples in the group. Faithful species are those, not being constant to any group, which are nevertheless confined to one or two groups. Quantitative characteristics were recorded only in broadest terms, but some species constant to more than one group tend to be common or abundant in only one group.

The ecology in relation to soil characteristics of most field layer species corresponds with what is known of their ecology throughout Eastern and Central England. Two minor divergences are Endymion non-scriptus, which is not normally so strongly calcicole, and Melica uniflora, which is normally confined to freely drained soils. Endymion may be responding more to free soil drainage, which in Bedford Purlieus occurs mainly on the extremes of the pH range.

Any attempt to map the field layer communities in terms of these four groups would produce a map in which either the pattern would be confused by a substantial area of intermediate conditions, or clarity achieved only by considerable simplification. An alternative method was therefore attempted, by which six species indicative of certain soil characteristics, were individually mapped.

Maps of Indicator Species

Six field layer species were mapped throughout the primary part of Bedford Purlieus in June 1972. Individually and in combination they were believed to indicate certain soil characteristics, and thereby provide material for a crude map of soil types. Since then, Mr. P. Stevens has completed a detailed soil survey in which they were, to some extent, used as a means of defining the boundaries of types defined by profiles. Nevertheless, the maps are included here because they illustrate and emphasise certain important features in the ecology of Bedford Purlieus.

The maps (Figs. 18-23) show where each of the species is a significant component of the field layer. This, in practice, is mainly where the species are dominant and co-dominant, but under dense shade, where the field layer is sparse, the species were 'significant' if they were frequent and widespread. The maps are thus a simplification of the actual distribution, which attempts to eliminate the differences resulting from the different shade/litter conditions under coniferous and other dense stands.

The six species, and the conditions they indicate when they are present in 'significant' quantities are:-

1. Mercurialis perennis. Constant in Groups A and B, but conspicuously more abundant in A. Indicates freely-drained, neutral and calcareous soils, but may occur (Sample 17) on perpetually moist receiving sites with very poor profile drainage where pebbles, a sand fraction and proximity to a watercourse facilitate water movement.

2. Pteridium aquilinum. Constant of Groups C and D, and thus generally complementary to Mercurialis perennis. However in C43 these species occur together (Sample 14) on a brown rendzina. Pteridium is thus indicative of soils with a relatively light, freely-drained surface horizon which in Bedford Purlieus occur mainly on acid soils, but not invariably so.

3. Deschampsia cespitosa. Constant in Groups A, B and C but abundant mainly in B. An indicator of poorly drained soils and those with constant flushing through inherently freely-drained soils. Complementary to Pteridium, but their tolerances of drainage conditions overlap in Group C soils.

4. Rubus fruticosus. The other widespread field layer dominant is a low-arching, rather hairy Rubus which appears to belong to Section Sylvatici-Virescentes and/or to Section Appendiculati-Vestiti. They are widespread and somewhat erratic in their occurrence, but are constant to Groups B and C, where they are often abundant. They appear to indicate neutral to mildly acid, heavy soils, irrespective of drainage conditions.

5. Galeobdolon luteum. Constant in Group A only, but often occurs on the margins of main Mercurialis zones.

6. Urtica dioica. Indicative of high phosphate, and generally of eutrophic soils. Often abundant in secondary woods on old arable or habitation sites, nettles in Bedford Purlieus are almost confined to the main valley, there they probably indicate naturally phosphate-rich soils, supplemented by fertiliser washed from the fields to the west.

The maps demonstrate a number of important features:-

(i) the extremely complex patterns of certain soil characteristics. The soil map shows much of this pattern but simplified by recognising complexes of soil types.

(ii) The detailed distribution of the soil characteristics indicated by each species, and the precise soil characteristics indicated by the zones along which two or more species overlap.

(iii) The difficulty of recognising field layer types on the basis of dominant species. Whilst, e.g., a Mercury society and a Deschampsia society can be found the two grade into each other over an area which forms a substantial fraction of their individual ranges (Fig. 24).

Similar Sites

Where does Bedford Purlieus stand in the national range of woodland variation? Or, to rephrase the question, where do ecologically similar sites occur? Perhaps the most useful approach is to examine the field layer and soils together but separate from the tree and shrub communities, which may have been deliberately altered by management.

Published descriptions of woodland communities are insufficient for the purpose in hand. One knows that, e.g., Mercurialis-dominated communities occur widely on chalk, limestone and the more calcareous clays, and that Pteridium is dominant on light, well drained soils throughout Britain, but this is a crude level of similarity. Greater precision would have been possible if more descriptions of woodland communities had been published comparable with McVean and Ratcliffe (1962) for Scottish mountain vegetation. In the absence of suitable published information, I have relied on my own field notes in the form of approximately 400 samples recorded in England and South Wales by the same system as the 24 samples in Bedford Purlieus. The geographical spread of these samples, though wide, is inevitably deficient, with substantial gaps, and a strong bias to Eastern England and the S.W. Midlands.

Samples were judged to be 'similar' to a Bedford Purlieus group if all, or all but one, of the constant species were present. Thus, samples similar to Group A have all, or any six, of the seven constant species present. The only variation in this definition affected Group D, where two samples were admitted which had all three dominant constants (Convallaria, Luzula sylvatica and Pteridium). The list of similar samples (Tables 10-13) is supplemented by three soil features and the geological stratum on which the soil has formed.

Sites defined as similar to Group A on purely floristic grounds occur on similar soils, but the range of soil characteristics is wider (Table 10). In addition to the 20 similar sites listed, samples 15, 16, 17 and 20 in Bedford Purlieus, all of which occur in Group B, are 'similar'. This should not be seen as a defect in an attempt at classification, for it simply indicates the distribution of those portions of woodland which are close to Bedford Purlieus Group A sites in the continuum of British woodland vegetation : it is realistic to identify some of those sites within Bedford Purlieus itself.

Sites similar to Group A samples (Table 10) occur in two main areas. One on heavy-neutral-calcareous soils formed from Boulder Clay in Eastern and Midland England, is geographically close to Bedford Purlieus. The other is on the more southerly outcrops of limestone in the Welsh borderland and S.W. England, where the soils are uniformly calcareous and freely drained, exactly like Group A. Curiously, no examples on oolitic limestone were picked out. Group B shows a similar distribution (Table 11), and so does Group D in vestigial form (Table 13). Sites similar to Group D are, however, restricted in their occurrence by the ecology of Convallaria, which is calcifuge in the Lowland Zone and calcicole in the Highland Zone.

Sites similar to Group C floristically (Table 12) are remarkably similar in soil characters, with only two anomalies. Sample 71 was a very rich community at the base of a steep limestone slope perpetually flushed, and Sample 85, on a light soil, had apparently been heavily trampled by sheep in the recent past: these had puddled the soil surface, allowing Deschampsia cespitosa to spread onto a site from which it may once have been absent. Apart from these, the similar sites are either on Keuper Marl or various forms of clay in Eastern and Midland England. Like the Group C samples, many of these 'similar' sites have a relatively light, acid, freely-drained horizon, over a relatively heavy, strongly-mottled subsoil.

REFERENCE

McVean, D.N. & Ratcliffe, D.A. 1962. Plant communities of the Scottish Highlands. London, H.M.S.O.

Table 6. Soil features of sample sites in Bedford Purlieus

	A										B									C			D	
	8	1	7	21	19	3	9	4	14	5	16	17	20	15	24	2	23	18	13	11	6	22	10	12
pH	8.0	8.0	7.8	7.9	7.8	8.2	7.8	6.9	8.0	5.6	5.2	6.4	5.5	5.6	6.1	5.9	5.4	5.1	4.8	4.4	4.4	4.1	4.0	4.1
Surface humus depth (cm)	t	o	o	o	o	o	o	o	t	t	t	o	t	t	t	4	t	t	t	2	3	9	7	6
Texture	SL	CL	SCL	CL	SCL	SCL	SCL	L	SL	SL	CL	SC	CL	C	SiC	SiC	C	SCL	SL	CL	SiCL	SiCL	SiL	SCL
Profile drainage: depth to mottles (cm)	No	No	No	No	No	No	No	No	No	No	29	1	29	5	8	4	14	12	+	8	13	21	14	27
Site Drainage	N	N(P)	R	N	N	R	R	N	N	R	N(P)	R	N(P)	Fl	N(P)	Fl	N	N(P)	R	N(P)	N	Sr	N	N
Parent Material	LLL	BL	LLL	BL	BL	CC	LLL	BL	LLL	LLL*	BC	CBC	CBC	CBC	UES	UES	UES	CBC	LLL*	UES	UES	UES	UES	UES
Soil Type	BR	BR	BE	BR	BR	BE	BR	BR	BR	BR*	SG	SGP	SG	PSG	PSG	SG	PSG	PSG	BR*	SG	PSG	SGT	SGT	SGT

KEY:

* overlain with acid drift

pH : Measured with 2:5 soil distilled water with Pye 293 Model

Humus depth : t = trace

Texture : "Field" techniques. Sand; Clay; Loam; Silt.

Profile drainage : Depth of consistently mottled horizon.
\+ S13 had a good structure, but faint mottles occurred to the surface.

Site drainage : Normal; Receiving; Sr Slightly receiving; (P)lateau situation; Flushed site on slope.

Parent Material : After Stevens

- LLL Lower Lincolnshire Limestone
- BL Blisworth Limestone
- CC Clay Colluvium
- CBC Chalky Boulder Clay
- BC Blisworth Clay
- UES Upper Estuarine Series

Soil Type : After Stevens

- BR Brown Rendzina
- GR Grey Rendzina
- BE Brown Earth
- SG Stagnogley (general)
- SGT Stagnogley (typical)
- SGP Stagnogleyic non-calcareous pelosol
- PSG Pelo-stagnogley

Table 7. Distribution of ground flora species in the sample sites

	A										B									C			D		Frequency
	8	1	7	21	19	3	9	4	14	5	16	17	20	15	24	2	23	18	13	11	6	22	10	12	
Agrostis canina										+									+						2
Ajuga reptans		+										+	+	+				+	+						6
Alliaria petiolata			+																						1
Allium ursinum			LD																						1
Anemone nemorosa	+	+	+	+	+	+	C	+	+	A	+	+	+	+	C	C	+	+	C	+	+	+	+		23
Angelica sylvestris	+					+									+										3
Anthoxanthum odoratum																					+		+	+	3
Arctium minus			+																						1
Arum maculatum	C	+	+	+	+	+	+	+	+	+	+	+	+	+		+									15
Blechnum spicant																							+		1
Brachypodium sylvaticum					+	+				+	+	+	+		+										7
Calamagrostis epigejos																								+	1
Campanula trachelium	+				+	+																			3
Carex remota											+		+										(+)		3
C. sylvatica			+			+		+	+	+	+		+	+		+	+	+	+	+					13
Chamaenerion angustifolium																								+	1
Circaea lutetiana											+	+			+										3
Cirsium palustre			+												+										2
C. vulgare															+										1
Conopodium majus										C								+							2
Convallaria majalis																							C	C	2
Deschampsia caespitosa		+	+	+	+	C	+	+	+	+	C	A	+	A	+	A	+	+	C	C	+	+			21
Dryopteris austriaca																						+	+		2
D. filix-mas							+			+		+	+	+	+			+			+	+			9
D. spinulosa															+			+			+				3
Endymion nonscriptus	A	C		A	C	+	C	A	C	A			+	+				+	+						13
Euphorbia amygdaloides																			+						1
Festuca gigantea						+																			1
Filipendula ulmaria			+			+					+	+			+										5
Galeobdolon luteum	+	A	+	C	C	C		A	LA	C	LA														10

	A										B									C			D		Frequency
	8	1	7	21	19	3	9	4	14	5	16	17	20	15	24	2	23	18	13	11	6	22	10	12	
Galium aparine		+				+						+				+									4
Geum rivale														+											1
G. urbanum							+	+																	2
Glechoma hederacea			C			+						+										+			4
Hedera helix	+			A	C		+			+			C		+					+					8
Heracleum sphondylium				+			+					+													3
Holcus mollis																			+		+				2
Hypericum hirsutum			+																						1
Hypericum sp. (seedlings)							+					+		+					+						4
Listera ovata					+										+										2
Lonicera periclymenum													+	+	+	+	+	C	+	+	+	+	+	+	13
Luzula pilosa									+		+		+	+			+	+	+	+	C	C	(+)	+	12
L. sylvatica																							A	C	2
Melica uniflora				+	+				+	+		+					+								6
Mercurialis perennis	D	A	C	C	A	D	A	A	LA	A	+	A	+	+	+		+	+	+						18
Milium effusum																		C			+				2
Moehringia trinervia										+											+				2
Orchis mascula				+	+	+	+				+														5
Oxalis acetosella																		+				+			2
Paris quadrifolia						+		+																	2
Pastinaca sativa							+																		1
Platanthera chlorantha															+		+								2
Poa trivialis			A	+		C	C	+		+	+	A	+		+		+				+				12
Polygonum aviculare														+											1
Potentilla sterilis									+	+	+		+	+											5
Primula vulgaris	+		+	+	+			+	+	C	+	+	+	+	+		+			+			(+)		15
Pteridium aquilinum									+								+			+	C	C	D	D	7
Ranunculus ficaria			+				+					+	+												4
R. repens			+																						1
Rubus caesius						+					+	+													3

	A										B									C			D		Frequency
	8	1	7	21	19	3	9	4	14	5	16	17	20	15	24	2	23	18	13	11	6	22	10	12	
Rubus fruticosus s.l.							+	+		+		+									C				5
R. Sect. Sylvatici		+			+						A		+	C	+	A	+	C	A	A		+	+		13
R. Sect. Triviales														+											1
Sinapis arvensis			+																						1
Stachys sylvatica						+																			1
Stellaria holostea										+		+													2
Tamus communis	+							+																	2
Taraxacum officinale			+																						1
Trifolium dubium			+																						1
Urtica dioica						+	+					+													3
Veronica chamaedrys						+							+												2
V. officinalis																			+						1
Vicia sepium		+										+													2
Viola odorata			+						+																2
V. riviniana	+		+		+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+				18
No. Species	11	10	22	12	15	22	17	14	14	20	18	23	20	19	19	7	13	15	15	10	14	10	12	8	

KEY:
D̲ominant
A̲bundant
C̲ommon
LA̲ Locally abundant
LD̲ Locally dominant
\+ Present
(+) Present in atypical niche

	8	1	7	21	19	3	9	4	14	5	16	17	20	15	24	2	23	18	13	11	6	22	10	12
8		40	32	52	60	43	38	55	48	46	36	26	40	35	29	18	29	28	28	32	14	8	15	0
1			31	55	56	44	44	58	50	47	43	49	47	48	28	59	35	48	48	30	25	30	18	0
7				41	38	46	36	50	53	43	50	44	43	34	39	28	40	27	27	25	24	19	12	0
21					74	47	62	62	62	63	53	46	50	43	39	32	48	30	30	36	23	18	17	0
19						54	56	62	62	69	61	47	57	47	47	36	50	40	40	48	28	24	22	0
3							46	56	44	48	55	53	48	34	34	35	34	32	32	25	22	19	6	0
9								58	39	54	46	55	54	50	44	33	40	44	44	37	39	30	14	0
4									64	65	63	43	59	55	42	48	59	48	48	50	36	25	15	0
14										65	63	38	59	61	30	38	59	48	48	58	36	33	23	18
5											63	56	70	56	51	47	55	51	46	47	41	27	19	0
16												59	68	54	54	40	58	42	42	50	38	29	33	8
17													51	43	52	33	44	32	37	30	32	30	11	0
20														72	56	44	61	63	57	47	47	40	38	14
15															42	46	56	65	65	55	42	41	32	15
24																31	56	47	41	48	49	35	26	7
2																	50	46	46	59	38	47	32	13
23																		57	57	78	59	52	48	29
18																			67	56	62	56	30	17
13																				56	48	40	30	17
11																					58	60	55	33
6																						58	55	33
22																							55	33
10																								60
12																								

Table 8.
Similarity Index for 24 sample stands, based on presence/absence of ground flora species.

$$\frac{2w}{a + b}$$ where

a = species in Stand X
b = species in Stand Y
w = species in both X and Y

Table 9. Summary of constant and faithful ground flora species

	A	B	C	D
Endymion non-scriptus	C*	+		
Galeobdolon luteum	C*	+		
Arum maculatum	C	+		
Mercurialis perennis	C*	C		
Primula vulgaris	+	C	+	
Deschampsia caespitosa	C	C*	C	
Viola riviniana	C	C	+	
Anemone nemorosa	C	C	C	+
Carex sylvatica	+	C	+	+
Luzula pilosa	+	C	C*	+
Rubus spp*	+	C*	C*	+
Pteridium aquilinum	+	+	C*	C*
Lonicera periclymenum		C	C	C
Anthoxanthum odoratum			+	C
Convallaria majalis				C*
Luzula sylvatica				C*
Total Constant Species	7	9	6	5

C = Constant, + = present, * = generally abundant. Species underlined are those for which maps are available.

Faithful Species

A	B	C	D
Campanula trachelium	Ajuga reptans		Blechnum spicant
Geum urbanum	Carex remota		
Orchis mascula	Circaea lutetiana		
Paris quadrifolia			
Tamus communis			
Viola odorata			

Filipendula ulmaria
Galium aparine
Heracleum sphondylium
Listera ovata
Melica uniflora
Poa trivialis
Potentilla sterilis
Ranunculus ficaria
Rubus caesius

Dryopteris austriaca

Table 10. Sites recorded by G.F. Peterken with ground flora communities similar to those on Group A soils in Bedford Purlieus

GFP Sample	Species omitted	Site	pH	Texture	Ht Mottles (cm)	
68	Deschampsia cespitosa	Coombe Woods, Mon	7.0	CL	No	Carboniferous Limestone
70	"	"	7.5	L	No	"
71	None	"	7.5	L	No	"
72	Deschampsia cespitosa	"	7.7	L	No	"
73	None	"	6.8	C	No	"
78	Galeobdolon luteum	Salisbury Wood, Mon	7.2	L	No	"
80	Anemone nemorosa	"	6.5	C	No	"
83	Deschampsia cespitosa	"	7.2	L	No	"
369	"	Asham Wood, Som	6.2	CL	No	"
370	None	"	7.5	CL	No	"
371	Deschampsia cespitosa	"	7.4	CL	No	"
367	Galeobdolon luteum	Cwmma Moors, Hereford	5.7	SiC	No	Silurian Limestone
65	Deschampsia cespitosa	Hudnalls, Glos	5.9	SL	No	Old Red Sandstone
89	Arum maculatum	Collinpark Wood, Glos	5.3	C	28	Keuper Marl
272	Galeobdolon luteum	Priors Hall, Northants	4.9	C	16	Boulder Clay
283	Viola riviniana	Oakley Purlieus, Northants	7.4	CL	15	"
43	Galeobdolon luteum	Scotgrove Wood, Lincs	5.4	L	16	"
173	"	Wickenby Wood, Lincs	6.5	LS	38	"
121	Arum maculatum	Swanton Novers Woods, Norfolk	6.0	L	No	"
128	"	"	5.3	L	28	"

Table 11. Sites recorded by G.F. Peterken with ground flora communities similar to those on Group B soils in Bedford Purlieus

GFP Sample	Species omitted	Site	pH	Texture	Ht Mottles (cm)	
73	Lonicera periclymenum	Coombe Woods, Mon	6.8	C	No	Carboniferous Limestone
370	"	Asham Wood, Som	7.5	CL	No	"
371	Deschampsia cespitosa	"	7.4	CL	No	"
07	Anemone nemorosa	Salcey Forest, Northants	?	CL	?	Boulder Clay
272	Lonicera periclymenum	Priors Hall, Northants	4.9	C	16	"
43	-	Scotgrove Wood, Lincs	5.4	L	1	"
47	Mercurialis perennis	Potterhanworth Wood, Lincs	4.6	CL	16	Oxford Clay
178	"	Great West Wood, Lincs	5.5	SCL	10	Boulder Clay
199	Carex sylvatica	Bonny Wood, Suffolk	5.8	CL	7	"
121	-	Swanton Novers Woods, Norfolk	6.0	L	No	"
122	Mercurialis perennis	"	4.8	SL	No	"
127	Deschampsia cespitosa	"	4.2	SL	No	"
128	Lonicera periclymenum	"	5.3	L	8	"

Table 12. Sites recorded by G.F. Peterken with ground flora communities similar to those on Group C soils in Bedford Purlieus

GFP Sample	Species omitted	Site	pH	Texture	Ht Mottles (cm)	
71	Lonicera periclymenum	Coombe Woods, Mon	7.5	L	No	Carboniferous Limestone
1	Anemone nemorosa*	Swithland Wood, Leics	?	C	?	Keuper Marl
3	" *	"	?	C	?	"
56	-	Chaddesley Wood, Worcs	4.2	C	23	"
61	Rubus fruticosus agg.	"	4.5	C	No	"
235	Anemone nemorosa*	"	4.4	SiL	23	"
91	Pteridium aquilinum	Collinpark Wood, Glos	4.7	C	5	"
85	Luzula pilosa	Strawberry Cottage, Mon	4.4	LS	No	Old Red Sandstone
398	-	Wormley Woods, Herts	5.2	CL	0	London Clay
363	Luzula pilosa	Laundimer Wood, Northants	5.2	CL	7	Boulder Clay
12	Anemone nemorosa	Kings Wood, Beds	4.2	CL	?	Cretaceous Clay
122	-	Swanton Novers Wood, Norfolk	4.8	SL	No	Boulder Clay
33	Pteridium aquilinum	Stainfield Wood, Lincs	4.8	C	5	"
47	"	Potterhanworth Wood, Lincs	4.6	CL	16	Oxford Clay
154	"	Newball Wood, Lincs	4.4	SL	13	Boulder Clay
160	"	Hardy Gang Wood, Lincs	4.7	SC	5	"
161	"	"	4.5	C	0	"
167	"	Cocklode Wood, Lincs	5.4	CL	13	"
178	"	Great West Wood, Lincs	5.5	SCL	10	"

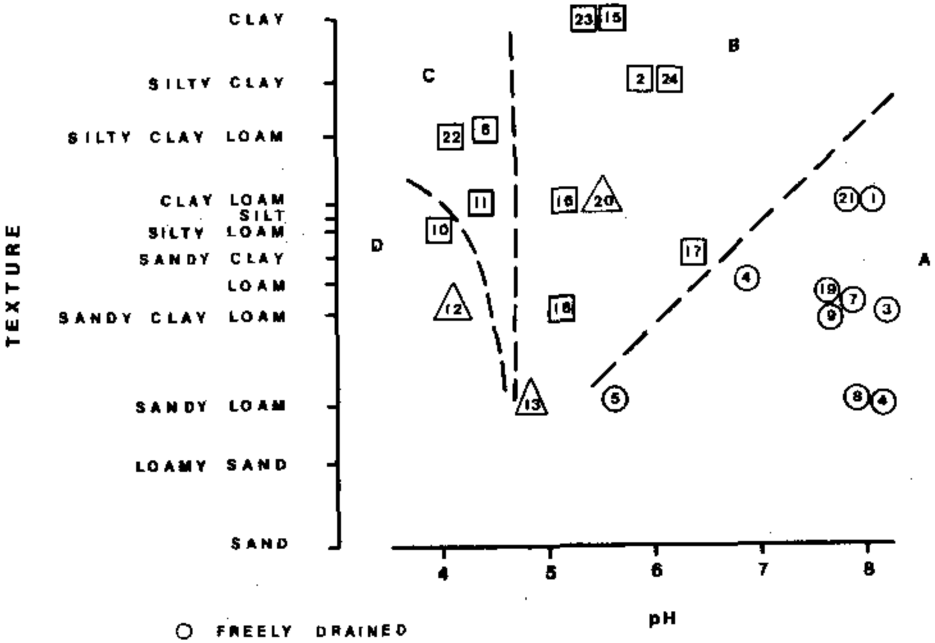
*Winter Samples. Anemone may be present.

Table 13. Sites recorded by G.F. Peterken with ground flora communities similar to those on Group D soils in Bedford Purlieus

GFP Sample	Constant species	Site	pH	Texture	Ht Mottles (cm)	
379	No Convallaria	Watersmeet Woods, Devon	4.7	CL	No	Old Red Sandstone
195	Three dominants only	Colleyweston Great Wood, Northants	4.2	Si	25	Jurassic
127	All species present	Swanton Novers Wood, Norfolk	4.2	SL	No	Boulder Clay
130	Three dominants only	"	3.6	S	No	"

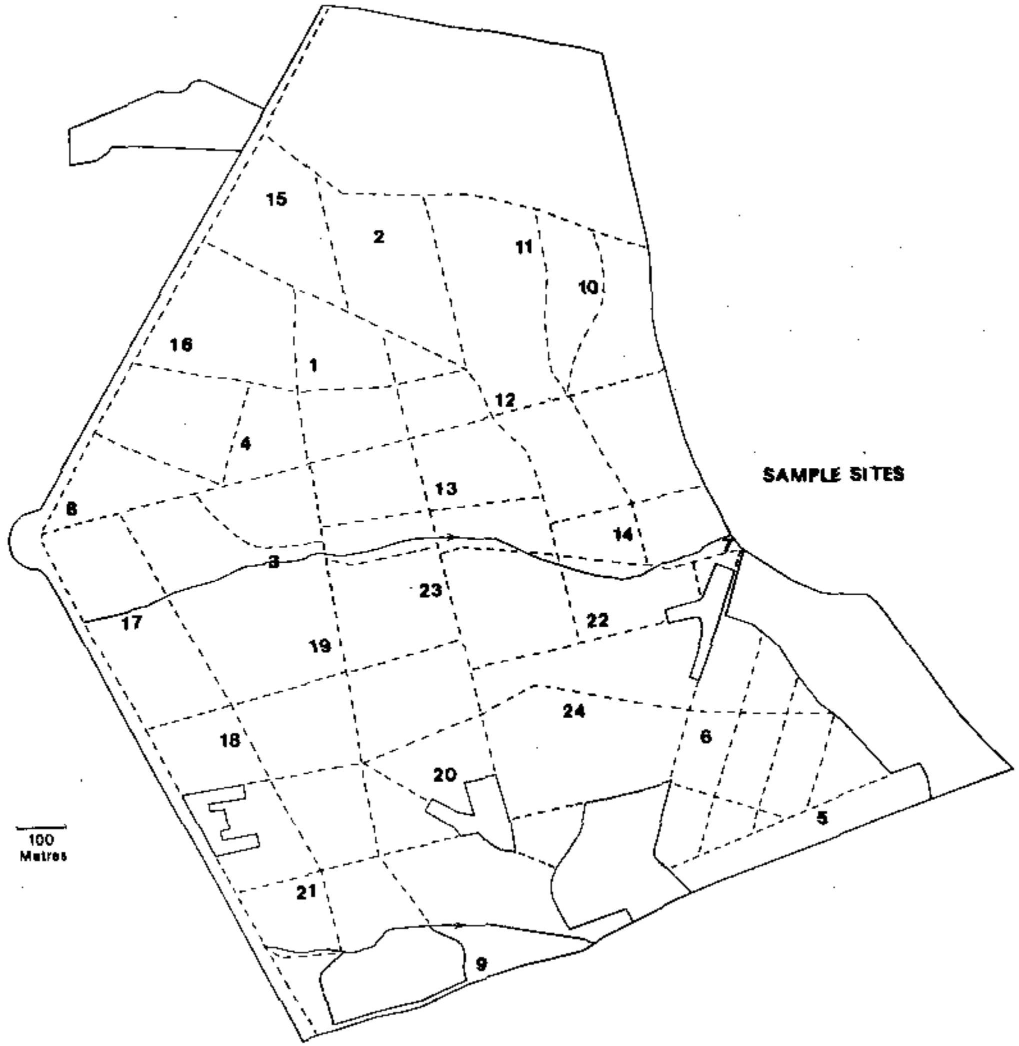
BEDFORD PURLIEUS

SAMPLES: SOIL CHARCTERISTICS



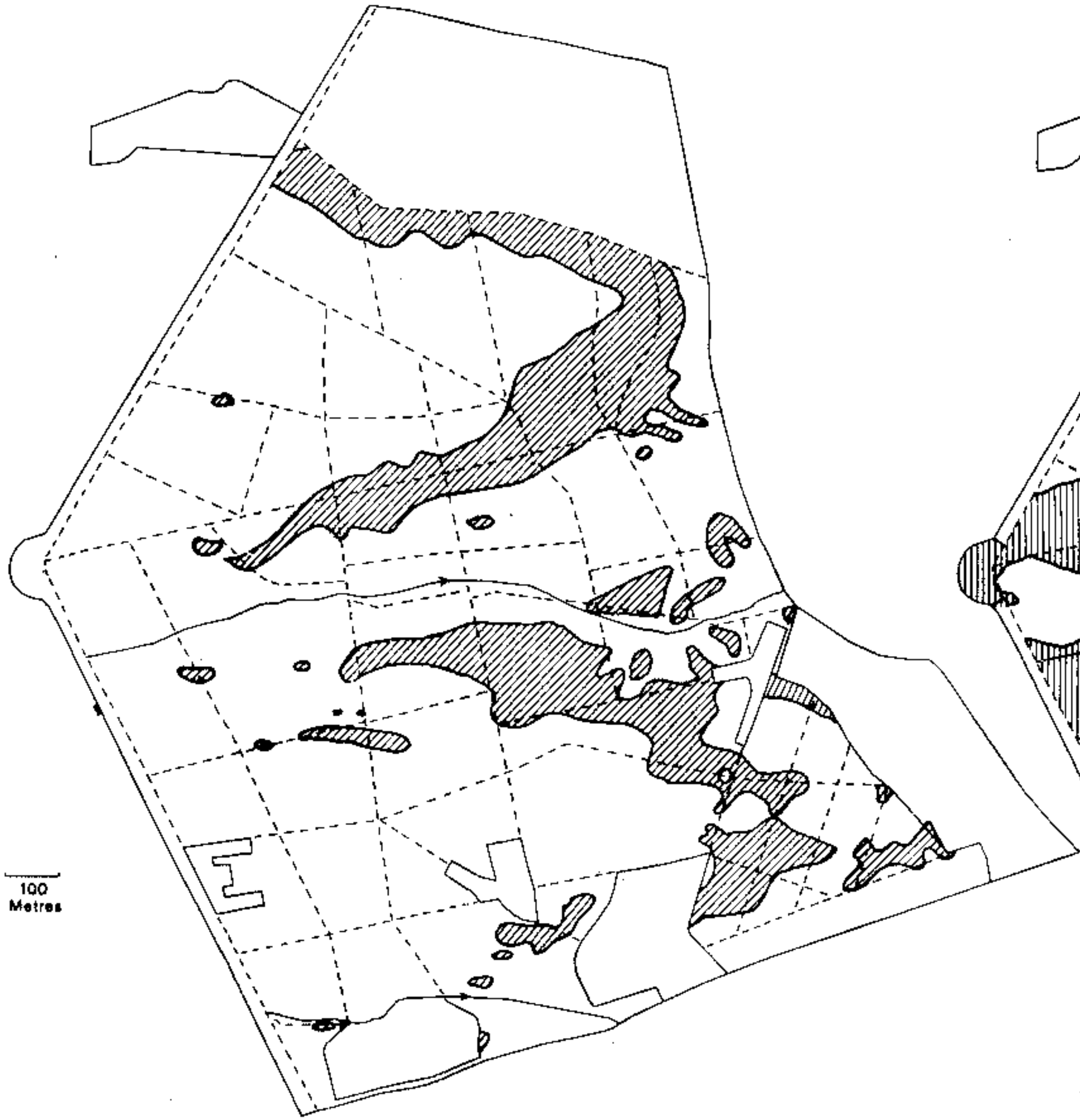
○ FREELY DRAINED
△ IMPERFECTLY DRAINED
□ POOR – V POORLY DRAINED

17. Soil characteristics of sample plots. The texture scale is derived from the ratio of sand and clay fractions of texture classes assessed by field methods.



16. Location of sample plots used to describe vegetation.

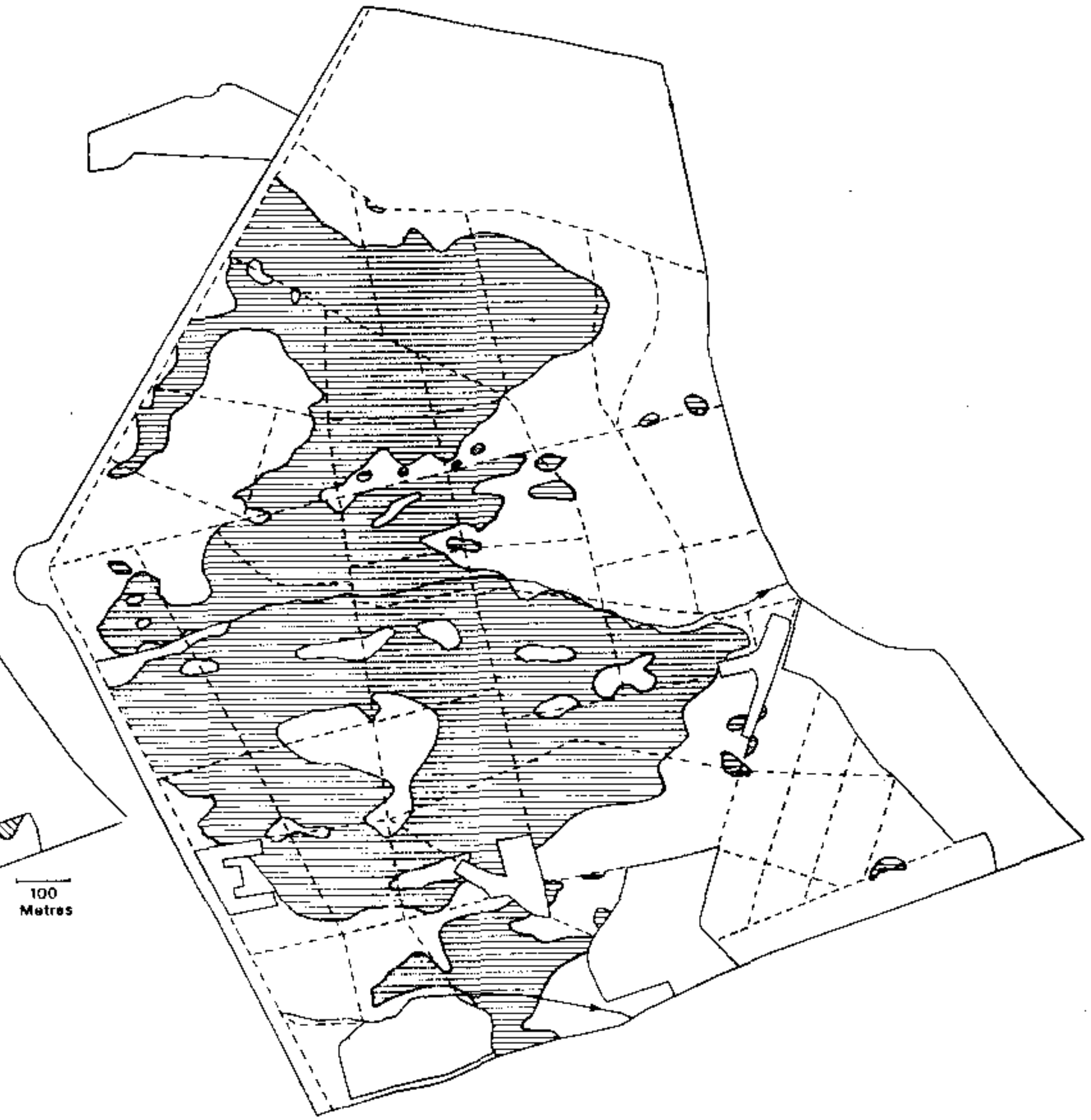
19. *PTERIDIUM aquilinum*



18. Distribution of *ME°CURIALIS perennis*

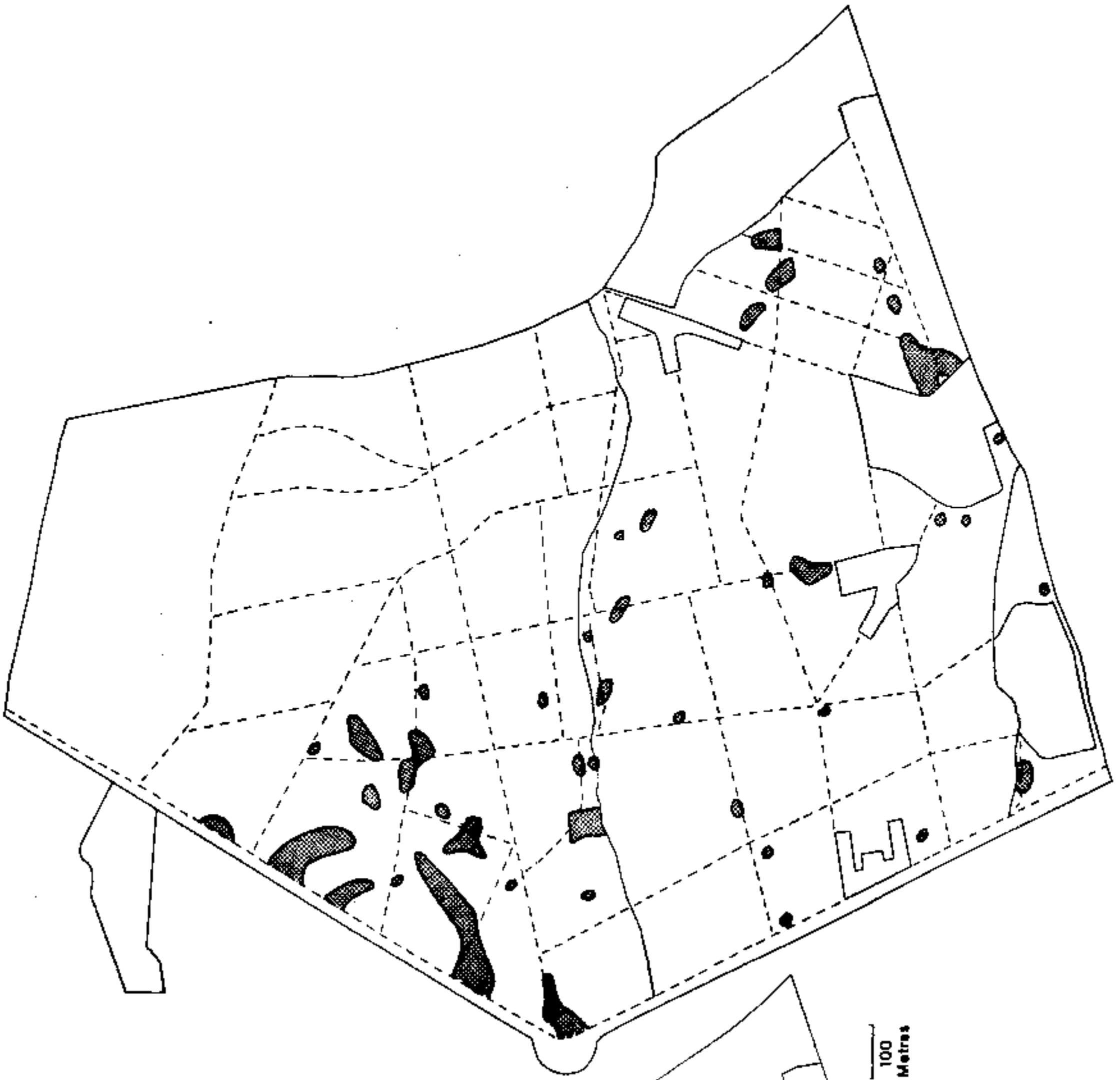
See text for explanation of Figs 18-23.

21. *RUBUS*

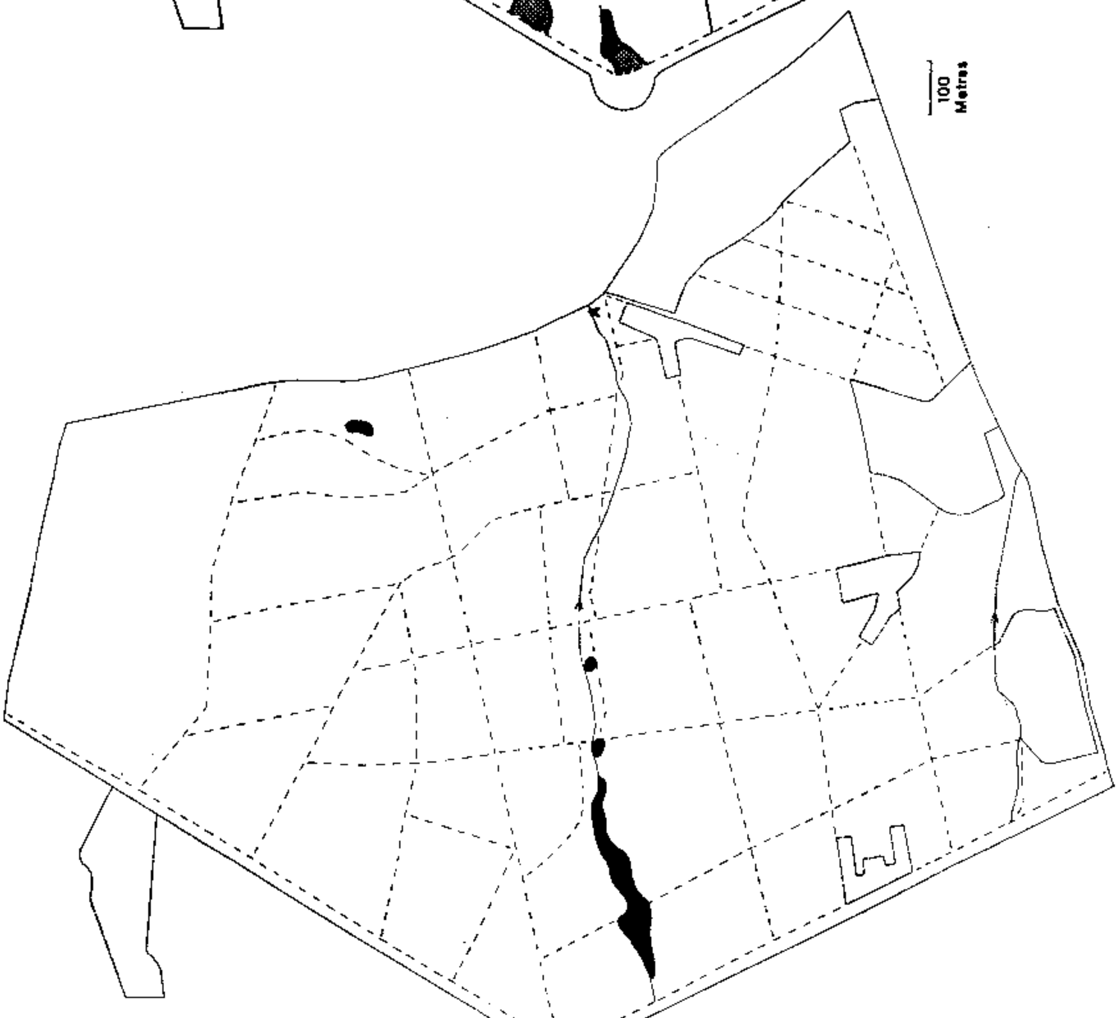


20. Distribution of *DESCHAMPSIA caespitosa*

22. GALEOBDOLON luteum



23. URTICA dioica
(and Allium ursinum)



24. Superimposed distributions of Mercurialis perennis (vertical lines) and Deschampsia cespitosa (horizontal lines).

TREES AND SHRUBS

G.F. Peterken

Most of the Bedford Purlieus woodland has reached its present condition by the planting of oak and other species into derelict coppice between 1935 and 1943. The coppice and other broadleaf growth has been largely suppressed under the pine, but amongst the oak it has been allowed to grow more or less unchecked, with only localised cleaning. The present canopy therefore consists of three main components - planted trees, coppice re-growth, and naturally regenerated trees and shrubs mostly contemporary with the planted individuals - in varying proportions. This reforestation over a limited period accounts for the somewhat uniform external appearance of the present stands, for only in small areas, principally in an irregular strip along the central valley and a part of C36, has more mature woodland survived.

The treatments carried out by the Forestry Commission are described below by M.J. Penistan. The present contribution is concerned only with the area of primary woodland, which is, in effect, the area owned by the Forestry Commission excluding the Bedlams. The composition and distribution of the various structural components are considered, and an attempt is made to consider the degree to which the present stands contain natural features. Information is presented in the form of a summary of stand structure and composition (Table 14), the records of stand composition in the 24 sample sites described above (Table 15), and in maps of selected features.

Standards and Pollards

True standards were almost all removed during and before the reforestation. A few oak and a wych elm have been found in C44 and C46, and two large beech in C37 appear to be true survivors of an active coppice-with-standards system. Most of the other mature trees occur in groups of high forest which have developed from coppice which has stood since the 19th century. Along the central stream these are mainly elm, ash and sycamore, and in C43 there is a group of limes. In parts of C35, C36 and C37 there are stands with many mature oaks mixed with contemporary coppice growth which appear to be a late 19th century precedent for the reforestation programme of the mid-20th century.

No pollard trees have been found within the wood, but two large oak pollards occur in the hedge over the road near the SW corner. These lie on the former boundary of the woods of Sulehay Walk, and are remnants of the former Royal Forest management.

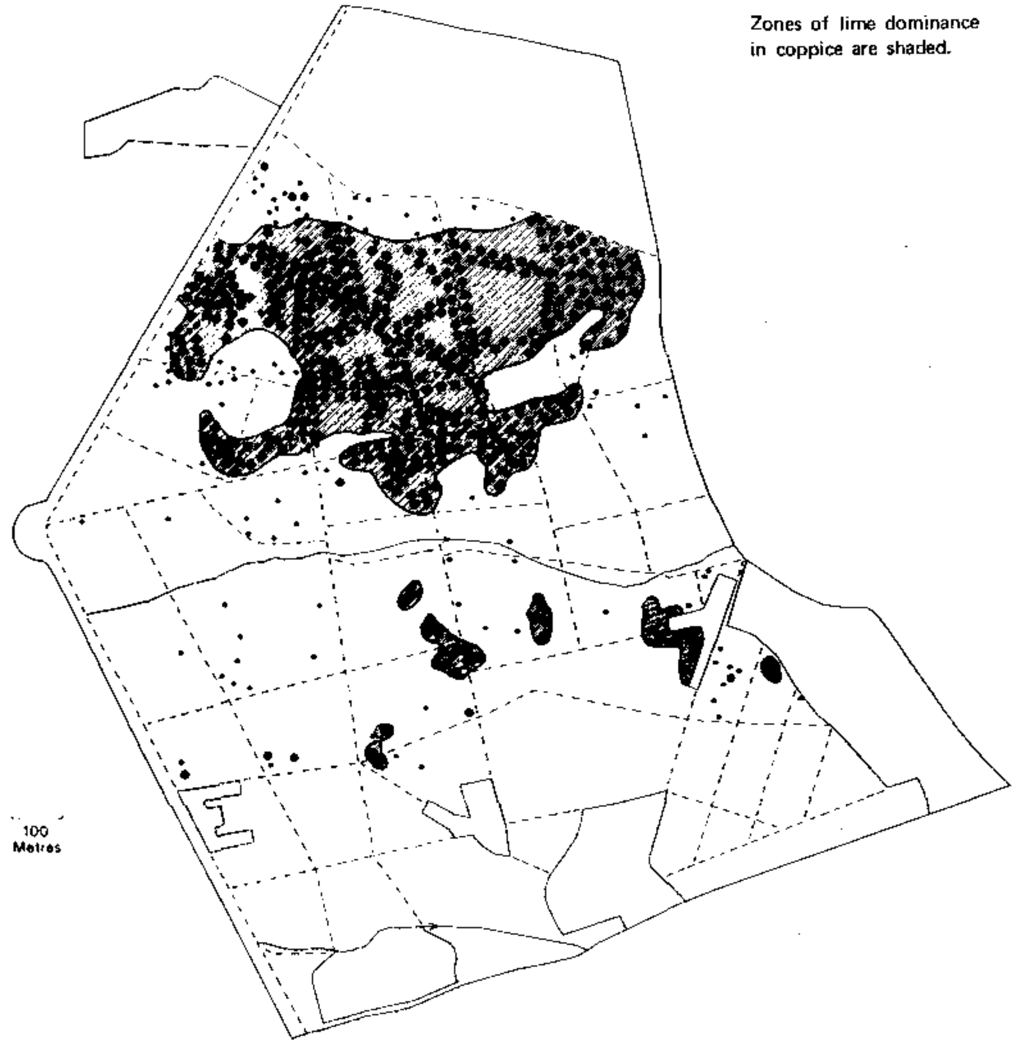
Coppice

Evidence on the exact composition of coppice is fading as the stands develop towards high forest. Nevertheless, it was still possible to map the distribution of coppice species by recording all individuals of coppice form on repeated traverses of compartments. The results (Figs. 25-34) are not maps of every coppice stool, but seek to show the main features of distribution and quantity. Shaded zones indicate where a species is abundant as coppice, large dots where it is frequent, and small dots where it occurs rarely. Hazel is nearly ubiquitous, and here the shaded zone indicates where it is rare or absent.

TREES AND SHRUBS

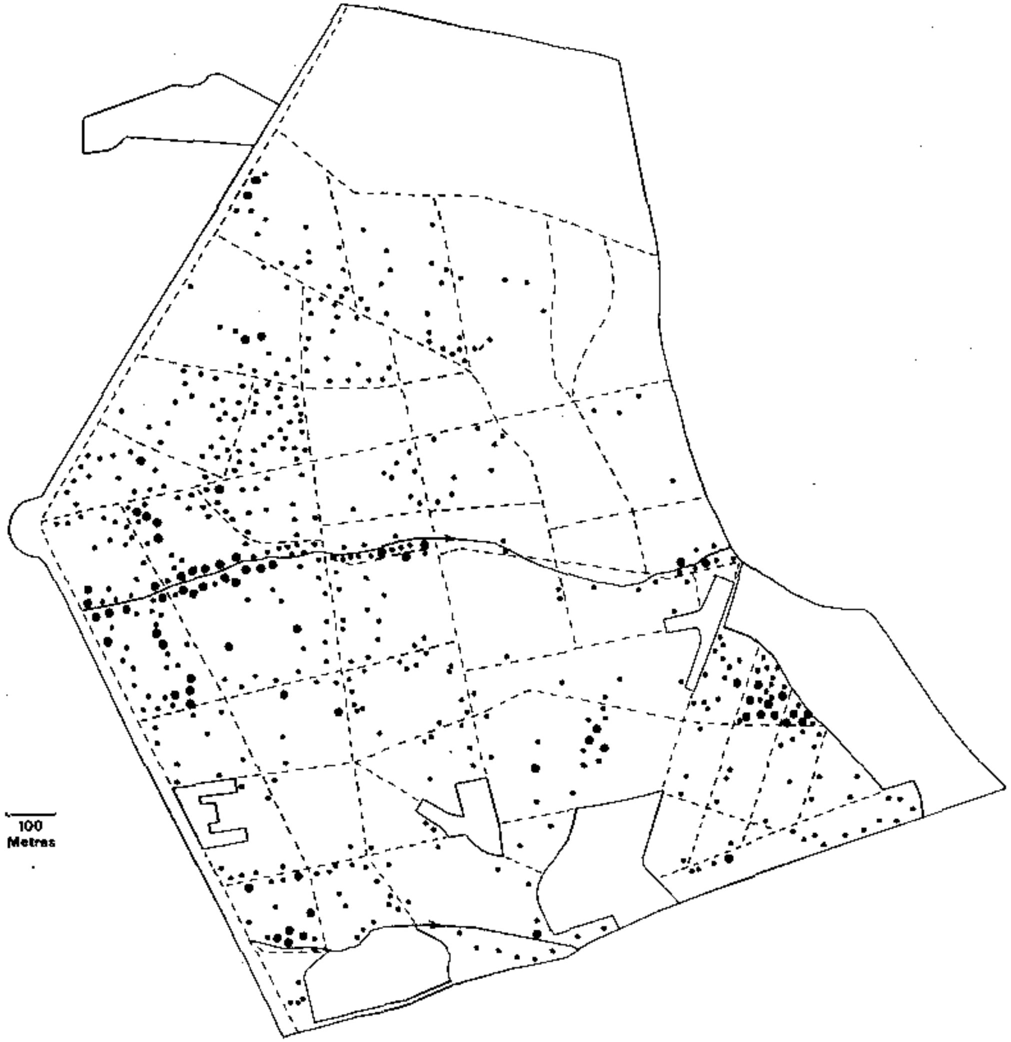
25. LIME (*Tilia cordata*) Coppice

Zones of lime dominance in coppice are shaded.



26. LARGE-LEAVED ELM Coppice (mainly *Ulmus glabra*)

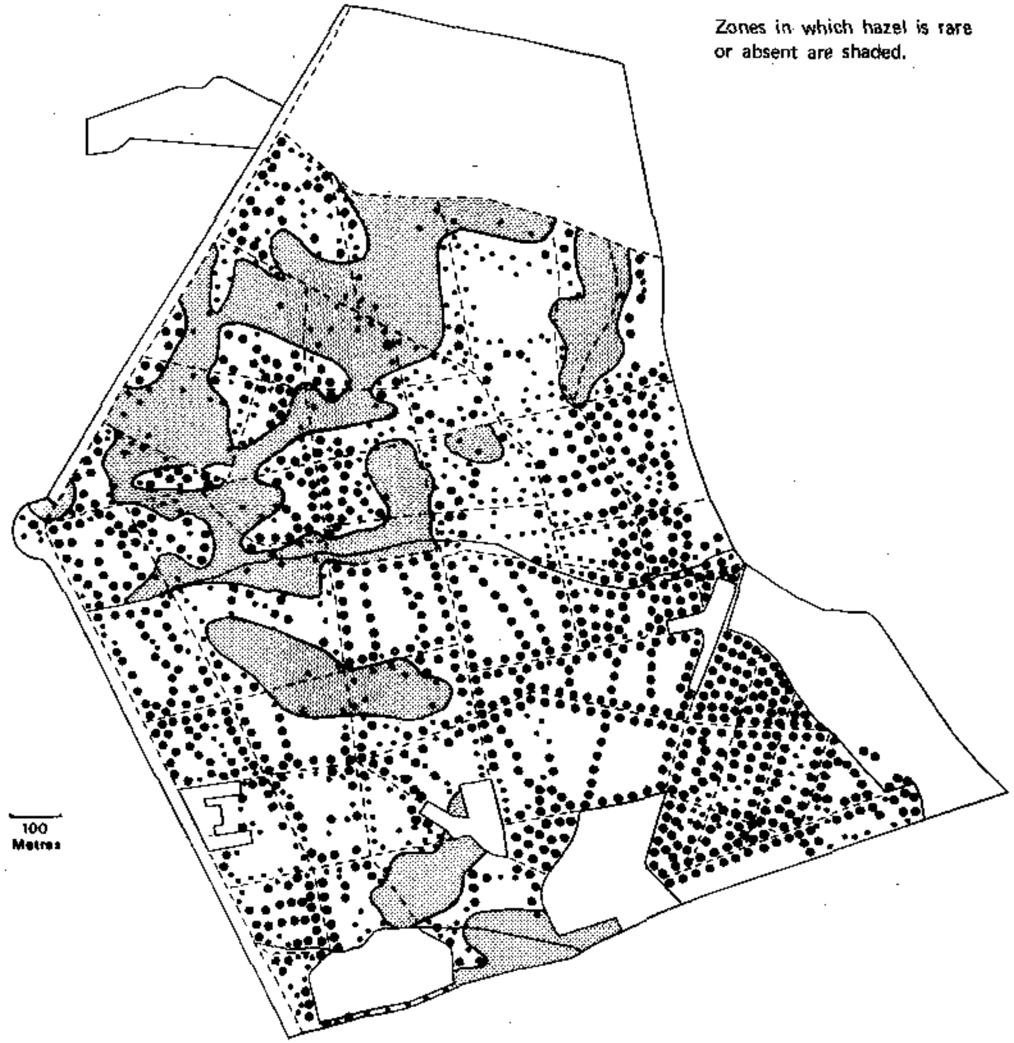
28. ASH *(Fraxinus excelsior)* Coppice



100 Metres

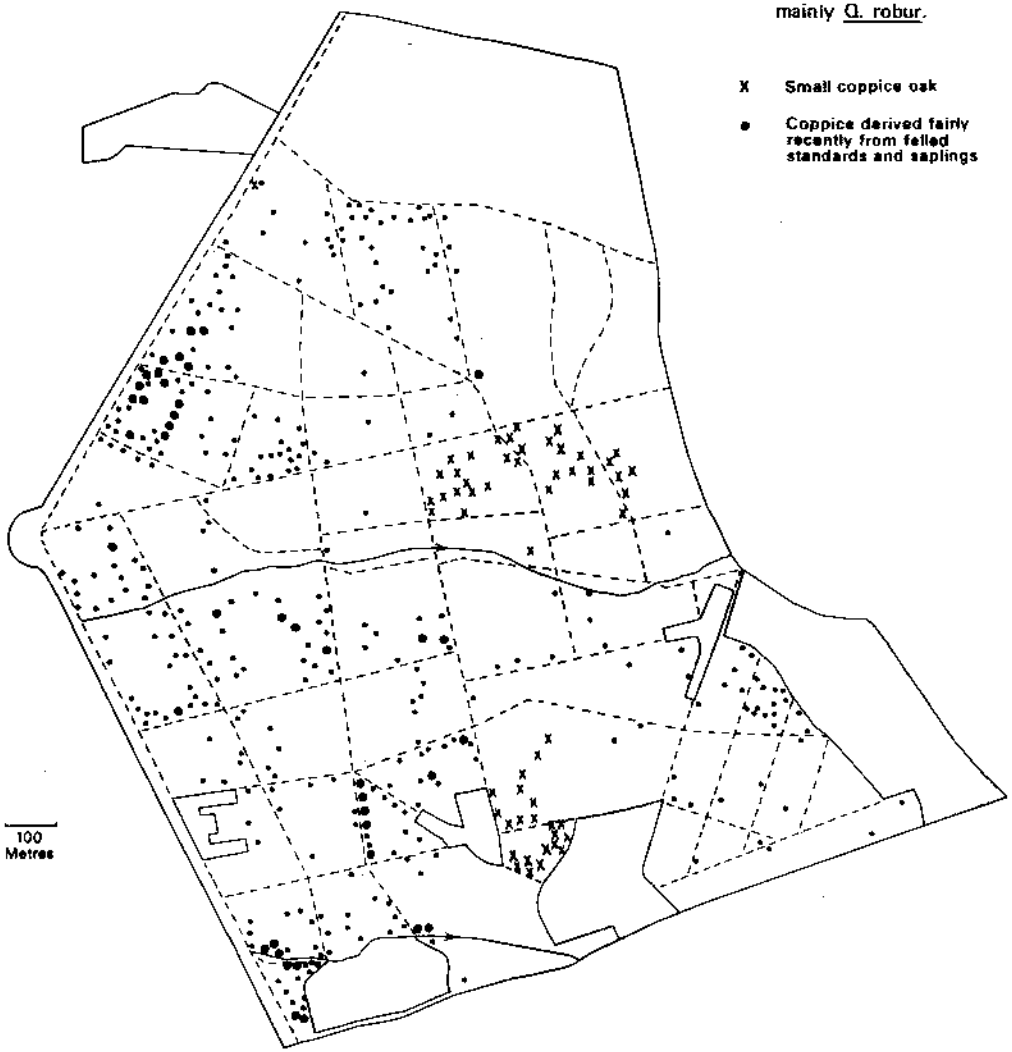
27. HAZEL *(Corylus avellana)* Coppice

Zones in which hazel is rare or absent are shaded.



100 Metres

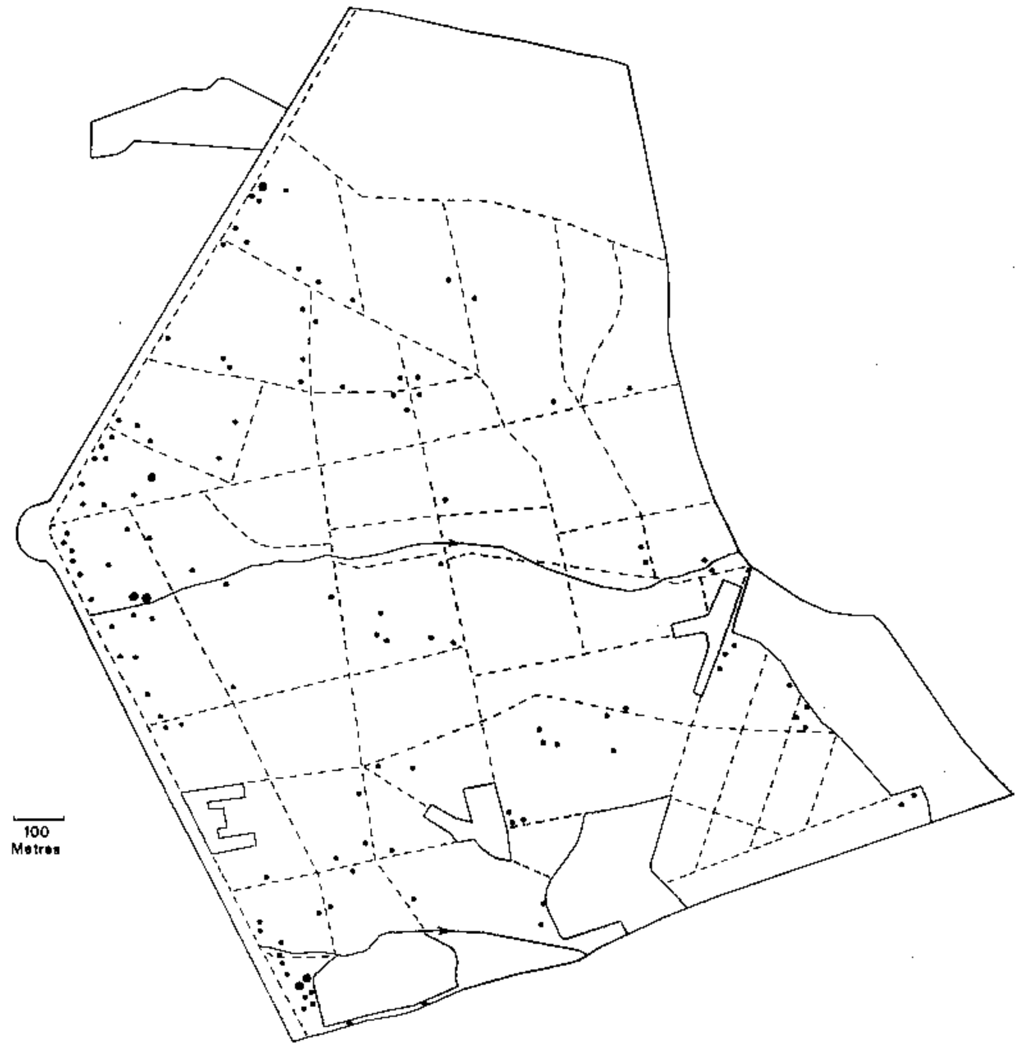
30. OAK (*Quercus spp.*) Coppice
mainly Q. robur.



Coppice of Ulmus with relatively small leaves, including U. carpinifolia.

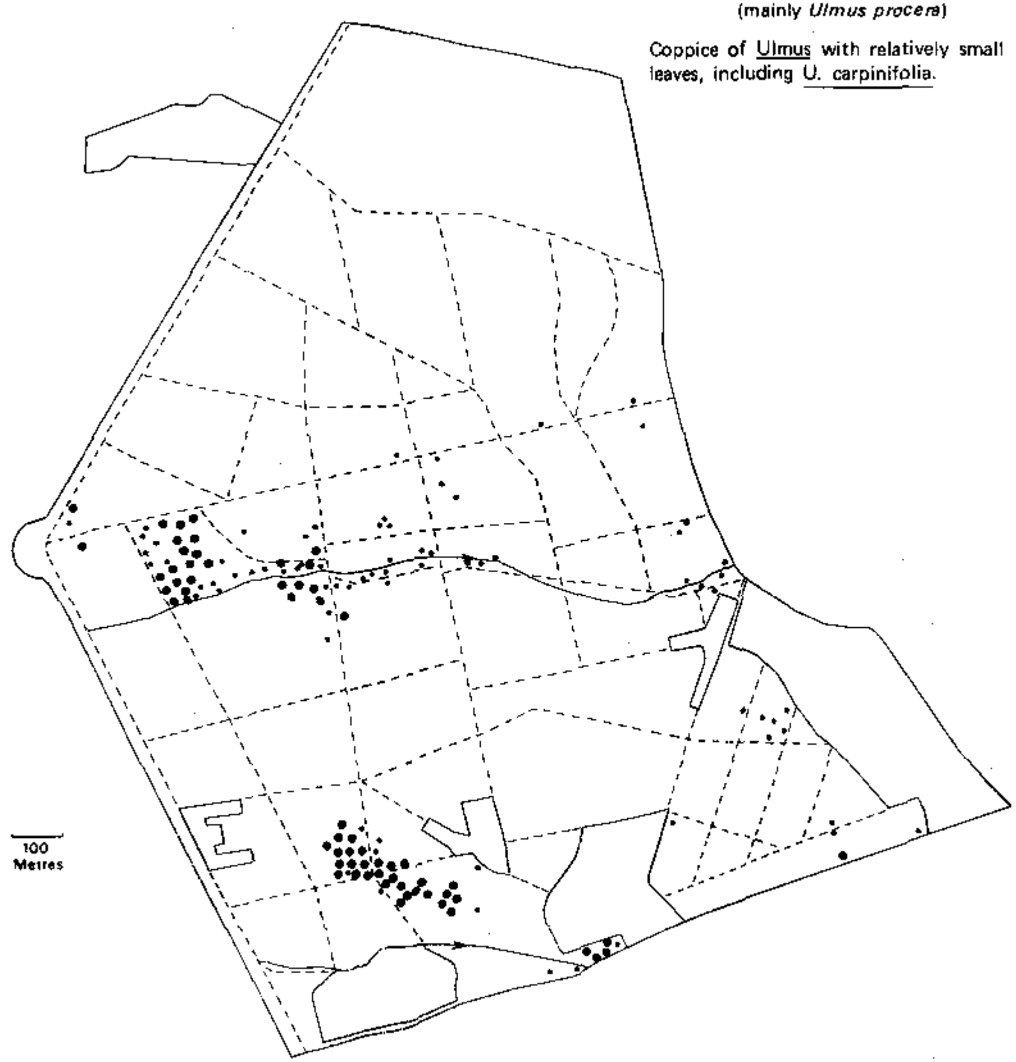
Acer pseudoplatanus coppice.

29. MAPLE (*Acer campestre*) Coppice



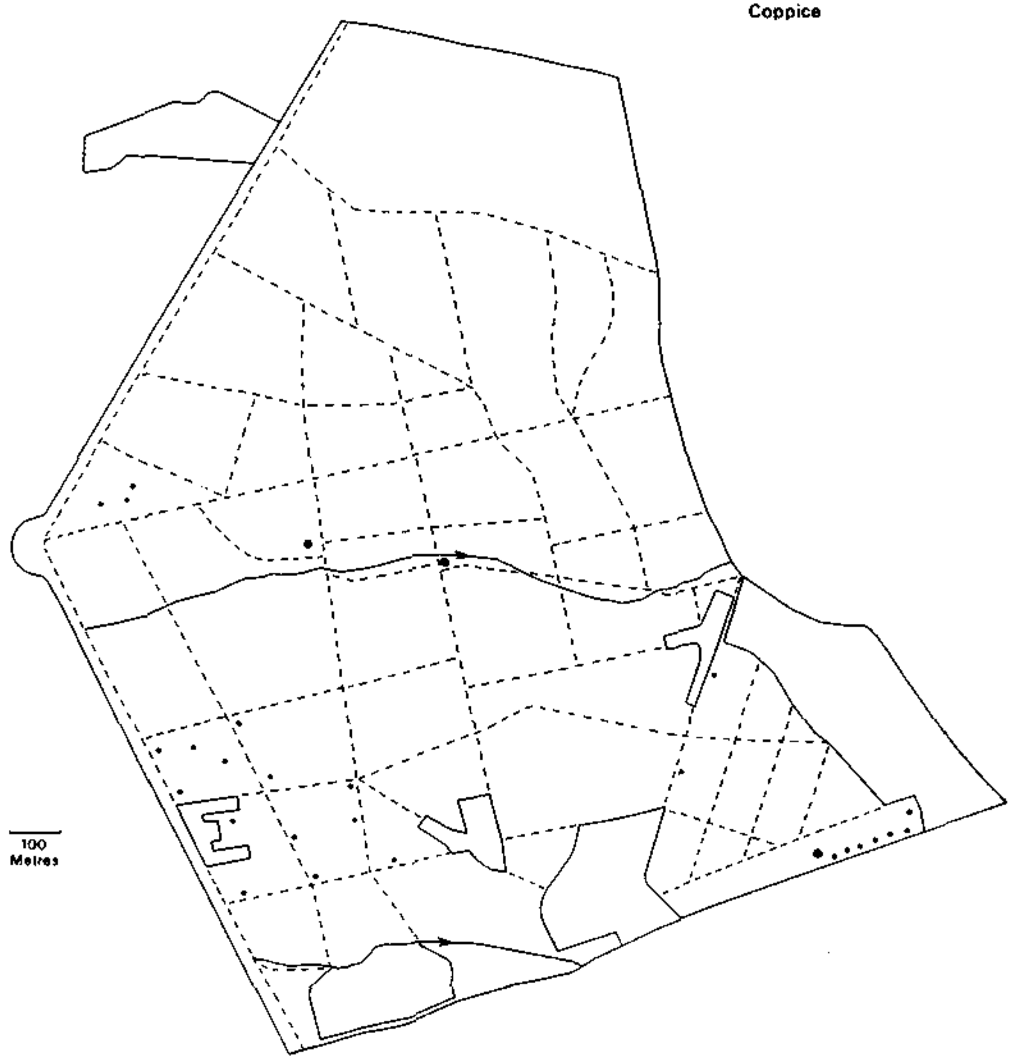
31. SMALL-LEAVED ELM Coppice
(mainly *Ulmus procera*)

Coppice of Ulmus with relatively small leaves, including U. carpinifolia.



32. SYCAMORE *(Acer pseudoplatanus)* Coppice

33. HORSE CHESTNUT *(Aesculus hippocastanum)* Coppice



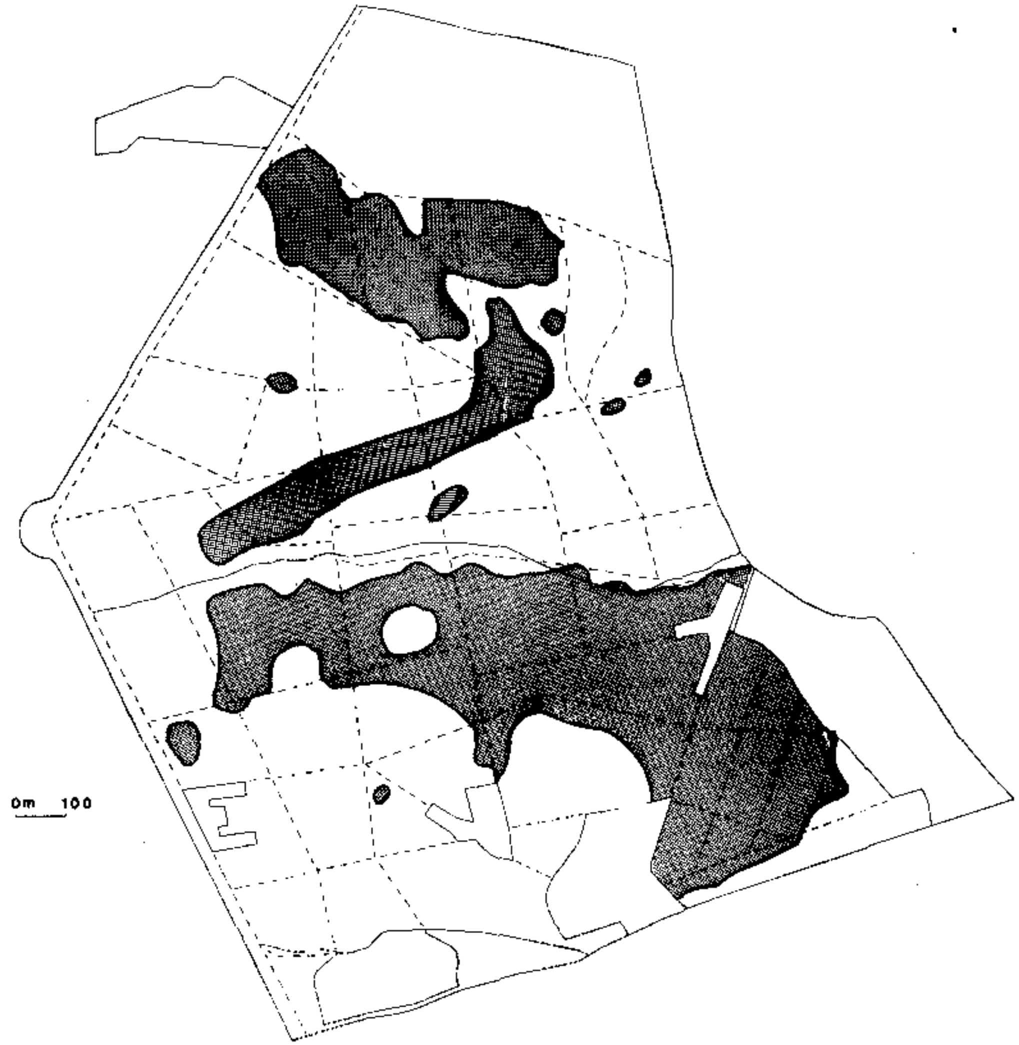
34. CHESTNUT *(Castanea sativa)* Coppice

36. VALLEY ELM WOODLAND

Ulmus woodland along the central valley.
Boundary within C38b cannot be defined precisely.

35. Betula poles.

BIRCH – zone of relative abundance



Coppice was mapped in detail because there were reasonable grounds for supposing that its distribution was largely natural. The historical record suggested that it was the most stable component of the stand, in contrast with the standard trees which were either planted for a strongly biased selection from natural growth, and the shrub and self-sown trees, which were of recent, if natural, origin. Coppice on the other hand, had evidently been present as a mixture which included many very old stools, and moreover was not known to have been planted or deliberately manipulated.

Bedford Purlieus is not an ideal place in which to investigate the naturalness of the coppice component, for the wood has been greatly modified since traditional coppicing ceased. Many self-sown individuals have themselves been coppiced, and such 'accidental' coppice has been added to the relicts of 'traditional' coppice. The latter can be detected to some extent, notably for those species which had formed large stools : the 'accidental' coppice inevitably has only small stools, usually once-cut. Hazel coppice, on the other hand, being a self coppicing species, must include coppice of both origins, and self-sown shrubs, which have never been cut.

Some species are alien to the site, and cannot therefore be elements of traditional coppice. Sycamore coppice, mainly once-cut stools, occurs more to the south where it appears to have been introduced. This distribution is probably best interpreted as a stage in a process of invasion which is not yet complete: sycamore saplings have much the same distribution. The horse chestnut stools have probably all been planted. Castanea coppice shows a remarkably high affinity with relatively light, acid soils which in a species native to the site would be interpreted as a natural distribution. Since the stools appear not to be even aged, and some at least are apparently self-sown, this could be an example of an alien species reaching its limits within the site by natural means after an original planting.

The main components of traditional coppice appear to have been hazel, ash, lime, wych elm, maple and oak. Hazel is, and probably was, almost ubiquitous. The other species show marked distributional features, which are not easily interpreted. Most of the oak is certainly 'accidental' coppice, and only in two zones is it certainly a relict of traditional coppice. Much of the ash and maple coppice is also 'accidental', but here there were no clear zones of old coppice stools. The lime and wych elm coppice was almost all 'traditional', occurring mostly as large stools, some of which had been cut at heights of 0.5m from the ground.

Lime coppice occurs mainly in the northern part, with outlying clumps to the south of the central stream. Individual stools occur scattered through mixed coppice at some distance from these concentrations. Its distribution is not apparently controlled by edaphic factors, for the main lime area crosses major soil boundaries, and occurs in all four groups of sample sites (Table 15). Nor is it controlled by recent management practices, for the main concentration and some of the satellite groups cross the rides created in the 18th century. No correlations have been detected with the medieval sale boundaries, nor is there any sign in the historical record that the distribution of lime has been deliberately altered by management before the 18th century.

Any explanation must accommodate the fact that lime is probably expanding within the wood at the present time. Saplings occur at many points where lime is not present as coppice, and must therefore have grown from seed. Root suckers from established individuals can extend and infil groups, but at a slow rate. If these two processes took place in the past, the present distribution could have developed by colonisation over a long period by seed from an established population in the north, the early colonising populations having expanded by vegetative means. If so, these processes have been very slow, perhaps for two reasons: (i) lime has been part of the underwood, allowed to develop to a fertile size only in the present century; (ii) the conditions under which lime regenerates from seed may be a mature, closed broadleaf canopy (now developing), which would not have developed under a coppice system. Thus, it seems possible that the coppice system has effectively fossilised a pattern established many hundreds of years ago, but this pattern may itself have been determined by a mixture of natural factors and the disturbance of pre-medieval exploitation.

Wych Elm coppice distribution is different, almost complementary, to that of lime, but the same general discussion applies. The distribution of this species, however, is weakly correlated with calcareous soils. Its near-absence from C47 suggests that it has been selectively eliminated from this compartment.

Additional difficulties obstruct the interpretation of the other native coppice species distributions. Clumping is apparent in the 'traditional' oak, but as the distribution of oak as coppice must have been under strict control, they are not likely to be relict natural concentrations. Ash and maple show some correlations with edaphic factors, the former with wet, heavy soils, the latter with calcareous soils, but their representation in samples (Table 15) shows that neither correlation is strong. The areas where hazel is under-represented are not correlated with an observed soil factor.

Taken together, the main features of native species distribution as coppice are:-

(i) No correlation with past or present management boundaries.
(ii) Correlations with edaphic factors are weak or nil, although there may of course be correlation with a factor which was not observed.
(iii) Most species show a degree of clumping.
(iv) The distribution of each species is apparently independent of all others. Coppice composition was mixed.
(v) Sharp boundaries are the exception.

Two types of coppice occur which may or may not be native. Of these, an Ulmus coppice of a weakly suckering form occurs in distinct clumps two of which merge with the valley elm coppice discussed below. Some outlying stools of this kind in Cocker Wood were briefly examined by Dr. O. Rackham who reported that they appeared to be glabra x carpinifolia (minor) hybrids. The small group of beech, including some coppice, in C36 could be a native population : the species has certainly been present for 300 years, and was present as mature trees in nearby Cliffe Park in 1565, according to Taverner's Survey (Public Record Office LRRO 5/39).

Other features

Maps have also been prepared of two other features. In Fig. 35, the distribution of birch maiden trees is shown. Ignoring a few isolated individuals, these occur in broad, well defined bands which appear to have some correlation with a geological/soil feature, possibly soils with a relatively coarse surface texture. These trees are certainly of recent, natural origin, and it is interesting to note that their distribution is apparently more closely related to a soil feature than that of the traditional coppice species.

Valley elm woodland (Fig. 36) occurs along the greater part of the central valley. Most individuals are single-stemmed, but some show clear signs of 19th century coppicing. At the western end they merge with the main belts and clumps of Elm coppice in a confusing manner, intergrading with them phenotypically and ecologically. Some are certainly good U. glabra, but most of those at the eastern end were referred to U. carpinifolia by Dr. O. Rackham, who also noted a probable hybrid between the two. Elm (not glabra) communities correlated with valley situations are a very rare feature in Britain, and may be confined to eastern England. They appear to be widespread on the continent in valley situations where alder might have been expected, and one might therefore describe the stand in Bedford Purlieus as an outlying example of a Continental type of vegetation. An alternative conjecture by Dr. O. Rackham is ". . . that these elms might have a wood-boundary origin. Some of the earlier maps suggest that, at an earlier date still, there were two woods separated by a narrow strip of non-woodland (in Essex it would be called a chase) which included the stream. In a Forest, with grazing in the woods in the later part of the coppice cycle, there would have been obvious advantages in arranging the wood-boundaries so as to exclude the streams. Half the chase (Forked Oak Riding), plus one end (Cookes Hole), remained in existence until recent times . . ."

Discussion

There seems to be no doubt that the correlation between soil features and the distribution of tree and shrub species is much weaker than the correlation between soil and ground flora. This is apparent both from the maps, and by comparing the records of sample sites (Tables 7 and 15). Unlike the herbs, few tree and shrub species are associated with particular sample groups, though, significantly, some shrubs species which are unlikely to have ever had a specific economic use are correlated (Clematis, Euonymus, Lonicera with B + C, and, though it did not occur in a sample, Frangula alnus with D).

It seems reasonable to suppose that trees, being large and deep rooted, are likely to be less subject to the minor variations in soil characteristics which appear to determine the dominance pattern in the field layer. Furthermore, centuries of coppicing may have altered the original distribution and reduced competition between species, both of which might have diluted correlations with soil features. In addition, planting, cleaning and layering, coupled with ease of pure-stand management, may have provided the means and incentive for simplification of composition. On the other hand, because of the concurrent need for variety of small-wood produce, the woodman may have deliberately arranged the concentration of particular species to cross management boundaries. Thus, the crop species which were present before the 20th century plantings are likely to have a semi-natural distribution, but the relative importance of man and nature is impossible to determine on the basis of present knowledge.

Some evidence in support of a substantial natural element in the coppice composition can be adduced from its geographical relationships. Just as the field layer shows strong affinities with south-western limestone woods, so does the coppice. Lime coppice on calcareous soils and Wych Elm coppice are both characteristic of limestone woods of the southern Welsh Borderland and S.W. England, and both are rare in Midland and Eastern England. Ash-hazel-maple coppice is widespread on heavy, base rich soils in the English lowlands, and is the characteristic type of neutral and calcareous clays of the East Midlands. Long-established coppice of suckering elms is apparently found mainly in a restricted zone stretching northwards into Nottinghamshire. Thus, the composition of the 'traditional' coppice in Bedford Purlieus, though hard to understand in isolation, fits well into the national pattern, and is reasonably well correlated in its affinities with those of the ground flora communities. Such patterns are perhaps best interpreted as the survival of a natural element in the composition of primary woodland coppices.

Table 14

	TREES						REGENERATION		
	Mature	Planted 1930 —	Nat. Regen 1930 —	COPPICE	SHRUBS	CLIMBERS	Vegetative	Saplings	Seedlings
NATIVE									
Acer campestre			+	C	C			C	+
Betula pendula			LA	+				+	
B. pubescens			LA	+				+	
Clematis vitalba						C		+	+
Corylus avellana				A	C			+	
Crataegus monogyna				+	C			C	
C. oxyacanthoides					C			+	
Daphne laureola					+				
Euonymus europea					+				
Frangula alnus					+				
Fraxinus excelsior	C		C	C				+	+
Ilex aquifolium					+				
Ligustrum vulgare					C			+	+
Lonicera periclymenum						C			
Malus sylvestris				+	+				
Populus tremula			+				+	+	
Prunus spinosa					C			+	+
Quercus petraea	+	+		+					
Q. robur	C	A	+	C				+	
Rhamnus catharticus					+				
Ribes nigrum					+				
R. sylvestre					+				
R. uva-crispa					+				
Rosa arvensis					C			+	+
R. canina					C			+	+
R. stylosa					+				
Salix aurita					+				
S. capraea			+	+	C				
S. cinerea				+	C				
S. fragilis					+				
Sambucus nigra					C				
Sorbus aucuparia			+	+	+			+	+
S. torminalis	+		+	+	+		+	+	
Thelycrania sanguinea					C				
Tilia cordata	+			LA	+		C	+	

Table 14 continued

	TREES			COPPICE	SHRUBS	CLIMBERS	REGENERATION		
	Mature	Planted 1930 —	Nat. Regen 1930 —				Vegetative	Saplings	Seedlings
Ulex europeaus					+				
Ulmus carpinifolia	LA		+	LA			+	+	
U. glabra	LA		+	LA				+	
Viburnum opulus					+				
V. lantana					+			+	+
STATUS UNCERTAIN									
Carpinus betulus				+					
Fagus sylvatica	+	LA		+				+	
Pyrus communis					+				
Salix alba					+				
Sorbus aria					+				
Tilia platyphyllos				+					
T. vulgaris				+					
INTRODUCED									
Acer platanoides		+	+						
A. pseudoplatanus	LA		LA	C	+			C	+
Castanea sativa				+	+			+	
Picea abies		LA							
Pinus nigra		LA							
P. sylvestris		LA							
Populus x canadensis	+		+						
Quercus cerris		+							
Tsuga heterophylla		LA							

Table 15. Bedford Purlieus : Tree and Shrub Species

	A										B									C			D	
	8	1	7	21	19	3	9	4	14	5	16	17	20	15	24	2	23	18	13	11	6	22	10	12
Acer campestre	2	4	2	4				4	1		4	5	1	1	4		4	4	1	1	1			
A. pseudoplatanus			6	5	8	4	7		6	6			4			1	4	4	4		4	1		
Betula pendula						4		4	5			3	4		7	6	3		}7					}8
B. pubescens		3			3				2	2				6	4	3	3			5	9	10		
Castanea sativa														4		4				4		4	7	4
Clematis vitalba		3	x	2	4		4	3	2					4										
Corylus avellana	5	6	4	5	4			3	6	6	2	6	4	6	6		8	6	5	6	5	6	4	5
Crataegus monogyna	7	4	4	6	5	5	4	5	4	4	7	4	5	4	7	4	5	5	4	4	4	4	x	
C. oxyacanthoides	2				4	2		4	2	2	4	2	2	2	4		4	2			4			
Euonymus europeaus	4			2				4	2															
Fagus sylvatica									8															
Fraxinus excelsior	7	5	5	5	8	6	6	6	2	7	4	8	6	6	6	1	6	7	5	4				
Ligustrum vulgare	2	4	2	4	4				2	2			1	4	1	4	4		4	4				
Lonicera periclymenum	4									4	4	4	4	4	4	4	4	4		4	4	4		4
Malus sylvestris				2		3			D			5	2		2			2						
Prunus spinosa	2	1	4			2		3				4		2	4	1								
Quercus cerris																3								
Q. petraea																					6			3
Q. robur	5	6		6	3			5	2	6	9	6	4	7	7	8	8	8	8	9		4	9	8
Ribes sylvestre			4																					

	A										B									C			D	
	8	1	7	21	19	3	9	4	14	5	16	17	20	15	24	2	23	18	13	11	6	22	10	12
Rosa arvensis				4						4	4	2			2			4	4		4		1	
R. canina	4	2						4				3	4	4		4	2			4				
Salix capraea				3									5			D								
Sorbus aucuparia																			4				x	4
S. torminalis	6			1													4	2						
Thelycrania sanguinea		4	2						2	4	4	4		2	2	4								
Tilia cordata		8	1			4		1			7			7		7		2	4	7			7	5
Ulmus glabra	6	1		6	5		8	6		2			6					4			5			
U. hollandica						6																		
U. procera			8			7			4	6														
Viburnum lantana								2																
V. opulus															4			2		1				
TOTAL SPECIES	13	13	12	14	10	10	5	14	16	13	10	13	14	15	15	15	13	14	11	12	10	7	7	8

<u>Quantity Scale</u> (cover)

10	100%	4	5%-
9	75%+	3	1 plant large
8	50-75%	2	1 plant small
7	33-50%	1	Saplings only
6	15-33%	x	Seedlings only
5	5-15%	D	Dead

VASCULAR PLANTS

Phyllida Rixon & G.F. Peterken

Introduction

With 462 vascular plant species recorded so far, Bedford Purlieus has an outstandingly rich flora and may indeed be the richest wood in the Lowland Zone. Certainly Druce (1930) thought that it could "lay claim to be considered the richest sylvan flora in the county", and there are few woods in Britain which could exceed it.

The records come from two main sources. Druce (1930) repeatedly mentions species present in his District 7, and collects together the earlier records published by himself (Druce 1902) and earlier botanists. In recent years, one of us (P.R.), has searched the wood thoroughly, and has been able to add to Druce's list, and confirm the continued presence of most of the species on record.

The count of 462 requires some qualification. No attempt has been made to separate the Rubus species of Section Triviales. Nor have the species within Taraxacum officinale been identified, even though casual observation suggests that at least three distinct forms occur. On the other hand, Anagalis arvensis ssp foemina has been separately listed as it was by Druce (1930). Records for some species are doubtful:- Campanula latifolia, Gentiana campestris. The Hieracium species have not been determined by a specialist.

The species list below has been annotated to show woodland species (W) and wetland species (Aq). The former comprise tree and shrub species, herbs capable of bearing the shade of a broadleaf canopy, and a few tall herbs and climbers particularly associated with wood edge conditions. Species without annotation are associated with grassland, disturbed ground and all other habitats except woodland and wetland. A few species which occur in both woodland and grassland are shown (Wg).

Factors affecting the flora

Why is the flora so rich? Two preliminary points should be made before considering the ecological basis of this richness. First, the flora may now number only 432 species, for some 30 have not been recorded in recent years (Table 16). Second, a few species have been deliberately introduced, though the maximum of 8 in this category is scarcely significant.

Perhaps the most important diversifying feature is the presence of grassland and a variety of disturbed habitats within and on the margins of the woodland area (Fig. 3). Disturbed ground occurs along the eastern boundary track, rides, and the war time clearings; in some of the latter open vegetation still persists on thin soils. The restored ground of the open-cast quarry adds temporarily to the extent of disturbed ground. The majority of species are associated with non-woodland habitats. Only 194 species appear to be woodland species, suggesting that the flora would be reduced to about 200 species if the entire site were ever completely occupied by closed-canopy woodland.

Table 16. Summary of Vascular Flora

TOTAL SPECIES	462
Introduced species	8
Extinct and possible extinct species	30
Habitat : Wood and Wood Edge	194
Grassland and Disturbed Ground	288
Aquatic	24
Possible Primary Woodland Species	47

The second main diversifying factor is the great range of edaphic conditions. Almost the entire range of soil pH, texture and drainage conditions which can be found in the woods of the East Midlands and East Anglia occur within this one site. Perhaps only Bradfield Woods, Suffolk, Swanton Novers Wood, Norfolk and King's Woods, Bedfordshire, rival this diversity. Calcifuge species are perhaps better represented in other woods in the Region, but few can exceed the variety of calcicoles.

Thirdly geographical location is such that predominantly northern species (e.g. Melica nutans) occur within the same site as predominantly southern species (e.g. Viburnum lantana, Campanula trachelium, Euphorbia amygdaloides), but whether the Soke of Peterborough is any more significant in this respect than any other part of Midland and Northern England is open to doubt.

Two other factors, both connected with site history and management, are likely to be significant. Bedford Purlieus is one of a group of purlieu woods along the northern rim of Rockingham Forest, other survivors of which are Easton Hornstocks, Collyweston Great Wood, Vigo Wood and Wakerley Woods. Apart from Vigo Wood, which is inaccessible, these are all known to be floristically rich, and to include many of the rare and local species also found in Bedford Purlieus. Significantly, some of these species are not known from some of the former Royal Forest woods in the south (e.g. Tilia cordata, Euphorbia lathyrus), or are much less frequent in them. One contributory factor could be that centuries of heavy, nearly continuous grazing in the Forest woods has impoverished the woodland flora, and only in the Purlieu woods, with their more efficient management, has the original richness been able to survive. Such an explanation would be difficult to prove, but the overwhelming impression after inspecting many woods in the Rockingham Forest area is that the former Forest woods have fewer species; many woodland species are highly restricted within them; and such rare species as may be present are usually those capable of flourishing under fairly heavy grazing.

If, as the archaeological and historical evidence suggests, part at least of Bedford Purlieus has never been completely cleared of woodland, this too could be a significant factor. Had it and the surrounding land ever been completely cleared of woodland, most of the 'woodland' species would not have survived on the site, and would have had to colonise from a distance when the present woodland developed. Woods in the area which are known to be secondary generally lack the rare species and have a relatively greater quantity of good colonisers, such as Geum urbanum, Arum maculatum, Stachys sylvatica, Viola odorata, Anthriscus sylvestris, etc. Furthermore, many species are known from neighbouring regions to be more or less confined to sites which have been continuously wooded through historical times (Peterken 1974). Those woodland species which are likely to be slow colonisers of newly available woodland ("Primary woodland species") in the Bedford Purlieus area are marked with an asterisk.

Extinction

Some species, which have been recorded in the past, but not recently, may have become extinct. Some are likely to be present in very small numbers, and may, like Lathyrus montanus be found after having been regarded as extinct. As T.C.E. Wells pointed out, the "extinct" species tend to fall into two groups: (i) those of wet grassland, such as Parnassia palustris, Valeriana dioica and Epipactis palustris which could have been eradicated by drainage and the conversion of ponds into concrete tanks, and (ii) species which are difficult to identify or whose taxonomic status has changed, and which cannot be varified by herbarium specimens, such as Centaurium pulchellum and Galium parisiense. The former are 'real' extinctions, whereas the latter are probably not.

The natural gas pipeline was run through the best piece of limestone grassland in c. 1967 but the topsoil was (roughly) put back. Astragalus danicus and Hippocrepis comosa did not reappear until 1973 and 1974. Filipendula vulgaris, Koeleria gracilis and Genista tinctoria have not been seen since, but could reappear.

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Nomenclature in the list below follows Clapham, Tutin & Warburg (1962). Rubus species as recorded by Druce (1930).

* Possible Primary Woodland Species
\+ Introduced species
(W) Woodland species
(Wg) Species of woodland and grassland
(Aq) Wetland species
Brackets for "extinct" species

Acer campestre (W)
\+ A. pseudoplatanus (W)
Achillea millefolium
(A. ptarmica)
Acinos arvensis

\+ Aesculus hippocastanum (W)
Aethusa cynapium
Agrimonia eupatoria
Agropyron caninum (W)
A. repens

Agrostis gigantea
A. stolonifera
A. tenuis (Wg)
Ajuga reptans (Wg)
Alchemilla vestita (W)

Alisma plantago-aquatica (Aq)
Alliaria petiolata
Allium ursinum (W)
Alopecurus pratensis
Anacamptis pyramidalis

Anagalis arvensis
(A. arvensis ssp. foemina)
* Anemone nemorosa (W)
Angelica sylvestris (Wg)
Anisantha sterilis

Anthemis cotula
Anthoxanthum odoratum (Wg)
Anthriscus sylvestris (Wg)
Anthyllis vulneraria
Aphanes arvensis

* Aquilegia vulgaris (W)
Arctium minus (W)
Arenaria serphyllifolia
Arrhenatherum elatius (Wg)
(Artemisia absinthium)

A. vulgaris
Arum maculatum (W)
Astragalus danicus
A. glycyphyllos
Athyrium filix-femina (W)

Atriplex patula
Atropa belladonna (Wg)
Avena fatua
Ballota nigra
Bellis perennis

Berberis vulgaris (W)
Betonica officinalis (Wg)
Betula pendula (W)
B. pubescens (W)
Blackstonia perfoliata

* Blechnum spicant (W)
Brachypodium pinnatum (Wg)
B. sylvaticum
Brassica napus
Briza media

Bromus mollis
B. thominii
Bryonia dioica (W)
* Calamagrostis canescens (Wg)
C. epigeios (Wg)

Callitriche stagnalis (Aq)
Calluna vulgaris
Caltha palustris (Aq)
Calystegia sepium
*(Campanula latifolia (W))

C. rotundifolia
* C. trachelium (W)
Capsella bursa-pastoris
Cardamine hirsuta
C. pratensis

Carduus crispus
C. nutans
(Carex acutiformis (Aq))
C. caryophyllea
C. contigua

C. demissa
C. divulsa
C. flacca
C. hirsuta
C. otrubae

C. ovalis
* C. pallescens (Wg)
(C. paniculata (WAq))
* C. pendula (W)
(C. pilulifera)

* C. remota (WAq)
C. rostrata (Aq)
(C. serotina (Aq))
C. sylvatica (W)
+ Carpinus betulus (W)

+ Castanea sativa (W)
Catapodium rigidum
Centaurea nigra
C. scabiosa
Centuarium minus

(C. pulchellum)
Cerastium arvense
C. glomeratum
C. holosteioides
Chaenorhinum minus

Chaerophyllum temulentum
Chamanaerion angustifolium (Wg)
Chenopodium album
C. rubrum
Chrysanthemum leucanthemum

C. segetum
Circaea lutetiana (Wg)
Cirsium acaulon
C. arvense (Wg)
C. eriophorum

C. palustre (Wg)
C. vulgare
Clematis vitalba (W)
Clinopodium vulgare
Conium maculatum (W)

Conopodium majus (Wg)
* Convallaria majalis (W)
Convolvulus arvensis
Corylus avellana (W)
+ Cotoneaster simonsii

Crataegus monogyna (W)
* C. oxyacanthoides (W)
Crepis capillaris
C. vesicaria
Cynosurus cristatus

Dactylis glomerata (Wg)
Dactylorchis fuchsii (Wg)
(D. praetermissa)
Daphne laureola (W)
Daucus carota

Deschampsia cespitosa (Wg)
Dipsacus fullonum (W)
*(D. pilosus (W))
Dryopteris carthusiana (W)
D. dilatata (W)

D. filix-mas (W)
(Echium vulgare)
Eleocharis palustris (Aq)
* Endymion non-scriptus (W)
Epilobium adnatum

E. hirsutum (Aq)
E. montanum (W)
E. palustre
E. parviflorum
Epipactis helleborine (W)

*(E. purpurata (W))
Equisetum arvense
E. palustre
Erigeron acris
Erodium cicutarium

Erophila verna
Euonymus europeaus (W)
Eupatorium cannabinum (W)
* Euphorbia amygdaloides (W)
E. exigua

E. helioscopa
* E. lathyrus (W)
Euphrasia officinalis agg.
Fagus sylvatica (W)
Festuca arundinacea

F. gigantea (Wg)
F. pratensis
F. rubra
Filipendula ulmaria (Wg)
(F. vulgaris)

Fragaria vesca (Wg)
* Frangula alnus (W)
Fraxinus excelsior (W)
Fumaria officinalis
* Gagea lutea (W)

Galeobdolon luteum (W)
Galium aparine (Wg)
G. cruciata
G. mollugo
* G. odoratum (W)

G. palustre
(G. parisiense)
G. saxatile
G. uliginosum
G. verum

(Genista tinctoria)
Gentianella amarella
Geranium columbinum
G. dissectum
G. molle

G. pratense
G. robertianum (W)
Geum urbanum (W)
Glechoma hederacea (Wg)
Glyceria fluitans (Aq)

Gnaphalium uliginosum
(Gymnadenia conopsea)
Hedera helix (W)
* Helleborus foetidus (W)
Helianthemum chamaescistus

Heracleum sphondylium (Wg)
(Hieracium boreale)
(H. lachenalii (W))
H. perpropinquum
H. pilosella

(H. tridentatum (W))
H. cf. umbellatum (W)
Hippocrepis comosa
Holcus lanatus
H. mollis (Wg)

(Hydrocotyle vulgaris (Aq))
* Hypericum hirsutum (W)
H. humifusum
(H. montanum)
H. perforatum

H. pulchrum
H. tetrapterum (Wg)
Hypochaeris radicata
Ilex aquifolium (W)
Inula conyza

Isolepis setacea (Aq)
Juncus articulatus
J. bufonius
J. conglomeratus
J. effusus (WgAq)

J. inflexus
J. subnodulosus
Knautia arvensis
(Koeleria gracilis)
+ Laburnum anagyroides (W)

Lactuca virosa (W)
L. serriola
Lamium album
L. purpureum
Lapsana communis (Wg)

* Lathraea squamaria (W)
* Lathyrus montanus (W)
L. nissolia
L. pratensis
* L. sylvestris (W)

Lemna minor (Aq)
L. trisulca (Aq)
Leontodon autumnalis
L. hispidus
L. taraxacoides

Lepidium smithii
Ligustrum vulgare (W)
Linaria vulgaris
Linum catharticum
Listera ovata (W)

Lithospermum officinale (W)
Lolium perenne
Lonicera periclymenum (W)
Lotus corniculatus
L. uliginosus

Luzula campestris
L. multiflora (Wg)
* L. pilosa (W)
L. sylvatica (W)
Lychnis flos-cuculi

* Lysimachia nemorum (W)
L. nummularia
Malus sylvestris (W)
Malva moschata
M. sylvestris

(Marrubium vulgare)
Matricaria matricarioides
Medicago lupulina
* Melampyrum pratense (W)
* Melica nutans (W)

* M. uniflora (W)
Melilotus altissima
M. officinalis
Mentha aquatica
M. arvensis

Mercurialis perennis (W)
* Milium effusum (W)
Moehringia trinerva (W)
Myosotis arvensis (Wg)
M. palustris

* Neottia nidus-avis (W)
Odontites verna
Ononis repens
O. spinosa
Ophioglossum vulgare (Wg)

Ophrys apifera
* O. insectifera (W)
O. mascula (W)
Origanum vulgare
* Oxalis acetosella (W)

Papaver rhoeas
* Paris quadrifolia (W)
(Parnassia palustris (Aq))
Pastinacea sativa
Phleum bertolinii

P. pratensis
Phragmites communis (Aq)
Phyllitis scolopendrium (W)
Pimpinella major (Wg)
P. saxifraga

+ Pinus sylvestris (W)
Plantago lanceolata
P. major
(Platanthera bifolia)
* P. chlorantha (W)

Poa annua
P. compressa
* P. nemoralis (W)
P. pratensis
P. trivialis (W)

Polygala serpyllifolia
P. vulgaris
Polygonum amphibium
P. aviculare
P. convolvulus

P. hydropiper
P. lapathifolium
P. persicaria
(Polypodium vulgare (W))
Populus tremula (W)

Potamogeton natans (Aq)
Potentilla anserina
P. erecta
(P. palustris (Aq))
P. reptans

P. sterilis (W)
Poterium sanguisorba
Primula veris
* P. vulgaris (W)
Prunella vulgaris

Prunus avium (W)
P. spinosa (W)
Pteridium aquilinum (Wg)
Pyrus communis (W)
Quercus cerris (W)

* Q. petraea (W)
Q. robur (W)
* Ranunculus auricomus (W)
R. ficaria (Wg)
R. repens (Wg)

Raphanus raphanistrum
Reseda lutea
R. luteola
Rhamnus catharticus (W)
Rhinanthus minor

Ribes nigrum (W)
R. sylvestre (W)
R. uva-crispa (W)
Rorippa nasturtium-aquaticum (Aq)
Rosa arvensis (W)

R. canina (W)
R. rubiginosa (W)
(R. sherardii (W))
R. stylosa (W)
Rubus caesius (W)

R. carpinifolius (W)
R. rhamnifolius (W)
R. macrophyllus (W)
R. schlechtendahlii (W)
R. vestitus (W)

R. discerptus (W)
R. rudis (W)
R. dasyphyllus (W)
R. bellardi (W)
R. Sect. Triviales (W)

Rumex acetosella
R. acetosa
R. crispus
R. obtusifolius (Wg)
R. sanguineus (W)

* Ruscus aculeatus (W)
Salix alba (W)
(S. aurita (W))
S. capraea (W)
S. cinerea (W)

S. fragilis (W)
Sambucus nigra (W)
Sanicula europaea (W)
(Sarothamnus scoparius (W))
Saxifraga tridactylites

Scabiosa columbaria
Schoenoplectus lacustris (Aq)
Scrophularia aquatica
S. nodosa (W)
Senecio erucifolius

S. jacobaea
S. squalidus
S. vulgaris
(Serratula tinctoria)
Sherardia arvensis

Silaum silaus
Silene cucubalus
S. dioica (Wg)
S. noctiflora
Sinapis arvensis

Solanum dulcamara (W)
S. nigrum
Sonchus arvensis
S. asper
S. oleraceus

Sorbus aria (W)
S. aucuparia (W)
+ S. intermedia
* S. torminalis (W)
Spergularia arvensis

Stachys arvensis
S. sylvatica
Stellaria graminea
S. holostea (W)
S. media (Wg)

Succisa pratensis
Tamus communis (W)
Taraxacum officinale
T. spectabile
Thelycrania sanguinea (W)

Thymus drucei
T. pulegioides
* Tilia cordata (W)
T. platyphyllos (W)
T. vulgaris (W)

Torilis japonica
Tragopogon pratensis
Trifolium campestre
T. dubium
T. medium

T. pratense
T. repens
Tripleurospermum maritimum
Trisetum flavescens
Tussilago farfara

Typha angustifolia (Aq)
T. latifolia (Aq)
Ulex europaeus (W)
Ulmus carpinifolia (W)
U. glabra (W)

U. hollandica (W)
U. procera (W)
Urtica dioica (Wg)
(Valeriana dioica)
V. officinalis (W)

Valerianella dentata
Verbascum nigrum
V. thapsus
Verbena officinalis
Veronica arvensis

V. beccabunga
V. chamaedrys (Wg)
* V. montana (W)
V. officinalis
V. persica

V. serpyllifolia
* Viburnum lantana (W)
V. opulus (W)
Vicia angustifolia
V. cracca

V. hirsuta
V. sativa
V. sepium
V. tetrasperma
Viola canina

V. hirta
V. odorata (W)
* V. reichenbachiana (W)
V. riviniana (W)
V. tricolor

Zerna erecta
Z. ramosa (W)

BRYOPHYTES

A.D. Horrill

Bedford Purlieus is mentioned by name in H.N. Dixon's "Moss Flora of Northamptonshire" (1899) where twelve mosses are recorded specifically at the site (see appended list). Seven of these species were found during the present survey, three could possibly still be present at the site, whilst two have probably vanished. Dixon's account of the hepatics (1911) has no records from this area.

A number of contributing factors - the climate, lack of suitable habitats and the past management of the wood - mean that few species can be expected. The site is in one of the driest areas of the country where the climate is of a continental type. The total number of "wet days" is about 120 (Ratcliffe, 1968), i.e. a day on which 1 mm of rain is recorded. Available habitats are limited by the absence of any exposed rocky material and comprise tree bases and fallen timber, the soil surface, rides, the damper sides of drainage channels and the seasonal stream running through the centre of the woodland. A very uniform flora is found throughout the area, the main variation being in the relative abundance of the species present. The main exceptions to this rule are the areas planted with conifers (mainly compartments 39, 40 and 43) and compartment 34 where there is a large open space dominated by bracken.

The typical bryophyte flora is illustrated by compartment 42B. The tree layer is of mixed coppice with a thin ground flora of Deschampsia cespitosa, Athyrium filix-femina, Dryopteris filix-mas, and Rubus fruticosus. The bryophyte layer on the surface of a brown calcareous clay is dominated by Eurhynchium striatum and Fissidens taxifolius. Atrichum undulatum, Eurhynchium praelongum, Fissidens bryoides and the liverwort Calypogeia fissa are present in moderate quantity on the bare soil surface, whilst the tree bases and stumps support Mnium hornum, Isothecium myosuroides and Lophocolea heterophylla. Rotting stumps and lying dead timber are mainly dominated by Brachythecium rutabulum and Lophocolea heterophylla with an occasional poorly developed specimen of Dicranum scoparium. In shady areas and particularly in situations where an old thicket has collapsed Thuidium tamariscinum has become locally dominant and formed a complete mat. Plagiochila asplenioides var. major and Mnium undulatum are usually associated with such areas.

This type of assemblage may be found in many parts of Bedford Purlieus but is limited in some areas by the density of the canopy and/or the litter layer. Where a dense tree layer prevails, e.g. compartments 32B, 36A, and 35 the ground cover of bryophytes is reduced to around 5-10%, mainly composed of Eurhynchium spp. and Fissidens taxifolius with very little else present.

A slight contrast is provided by the conifer areas, where, even on brown calcareous soils, a more acidic substrate of needles has accumulated. In compartment 39D a noticeable point is the frequency of Pseudoscleropodium purum which, together with Thuidium tamariscinum, Hypnum cupressiforme, Dicranum scoparium and Eurhynchium praelongum forms the main bryophyte mat. Polytrichum formosum may occasionally be seen in these areas whilst the rides through them, e.g. between compartments 39C and 39D, are dominated by mats of Thuidium tamariscinum and Pseudoscleropodium purum.

Rather more acid conditions occur in part of the Bedlams, where the woodland floor on either side of a ride is covered by a humus layer. Here Mnium hornum, Hypnum cupressiforme and Dicranella heteromalla will be found on the mixtures of exposed clay and humus around old stools and tree bases.

The open, bracken-dominated area in compartment 34 supports a very poor flora but it appears to have been burnt over fairly recently, for two species characteristic of burnt areas, Funaria hygrometrica and Ceratodon purpureus, are present. The dead wood and stumps in this area support Tetraphis pellucida, Dicranum scoparium and Hypnum cupressiforme, whilst on the grassy track running to the area, patches of Rhytidiadelphus squarrosus may be found.

Some habitats occur throughout the site. The most important are (i) the drain and ditch sides and (ii) the sites for epiphytic species. The upper parts of the drains and ditches support a flora similar to the rest of the wood, although the abundance of Fissidens taxifolius is very noticeable. Lower down, in moister conditions, Pellia endiviifolia is frequent together with sheets of Calypogeia fissa. At one point where the main ditch crosses the ride between compartments 41A and 42A there are areas dominated by Mnium longirostrum both on the ride surface and on the ditch sides. Epiphyte species are rare and confined to the tree bases and stumps. It is interesting to note that Dixon (1899) records Ulota bruchii as "very poor" a species certainly now not present in the wood and possibly eliminated by air pollution. The main epiphytes are Isothecium myosuroides, Hypnum cupressiforme and Mnium hornum, all on tree bases. A little Dicranoweissia cirrata was found and rarely the liverwort Metzgeria furcata occurs on tree bases near the ditches. Bryum capillare was recorded a few times on Elm trees by the main drainage ditch.

Finally, two species found as rarities during the survey which may exist elsewhere in the wood. In compartments 41A and 44A Homalia trichomanoides was found growing on old coppice stools and in one instance Plagiothecium undulatum was discovered growing on a rotten stump.

Mosses recorded by H.N. Dixon (1899)

Encalypta streptocarpa
\+ Ulota bruchii
* Homalia trichomanoides
* Pseudoscleropodium purum
* Cirriphyllum piliferum
* Eurhynchium swartzii
\+ Campylium chrysophyllum
* Hypnum cupressiforme
* H. cupressiforme var. filiforme
* Ctenidium molluscum
Pleuridium subulatum
* Dicranum scoparium

* Found in recent survey   + probably extinct

Preliminary species list to October 1974

Mosses	Habitat where commonly found
Acrocladium cuspidatum	wet grassy rides
Amblystegium serpens	tree bases
Atrichum undulatum	soil surface
Barbula revoluta	soil surface in rides
B. unguiculata	soil surface in rides
Brachythecium rutabulum	dead timber
Bryum argentium	old culvert
B. capillare	epiphyte
Ceratodon purpureus	soil, burned areas
Cirriphyllum piliferum	soil surface
Ctenidium molluscum	soil surface
Dicranella heteromalla	clay soil surface
Dicranoweissia cirrata	epiphyte
Eurhynchium praelongum	soil surface
E. striatum	soil surface
E. swartzii	soil surface, grassy rides
Fissidens bryoides	soil surface
F. taxifolius	soil surface
F. incurvus	soil surface
Funaria hygrometrica	soil, burned areas
Hypnum cupressiforme	tree bases
Isothecium myosuroides	epiphyte
Mnium hornum	tree bases
M. longirostrum	rides and ditches
M. undulatum	soil surface
Plagiothecium denticulatum	tree base
P. undulatum	dead rotten stump
Polytrichum formosum	soil, conifer areas
Pseudoscleropodium purum	soil, conifer areas
Thamnium alopecurum	soil surface
Thuidium tamariscinum	soil surface
Tortula muralis	old culvert stonework

Hepatics

Calypogeia fissa	ditch sides
Lepidozia reptans	tree base
Lophocolea bidentata	grassy rides
L. heterophylla	epiphyte
Metzgeria furcata	epiphyte
Pellia endiviifolia	ditch bottoms
Plagiochila asplenioides	soil surface
P. asplenioides var. major	soil surface

All nomenclature as in Watson (1955)

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FUNGI

Sheila Wells

Although Bedford Purlieus has been visited by naturalists for more than a century, surprisingly little is known about the fungi. The Rev. M.J. Berkley, one of the most eminent mycologists of his time, had the living of the Parish of Apethorpe for about 40 years, yet I have been unable to find any published records made by him from the wood. In 1883, towards the end of his life, Rev. Berkley in an address to the Northamptonshire Natural History Society refers to the presence of truffles (Tuber aestivum) in the area which included Bedford Purlieus, but unfortunately no mention is made of other fungi. His collection of fungi is now incorporated in the Herbarium at Kew and I have not undertaken the difficult task of going through the Herbarium to ascertain if any of his specimens came from Bedford Purlieus. However, Dr. Reid has recently found a specimen of Clavulinopsis corniculata (Fr.) Corner in the Herbarium at Kew, stamped Herb. Berkley, collected in Bedford Purlieus in 1841.

Dr. D.A. Reid visited the wood during November 1972 and recorded 85 species, mostly Aphyllophorales and Ascomycetes. The present survey, made in the period from November 1973 to October 1974 has brought the total to 309, of which about two-thirds are Agarics. Special attention has been paid to the larger fungi, but nevertheless, certain difficult groups, for example Psathyrella, Cortinarius and Russula have been inadequately recorded and it is certain that, if experts in these genera visited the wood, more species would be added. Similarly, Myxomycetes and Ascomycetes have been under-recorded.

The variety of soil types found in the wood suggests that there is a relationship between the distribution of fungi, both in type and numbers, and the soil, but in this short study it has not been possible to discover any pattern. On the other hand, well-known associations between certain fungi and tree species were observed.

In coniferous areas such species as Lactarius deliciosus, Gomphidius rutilus and Boletus granulatus were abundant, but absent elsewhere. Auriscalpium vulgare was common on cones under pines. The large puff-ball Calvatia excipuliforme seemed to be confined almost entirely to the conifer plantations.

In the mixed deciduous areas many of the Agarics collected were probably mycorrhizal but it is often difficult to decide with which trees they are associated. However, in some cases the associations were quite clear - Russula fellea was conspicuous under beech; Lactarius pyrogalus was always under hazel; Lactarius quietus was found under oak; Amanita muscaria appeared under birch and Hygrophorus chrysodon was twice collected under lime.

Evidence of previous tree cover was afforded by the occasional occurrence of species normally associated with deciduous wood in present day coniferous areas, e.g. Mycena polygramma, Oudemansiella longipes. The presence of Heterobasidion annosum on a stump under ash trees, suggests that conifers had previously grown there.

A number of species which grow on stumps, dead branches and sticks have been recorded e.g. Marasmius ramealis, Mycena galericulata, Hypholoma fasciculare, but other species which are usually found on large pieces of timber appear to be infrequent and Pleurotus ostreatus has not yet been recorded. This may be due to the relative scarcity of this particular habitat.

Further variety is added by the presence of sawdust heaps, grassy paths, ditch banks and mammal dung, each of which supports a special fungus flora e.g. Paxillus panuoides on the sawdust heap in 40A; Humaria hemispherica on bare soil; Pilobolus species growing on deer dung and Bolbitius vitellinus on the paths.

Other specialised habitats e.g. cupules of oak, catkins of birch, fruits of hawthorn and hazel are known to support particular species of Ascomycetes, but these have not been investigated.

It is difficult to apply the concept of rarity to fungi because of their mode of reproduction and inadequate study. Bearing this in mind the following species which are considered uncommon have been recorded:- Oudemansiella longipes, Lepiota fuscovinacea, L. bucknallii, Russula queletii. Cortinarius dionysae is a new record for the British Isles and is likely to be uncommon.

Published lists of fungi from particular woodland sites are so few that it is difficult to assess the richness of the flora of Bedford Purlieus in comparison with woods of similar size and floristic composition. The number of species recorded is about the same as in the published lists for Monks Wood (Steele & Welch, 1973) and Northaw Great Wood (Sage, 1966). The fungi in both of these woods have been studied for a longer period and it therefore seems likely that Bedford Purlieus may prove to be richer mycologically than these areas after a longer period of study.

ACKNOWLEDGEMENTS

I would like to thank my husband for his encouragement and for his help with collection and identification of specimens; Dr. D.A. Reid for his help with critical species and for allowing me to use the data from his 1972 list; Mr. A. Rayner for help with determinations of Russulas and Mr. S. Carter for identifying all the Myxomycetes.

LIST OF FUNGI RECORDED FROM BEDFORD PURLIEUS 1972-1974

The following list was compiled between November 1973 and November 1974, with additional records from Dr. D.A. Reid in 1972 (= Rec. D.A.R. in List).

MYXOMYCETES

Nomenclature follows Ing, B. 1968. All determinations by Mr. S.G. Carter.

Arcyria denudata (L.) Wettst. Stump on bank at edge of 32A.

A. incarnata (Pers.) Pers. Stump on bank at edge of 32A.

Comatricha nigra (Pers.) Schroet. Wood debris 32B.

Fuligo septica (L.) Web. On stock at edge of 47A.

Lamproderma scintillans (Berk. & Br.) Morg. 35.

Lycogala epidendrum (L.) Fr. Stump 37C.

Trichia persimilis Karst. On lime stool 36A.

T. varia (Pers.) Pers. Decaying bark 37C.

PHYCOMYCETES

Pilobolus cristallinus Tode On deer dung.

ASCOMYCETES

Nomenclature follows Dennis, R.W.G. British Ascomycetes, 1968.

PYRENOMYCETES

Daldinia concentrica (Bolt. ex Fr.) Ces. & de Not. All recorded by D.A.R.

Diatrype disciformis (Hoff. ex Fr.) Fr.

Gloniopsis levantica Rehm

Herpotrichia macrotrichia (Berk. & Br.) Sacc. On dead *Heracleum* stem.

Hypoxylon fuscum (Pers. ex Fr.) Fr.

H. multiforme (Fr.) Fr.

H. rubiginosum (Pers. ex Fr.) Fr.

H. serpens (Pers. ex Fr.) Fr.

Lasiosphaeria spermoides (Hoff. ex Fr.) Ces. & de Not.

Nectria cinnabarina (Tode ex Fr.) Fr.

N. episphaeria (Tode ex Fr.) Fr.

Thaxteria phaeostroma (Dur. & Mont.) C. Booth

Xylaria hypoxylon (L. ex Fr.) Grev.

DISCOMYCETES

Calycella sulphurina (Quél.) Boud. On rotting twigs 39A.

Chlorosplenium aeruginascens (Nyl.) Karst. Common on dead deciduous wood.

Coryne sarcoides (Jacqu. ex Fr.) Tul. Dead wood 38B.

Cudoniella acicularis (Bull. ex Fr.) Schr. apud Cohn. On rotting log 43B.

Cyathipodia macropus (Pers. ex Fr.) Dennis Rotting lime branch 39A.

Cyathicula coronata (Bull. ex Mérat) de Not. Rec. D.A.R.

Dasyscyphus brevipilus Le Gal Rec. D.A.R.

Disciotis venosa (Pers.) Boud. On ground 38B, 43A.

Helvella crispa Fr. On ground at edge of 35 and on Main Ride.

Humaria hemisphaerica (Wiggers ex Fr.) Fuckel On rotting wood 32B, 43A.

Leotia lubrica Pers. On ground 32B, 40B.

Mitrophora semilibera (DC ex Fr.) Lév. On ground 43C.

Peziza badia Pers. ex Mérat On ground 32A.

P. repanda Pers. On ground 33, sawdust heap 43C.

P. succosa Berk. On ground 32A & B.

Polydesmia pruinosa (Berk. & Br.) Boud. Rec. D.A.R.

Propolis versicolor (Fr.) Fr. Rec. D.A.R.

Rutstroemia firma (Pers.) Karst. On sticks 48A.

R. sydowiana (Rehm) White Rec. D.A.R.

Scutellinia trechispora (Berk. & Br.) Lamb. On soil 32B.

Trichoglossum hirsutum (Pers. ex Fr.) Boud. In moss under hazel 48A.

HETEROBASIDIOMYCETES

UREDINALES

Nomenclature follows Wilson & Henderson, British Rust Fungi, 1966.

Melampsora populnea (Pers.) Karst (= M. rostrupii Wagn.) On Dogs Mercury 35, 37C.

Phragmidium violaceum (C.F. Schultz) Wint. On stems of Blackberry, 35, 39A.

Triphragmidium ulmariae (Dc.) Wint. On stems of Meadow Sweet on path between 35 and 39A.

TREMELLALES

Nomenclature follows Donk, M.A., 1966.

Calocera cornea (Batsch ex Fr.) Fr. On dead wood 37C, 48A.

C. viscosa (Pers. ex Fr.) Fr. On coniferous stump 39C.

Dacryomyces stillatus Nees ex Fr. (= D. deliquescens Duby) On dead wood in all areas.

Exidia thuretiana (Lév.) Fr. On wood 38B.

E. glandulosa (Bull. ex St. Amans) Fr. On dead wood 32B, 38B.

Hirneola auricula-judae (Bull. ex St. Amans) Berk. Rec. D.A.R.

Tremella mesenterica Retz. ex Hook On dead Sycamore branches 39C.

HOMOBASIDIOMYCETES

APHYLLOPHORALES

Nomenclature follows Pegler, D.N., 1973, Donk, M.A., 1964, Corner, E.J., 1950 and Christiansen, M.P., 1960.

Auriscalpium vulgare S.F. Gray Common on pine cones.

Bjerkandera adusta (Willd. ex Fr.) Karst. On birch log 48A.

Clavariadelphus junceus (Fr.) Corner Rec. D.A.R.

Clavulina cristata (Fr.) Schroet. At edge of main ride in several places.

C. rugosa (Fr.) Schroet. 48A.

Clavulinopsis helvola (Fr.) Corner In moss on ground 32B.

Cristella farinacea (Pers. ex Fr.) Donk Rec. D.A.R.

C. sulphurea (Pers. ex Fr.) Donk Rec. D.A.R.

Coriolellus serpens (Fr.) Bond. Rec. D.A.R.

Coriolus versicolor (L. ex Fr.) Quél. Common on stumps and dead branches.

Cylindrobasidium evolvens (Fr. ex Fr.) Julich Rec. D.A.R.

Daedalea quercina L. ex Fr. Frequent especially on Sweet Chestnut stumps 32B.

Daedaleopsis confragosa (Bolt. ex Fr.) Schroet. On dead branches in 38B, 40B, 43B, 48A.

Flagelloscypha citrispora (Pilát) Reid Rec. D.A.R.

Hapalopilus nidulans (Fr.) Karst. On birch log by ride 43B.

Heterobasidion annosum (Fr.) Bref. On stumps 39C, 40A.

Hirschioporus abietinus (Dicks. ex Fr.) Donk On dead pine branches 40A.

Hymenochaete cinnamonea (Pers.) Bres. Rec. D.A.R.

Hypoderma tenue (Pat.) Donk Rec. D.A.R.

Merulius corium Fr. On dead sticks 40B.

Mycoacia uda (Fr.) Donk Rec. D.A.R.

Peniophora cinerea (Fr.) Bres. Rec. D.A.R.

P. lycii (Pers.) Höhn. & Litsch. Rec. D.A.R.

P. quercina (Pers. ex Fr.) Cooke Rec. D.A.R.

P. rufomarginata (Pers.) Litsch. Rec. D.A.R.

Phanerochaete cremea (Bres.) Parm. Rec. D.A.R.

Phlebia merismoides Fr. On sticks and dead branches 36B.

P. rufa Pers. ex Fr. Rec. D.A.R.

Piptoporus betulinus (Bull. ex Fr.) Farst. On birch in deciduous areas.

Polyporus squamosus Huds. ex Fr. On stump 35.

Ramaria flaccida (Fr.) Rock. In large patches under pine 40A.

Stereum gausapatum (Fr.) Fr. On dead branches 37C, 40A.

S. hirsutum (Willd. ex Fr.) S.F. Gray On dead twigs 37C.

S. rugosum (Pers. ex Fr.) Fr. Rec. D.A.R.

S. sanguinolentum (Alb. & Schw. ex Fr.) Fr. On pine branch 40A.

Strangulidium rennyi (Berk. & Br.) Pouz. Rec. D.A.R.

Typhula erythropus Fr. Rec. D.A.R.

Tyromyces albellus (Peck.) Bond. & Sing. Birch stump 36D.

T. caesius (Schrad. ex Fr.) Murr. Sycamore branch 39B.

T. gloeocystidiatus Kotl. & Pouz. Rec. D.A.R.

Vuilleminia comendens (Nees ex Fr.) Maire On dead sticks 33.

Xylodon versiporus (Pers.) Bond. Rec. D.A.R.

AGARICALES

Nomenclature follows Dennis, R.W.G., Orton, P.D. & Hora, F.B., 1960. New Check List of British Agarics and Boleti, except where otherwise stated.

Agaricus arvensis Schaeff. ex Secr. At edge of 40A.

A. campestris L. ex Fr. At edge of 43A.

A. silvaticus Schaeff. ex Secr. Forming rings 39C, 40A.

A. silvicola (Vitt.) Peck 40A.

A. xanthodermus Genevier Abundant, often in rings under conifers 39C, 42B.

Amanita citrina (Schaeff.) S.F. Gray 32C, 33.

A. citrina var. alba (Gillet) E.J. Gilbert 32B.

A. fulva (Schaeff.) Secr. 32A, 32B.

A. muscaria (L. ex Fr.) Hooker With birch 32B, 33, 36B.

A. phalloides (Vaill. ex Fr.) Secr. Under hazel 43C.

A. rubescens ([Pers.] Fr.) S.F. Gray 32, 33, 36D, 39C.

Armillaria mellea (Vahl ex Fr.) Kummer Common on stumps in most sections and often at base of living trees affected by this fungus.

Bolbitius vitellinus (Pers. ex Fr.) Fr. In grass on ride through 37A.

Boletus badius Fr. 32B.

B. edulis Bull. ex Fr. 33, 43C.

B. erythropus (Fr. ex Fr.) Secr. 33.

B. granulatus L. ex Fr. Abundant under conifers in 39C, 40A, 43A.

B. luridus Schaeff. ex Fr. 39C.

B. piperatus Bull. ex Fr. 39C.

B. rubellus Krombh. At edge of roadway by 48A.

B. scaber Bull. ex Fr. Common under deciduous trees.

B. subtomentosus L. ex Fr. 32A.

Cantharellus infundibuliformis (Scop.) Fr. 32A, 33, 36C, 40B.

Clitocybe cerussata (Fr.) Gillet 36D, 42B.

C. clavipes (Pers. ex Fr.) Kummer 32C, 36D.

C. dicolor (Pers.) J. Lange Under conifers 39C, 40A.

C. fragrans (Sow. ex Fr.) Kummer 38B.

C. incilis (Fr.) Gillet 40A.

C. infundibuliformis (Schaeff, ex Weinm.) Quél. 32A, 36B.

C. nebularis (Batsch ex Fr. Kummer) Under conifers.

C. odora (Bull. ex Fr.) Kummer Under conifers 40A.

C. vibecina (Fr.) Quél.

Clitopilus prunulus (Scop. ex Fr.) Kummer 43B, 32B.

Collybia confluens (Pers. ex Fr.) Kummer In beech litter, 36D.

C. cookei (Bres.) J.D. Arnold 33.

C. dryophila (Bull. ex Fr.) Kummer 39A, 40B, 43A.

C. erythropus (Pers. ex Fr.) Kummer) 32A, 40A.

C. fusipes (Bull. ex Fr.) Quél. 32B, 40A.

C. maculata (Alb. & Schw. ex Fr.) Kummer 33, 36B, 40A.

C. peronata (Bolt. ex Fr.) Kummer 39C, 40A, 42B.

Conocybe filaris (Fr.) Kühn. 43A.

C. magnicapitata P.D. Orton Rec. D.A.R.

C. rickeniana Sing. P.D. Orton 43C.

C. subpubescens Kühn. ex P.D. Orton 39A.

C. togularis (Bull. ex Fr.) Kühn. 41B, 43B.

Coprinus atrementarius (Bull. ex Fr.) Fr. 38C, 50A, Main Ride.

C. comatus (Mull. ex Fr.) S.F. Gray 47A.

C. disseminatus (Pers. ex Fr.) S.F. Gray On stumps 35, 36A, 37C.

C. hemerobius Fr. In grass 37B, 40A.

C. lagopus (Fr.) Fr. On ground under lime 33.

C. micaceus (Bull. ex Fr.) Fr. On stumps & on ground, common.

C. plicatilis (Curt. ex Fr.) Fr. In grass on Main Ride.

C. radiatus (Bolt. ex Fr.) S.F. Gray On cow dung, 50A.

Cortinarius delibutus Fr. 32A, 40B, Det. D.A.R.

C. dionysae R. Henry NEW BRITISH RECORD Under birch tree at edge of ride in 40A. (See Kühner, R. & Romagnesi, H. Flore Analytique des Champignons Superieurs. Det. D.A.R.)

C. hemitrichus sensu Kühner & Romagnesi 32B, Det. D.A.R.

C. lepidipus Cooke 32A, Det. D.A.R.

C. nemorensis (Fr.) J. Lange 33, Det. D.A.R.

C. punctatus sensu K. & R. 32A, Det. D.A.R.

C. sodagnitus R. Henry 43A, 43B.

Craterellus cornucopioides ([L.] Fr.) Pers. Under beech 39C, 48A.

C. sinuosus (Fr.) Fr. 34.

Crepidotus amygdalosporus Kühn. On rotting twigs 33.

Entoloma nidorosum (Fr.) Quél. 32B, 43A.

E. sinuatum (Bull. ex Fr.) Kummer 48A.

Flammulina velutipes Karst. Common on dead wood.

Galerina hypnorum (Schrank ex Fr.) Kühn. In moss 32B, 35.

G. mutabilis (Schaeff. ex Fr.) P.D. Orton On stumps & on old lime stools, common.

G. unicolor (Vahl ex Sommerf) Sing. Under conifers in 40A.

Gomphidius rutilus (Schaeff. ex Fr.) Lundell Abundant in conifer areas.

Gymnopilus junonius (Fr.) P.D. Orton On Sweet Chestnut stump in 32A.

G. penetrans (Fr. ex Fr.) Murr. On stumps & sticks in deciduous and conifer areas.

Hebeloma crustiliniforme (Bull. ex St. Amans) Quél. 32B, 33, 36A, 36B, 50A.

H. sinapizans (Paulet ex Fr.) Gillet 32B, 43A, 48A.

Hygrophoropsis aurantiaca ([von Wulfen] Fr.) Maire Conifer area of 40A.

Hygrophorus camarophyllus (Alb. & Schw.) Dumée, Grandjean & Maire 36D.

H. chrysodon (Batsch ex Fr.) Fr. Under lime in 36A.

H. conicus (Scop. ex Fr.) Fr. 32A, 50A.

H. dichrous Kühn. & Romag. 34, 40A.

H. eburneus (Bull. ex Fr.) Fr. Abundant in all parts of the wood often forming rings.

H. hypothejus (Fr. ex Fr.) Fr. Under conifers in 42B.

H. nigrescens (Quél.) Quél. 36D.

H. niveus (Scop.) Fr. In litter under hazel in 48A.

Hypholoma fasciculare (Huds. ex Fr.) Kummer Common on stumps & old stools.

H. sublateritium (Fr.) Quél. On stump in 38B.

Inocybe asterospora Quél. Single specimens in 36B, 37C.

I. cervicola (Pers. ex Pers.) Quél. Small group beside ride in 40A.

I. cookei Bres. 39C.

I. corydalina Quél. On Main Ride.

I. dulcamara (Alb. & Schw. ex Pers.) Kummer

I. geophylla (Sow. ex Fr.) Kummer Frequently found in all parts of the wood.

I. geophylla var. lilacina Gillet 37C.

I. maculata Boud. 39C.

I. pyriodora (Pers. ex Fr.) Kummer On Main Ride. Variant with reddish cap and stipe on ride through 40A.

Laccaria amethystea (Bull. ex Mérat) Murr. Common in all parts of the wood.

L. laccata (Scop. ex Fr.) Cooke Very common.

Lacrymaria velutina (Pers. ex Fr.) Konrad & Maubl. 33, 36D, 48A.

Lactarius blennius (Fr. ex Fr.) Fr. Under beech in 36D, 43A.

L. camphoratus (Bull. ex Fr.) Fr. 32B.

L. chrysorheus Fr. Under lime in 33.

L. deliciosus (L. ex Fr.) S.F. Gray At edges of rides through 39C, 40A, 42B.

L. glyciosmus (Fr. ex Fr.) Fr. 32B, 48A.

L. mitissimus (Fr.) Fr. 33, 40A - deciduous area.

L. piperatus (Scop. ex Fr.) S.F. Gray 33, 39C.

L. pyrogalus (Bull. ex Fr.) Fr. Under hazel in 32C, 48A.

L. quietus (Fr.) Fr. Under oaks in 32A, 33, 36A, 43A, 48A.

L. rufus (Scop. ex Fr.) Fr. Under conifers 39D.

L. serifluus (DC ex Fr.) Fr. 48A.

L. subdulcis (Pers ex Fr.) S.F. Gray 32B, 33, 36B, 40B, 48A.

L. tabidus Fr. 32, 32B, 33.

L. torminosus (Schaeff. ex Fr.) S.F. Gray Common in deciduous areas.

L. turpis (Weinm.) Fr. Common in mixed deciduous areas.

L. vellereus (Fr.) Fr. 33, 48A.

L. zonarius (Bull. ex St. Amans) Fr. At edge of Main Ride in 34.

Lentinellus cochleatus (Pers. ex Fr.) Karst. On stump in 36D.

Lepiota bucknallii (Berk. & Br.) Sacc. Under beech in 43A.

L. castanea Quél. 40A, 43A, 42B.

L. cristata (Fr.) Kummer Common in deciduous & coniferous areas.

L. eriophora Peck Under hazel in 43C.

L. friesii (Lasch) Quél. 36A, 40A.

L. fuscovinacea F.H. Möller & J. Lange In moss under pines in 39D.

L. sistrata (Fr.) Quél. In pine areas of 39D, 43A.

L. subgracilis Kühn 40A.

Lepista nuda (Bull. ex Fr.) Cooke Forming rings under pines 40A near border with deciduous trees.

Macrocystidia cucumis (Pers. ex Fr.) Heim Single specimens in 39D, 48A.

Marasmius boulliardii Quél. 41A.

M. epiphyllus (Pers. ex Fr.) Fr. Amongst leaf litter in 36A, 48A.

M. ramealis (Bull. ex Fr.) Fr. Common, often in large numbers on fallen twigs in all parts of the wood.

M. rotula (Scop. ex Fr.) Fr. On woody debris 40A.

Melanoleuca brevipes (Bull. ex Fr.) Pat. 42B.

M. melaleuca (Pers. ex Fr.) Murr. Main Ride by 34, 42B, 43A.

Mycena alcalina (Fr. ex Fr.) Kummer On dead wood 36A.

M. capillaris (Schum. ex Fr.) Kummer Rec. D.A.R.

M. epipterygia (Scop. ex Fr.) S.F. Gray Among leaves under deciduous trees 33, 48A.

M. fibula (Bull. ex Fr.) Kühn. In moss on rides 39C, 39D, 43A.

M. filopes (Bull. ex Fr.) Kummer Rec. D.A.R.

M. galericulata (Scop. ex Fr.) S.F. Gray Very common on dead wood in all parts of the wood.

M. galopus (Pers. ex Fr.) Kummer Common in all parts of the wood.

M. haematopus (Pers. ex Fr.) Kummer Rec. D.A.R.

M. inclinata (Fr.) Quél. On wood 48A.

M. leptocephala (Pers. ex Fr.) Gillet Common on the ground in all parts of the wood.

M. lineata f. pumila Lange, (see Kühner & Romagnesi - Fl. Ann. des Champ. Sup. p. 103) On moss at base of living trunk, 38B.

M. olida Bres. Rec. D.A.R.

M. polygramma (Bull. ex Fr.) S.F. Gray 39C, 39D, 40A, 48A.

M. pura (Pers. ex Fr.) Kummer In conifer areas of 39C, 40A.

M. sanguinolenta (Alg. & Schw. ex Fr.) Kummer 32A, 33, 43A, 48A.

M. speirea (Fr. ex Fr.) Gillet Rec. D.A.R.

M. swartzii (Fr. ex Fr.) A.H. Smith In moss on ride through 39C.

M. tortuosa P.D. Orton On small rotting twigs 38B.

M. vitilis (Fr.) Quél. 43A, 48A.

Nolanea juncinus (K. & R.) P.D. Orton On ground 36C.

N. mammosa (L. ex Fr.) Quél. On ground under sycamore, 39B.

N. staurospora Bres. 39C.

Oudemansiella longipes (Bull. ex St. Amans) Moser Under conifers in 40A.

O. radicata (Relhan ex Fr.) Sing. Common in all parts of the wood.

Panellus serotinus (Schrad. ex Fr.) Kühn. On rotting log 41B.

P. stipticus (Bull. ex Fr.) On stump in 37A, fallen birch in 40A.

Paxillus atrotomentosus (Barsch ex Fr.) Fr. On dead coniferous wood 39A, 40A.

P. involutus (Batsch ex Fr.) Fr. Very common in all parts of the wood.

P. panuoides (Fr. ex Fr.) Fr. On sawdust heap in 40A.

Pluteus cervinus (Schaeff. ex Fr.) Kummer 40A. Enormous specimens on sawdust heaps in 40A and 43B.

P. lutescens (Fr.) Bres. On old hazel stools 35, 48A.

P. salicinus (Pers. ex Fr.) Kummer Rec. D.A.R.

P. thomsonii (Berk. & Br.) Dennis On old hazel stools, 35, 48A.

Psathyrella candolleana (Fr.) Maire 33.

P. hydrophila (Bull. ex Mérat) Maire In large clusters on stumps 32B, 48A.

P. pseudogracilis Romag. (See Kühn. & Romagn. Fl. Ann. Champ. Sup. p. 357) 34.

P. spadiceogrisea (Fr.) Maire On ground 38B.

Russula betularum Hora In mixed deciduous area containing birch in 38B.

R. carminea (Schaeff.) K. & R. Ride beside 33.

R. cyanoxantha (Schaeff. ex Secr.) Fr. Path through 32A.

R. delica Fr. In 33 and at edge of coniferous area of 40A.

R. densifolia (Secr.) Gillet 32B.

R. emeticella (Sing.) Hora 32A, 32B, Det. A.D.M. Rayner.

R. fellea (Fr.) Fr. Under beech in 36D, 33.

R. foetens (Pers. ex Fr.) Fr. 32B.

R. fragilis (Pers. ex Fr.) Fr. 32B, 33, 48A.

R. heterophylla (Fr.) Fr. Path through 33.

R. laurocerasi Melzer Frequent in 32A, 32B.

R. lutea (Huds. ex Fr.) S.F. Gray 43A.

R. luteotacta Rea Common on ride by 32B.

R. mairei Sing. 36D, under beech, Det. A.D.M. Rayner.

R. nigricans (Bull. ex Mérat) Fr. Common in 32B, 33, 36A, 36D, 40A.

R. ochroleuca (Pers. ex Secr.) Fr. 48A.

R. pulchella Borszozow On Main Ride in 36D, Det. A.D.M. Rayner.

R. queletii Fr. apud Quél. Edge of path 39C. An uncommon species.

R. sardonia Fr. Under conifers 40A, Det. A.D.M. Rayner.

R. velenovskyi Melzer & Zvara 32B, 33, 39C.

Stropharia aeruginosa (Curt. ex Fr.) Quél. On ground in 40A, 42B, 50A.

S. inuncta (Fr.) Quél. Beside Main Ride, 40B.

Tricholoma atrosquamosum (Chevallier) Sacc. Edge of 32B.

T. fulvum (Dc. ex Fr.) Sacc. Frequent in 36B, 39A, 40A, 48A.

T. gambosum (Fr.) Kummer At edge of 39B.

T. imbricatum (Fr. ex Fr.) Kummer Forming rings on ride and at edge of 42B.

T. ionides (Bull. ex Fr.) Kummer Amongst Dogs Mercury under conifers in 39C.

T. saponaceum (Fr.) Kummer Common in 32A, 34, 36C, Det. D.A.R.

T. sejunctum (Sow. ex Fr.) Quél. Under lime 36B.

T. terreum (Schaeff. ex Fr.) Kummer Common often forming rings under conifers in 36B, 39C, 40A, 42B.

Tricholomopsis platyphylla (Pers. ex Fr.) Sing. 32B.

T. rutilans (Schaeff. e Fr.) Sing. Common on coniferous logs and stumps in 39C, 40A.

Tubaria furfuracea (Pers. ex Fr.) Gillet Common in all parts of the wood.

Volvariella parvula (Weinm.) P.D. Orton Single specimen under conifers 40A.

GASTEROMYCETES

Nomenclature follows Palmer, J.T. 1968.

Calvatia exculipuliformis (Schaeff. ex Pers.) Perd. Common in coniferous areas often in rings.

Geastrum rufescens Pers. em. Kits van Wav. On ground under deciduous trees 39A & C, under pine in 40A.

Lycoperdon echinatum Pers. ex Pers. Deciduous area of 43A.

L. molle Pers. 39C.

L. perlatum Pers. 40B.

L. pyriforme Schaeff. ex Pers. Common on stumps 38A, 40A & B, 50A.

Mutinus caninus (Huds. ex Fr.) Pers. Deciduous area 40A, Rec. R.C. Welch.

Phallus impudicus L. ex Pers. Under bracken 33, 34.

Sphaerobolus stellatus Tode. ex Pers. Rec. D.A.R.

HYPHOMYCETES

Nomenclature follows Ellis, M.B. Dermatiaceous Hyphomycetes, 1971.

Exosporium tiliae Link. ex Schlecht. Rec. D.A.R.

Oidium aureum Link. Rec. D.A.R.

LICHENS

O.L. Gilbert

INTRODUCTION

Large old woods are frequently important lichen sites as they provide a refuge for species unable to survive in the surrounding more open and polluted landscapes. Two visits to Bedford Purlieus showed that while it contains several epiphytic lichens of interest this ancient wood is not a major lichen site. Only 35 corticolous species have been recorded, most of which are good colonisers widespread in Britain. Natural high forest in this area probably contained epiphytic lichens at a density of over 100 species/sq. km. and it is significant that none of the twenty or so indicators of sites where there has been a continuity of the ancient forest canopy were found (Rose, 1974).

Several factors which make the present wood rather unsuitable for lichens can be identified. Intensive management in the past, particularly the repeated clear fellings will have resulted in the destruction of entire communities which do not readily reinvade and the accompanying drying out of the wood will have impoverished any fragments of these assemblages which survived a felling. The most recent (20th century) felling and replanting has produced a dense, young wood of even-aged blocks with no large trees. This is the exact opposite of the situation found in the best woodland lichen sites, e.g. the New Forest (Rose & James, 1974) where the most interesting lichen assemblages are on large old trees at the edge of glades where they receive shelter and moderately high illumination. So in Bedford Purlieus the intensity of woodland management has gradually and continuously reduced the lichen flora.

There are many signs that air pollution is also adversely affecting the lichen flora. Most trees carry only the pollution resistant species *Lecanora conizaeoides* and *Lepraria incana* while the more SO_2 sensitive lichens are confined to tree stumps, tree bases, leaning trees, dead horizontal branches or very well sheltered situations. There is no doubt however that if large old trees were present and if there had been a continuity of high forest the lichen flora would be much richer.

Eutrophication caused by fertiliser and dust blowing into the wood was not detected. Due to this factor tree boles in the adjacent farmland carry rather different lichen assemblages. Their rating on the Hawksworth/Rose (1970) qualitative scale for estimating SO_2 air pollution suggests a mean winter SO_2 level for the area of about 70 $\mu g/m^3$.

THE LICHEN FLORA

Woodland

General. The planted trees and coppice regrowth less than fifty years old which make up the bulk of the wood all carry *Lecanora conizaeoides* and *Lepraria incana*. These two conspicuous and ubiquitous lichens are occasionally joined by *Bacidia chlorococca*, *B. umbrina*, and *Lecanora granulosa* together with *Cladonia coniocraea* on tree bases and *Chaenotheca ferruginea* in sheltered cracks on the trunks.

The Nursery. This peninsula of woodland contains some of the oldest trees in the SSSI but is rather exposed to air pollution which restricts most lichens to the base of the larger trees. One or two of the bigger oaks by the pond carry relics of a typical woodland lichen flora but it is only these slightly unusually situated trees which hold foliose lichen communities. Here Evernia prunastri, Hypogymnea physodes, Parmelia glabratula, P. revoluta, P. saxatilis and P. sulcata can be seen.

Central Valley. The discontinuous strip of valley elm wood which is found particularly towards the eastern end of the central valley contains some of the oldest and most sheltered trees in the wood. The elm boles are frequently heavily shaded and consequently support rather specialised communities, but this shallow valley undoubtedly contains the most interesting lichens in the wood. White patches of Phlyctis argena are conspicuous on the better trees and close inspection reveals a number of small crustaceous species including Arthonia spadicea, Bacidia incompta, Dimerella diluta, Lecania cyrtella, Porina chlorotica var carpinea, and the foliose Parmelia subrudecta which are not present elsewhere in the wood.

Other Habitats

Gates, gateposts and fence posts. The old gates and gateposts which stand at several of the entrances are made from hardwood and support quite varied lignicolous communities. Eleven species occur on the gateway at the west end of Centre Riding including Cyphelium inquinans and Lecidea scalaris in fruit. Softwood fence posts are a much poorer habitat.

Disused Quarries. C 20, C 42. Both these small, heavily shaded quarries contain only small areas of outcropping limestone. Traces of two moribund Verrucarias probably date from the light phase when the compartments were last felled.

Rides. No lichens were found in the wide grassy rides of the Bedlams or elsewhere.

Wartime bunkers, shelters and hut bases. Since these structures were erected 26 saxicolous and terricolous lichens have become established on them. Most are common and aggressive species widespread on buildings and in man-made habitats generally. The most interesting are two small immersed species Sarcogyne regularis and Staurothele hymenogonia found on limestone pebbles (old hardstanding) around hut bases in C 45A. Several of the largest lichens in the wood, e.g. Peltigera polydactyla appear to be limited to the site of these old encampments which could make useful halts on a nature trail.

Comparison with other woods in the region

In his extensive surveys Rose (1974) has found that old coppice woodland with oak standards in southern England contains on average 42 epiphytic lichen species/km^2 (or less). This rather low number is thought to be related mainly to history of management. When compared with similar ancient woods in the region, e.g. Monks Wood, which has 43 species (Laundon, 1972 and B.J. Coppins pers. comm.) and Hayley Wood with 40 (Rackham, 1975) Bedford Purlieus with only 35 recorded epiphytes seems more impoverished than usual. It should however be borne in mind that the other woods have been visited by more lichenologists and their lists are helped by the presence of a few large trees in each, especially old oak pollards in Hayley Wood. If managed correctly the Valley elm wood in Bedford Purlieus could develop into an important East of England refugium for lichens which require sheltered conditions and old mossy tree boles.

ANNOTATED LIST OF LICHENS

Prior to this survey (1974) nine lichens had been recorded from the wood, by J.R. Laundon in 1956, J.L. Gilbert (1958) and F.A. Adams (1960 and 1961). The lichen flora now stands at 60 species, of which 35 are corticolous, the remainder occurring only in accessory manmade habitats such as around the army huts. Nomenclature is based on James (1965).

Arthonia spadicea. Rare. On elm and ash in the valley elm wood.

Bacidia chlorococca. Occasional. On larger trees throughout the wood.

B. incompta. Rare. Plentiful on one elm near the stream. C 42.

B. umbrina. Occasional. On larger trees throughout the wood.

Caloplaca citrina. Common. On asbestos, concrete and mortar.

Candelariella aurella. Common. On asbestos and concrete.

C. vitellina. Rare. On old gates and gateposts.

Catillaria griffithii. On ash, 1961, F.A. Adams. Rare. On mature oak.

Chaenotheca ferruginea. Occasional. On the sheltered side of larger trees throughout the wood, especially oaks, but also birch, ash and elm.

Cladonia chlorophaea. Occasional on tree stumps.

C. coniocraea. 1958, J.L. Gilbert. Occasional on stumps and the base of large oak, birch and limes.

C. fimbriata. Rare on stumps. Abundant around some of the army hut bases where it forms quite a feature.

*C. ochrochlora. On rotten wood, 1960, F.A. Adams.

*Collema tenax var vulgare. On ground, 1958, J.L. Gilbert.

Cyphelium inquinans. Rare. On two gateways and on one decorticated standing oak in the Nose.

Dimerella diluta. Rare. Plentiful on the larger elms in the valley elm wood.

Evernia prunastri. Rare. On the base of three oaks by pond in the Nose.

Hypogymnia physodes. Rare. On a few trees in the Nose, very rare elsewhere in the wood. Possibly restricted by the scarcity of well-illuminated habitats.

Lecania cyrtella. Rare. On a few elms in the valley elm wood.

L. erysibe. Frequent. On concrete, brick and asbestos.

Lecanora campestris. Frequent. On concrete and asbestos roofs.

*L. carpinea. On ash, S.W. edge of Purlieus, 1956, J.R. Laundon.

*L. chlarona. On ash S.W. edge of Purlieus, 1956, J.R. Laundon.

*L. chlarotera. 1960, F.A. Adams.

L. conizaeoides. Abundant. On most trees, shrubs, gates and fenceposts.

L. dispersa. Rare on base of one oak by pond in the Nose. Abundant on concrete, asbestos and mortar.

L. expallens. Scarce. On the bark of tree stumps in the Nose. Very rare elsewhere.

L. muralis. Occasional. On asbestos roof of building near Centre Tree.

Lecidea granulosa. Rare. On the base of oak, ash and birch.

L. scalaris. Rare. Plentiful on the base of a few oaks. In fruit on gate at west end of Centre Riding.

L. stigmatea. Frequent on concrete and asbestos roofs.

L. uliginosa. Occasional on gates, tree stumps and the boles of ash trees.

Lepraria incana. Abundant on trees, shrubs and stumps, in shaded situations.

Micaria prasina (Catillaria prasina). Rare. On elm in the Central Valley.

Parmelia glabratula subsp glabratula. Scarce. On ash, oak and elm. Can withstand considerable shade.

P. revoluta. Rare. On the base of two oak by pond in the Nose.

P. saxatilis. Rare. On stumps, tree bases and horizontal branches.

P. subrudecta. Rare. On a few large elm at east end of the Central Valley.

P. sulcata. Rare. On stumps, tree bases and horizontal branches.

Peltigera polydactyla. Occasional. Locally abundant on and around army hut bases.

Pertusaria pertusa. Rare. On one oak adjacent to farmland, the Nose.

Physcia adscendens. Common on asbestos and concrete. Occasional on toprail of gates.

P. caesia. Common on asbestos and concrete.

P. orbicularis. Common on asbestos and concrete. Occasional on toprail of gates.

P. tenella. Rare on concrete.

Phlyctis argena. Bedford Purlieus, 1956, J.R. Laundon. 1960, F.A. Adams. Rare in the general woodland becoming frequent on elm in the Central Valley.

Placynthium nigrum. Frequent. On asbestos roof of building near Centre Tree.

Porina chlorotica var carpinea. Rare. On elm and ash in the Central Valley.

Protoblastenia rupestris. Frequent. Concrete and asbestos roofs.

Rinodina subexigua. Frequent. Concrete and asbestos.

Sarcogyne regularis. Rare. On oolitic pebbles in grassland around the army huts, in C 45A.

Staurothele hymenogonia. Rare. On oolitic pebbles in grassland around the army huts, C 45A.

Verrucaria hochstetteri. Rare. Shaded oolite in the old quarries C 20 and C 42.

V. muralis. Rare. On oolitic pebbles in grassland around the army Huts, C 45A.

V. nigrescens. Occasional. Limestone and asbestos.

V. viridula. Occasional. Shaded oolite in the old quarries, and oolitic pebbles around army huts.

Xanthoria aureola. Occasional on concrete

X. candelaria. Rare. Base of one oak by pond, the Nose.

X. elegans. Frequent. On asbestos roof of building near Centre Tree.

X. parietina. Frequent on concrete and asbestos.

* Denotes species not found during present survey.

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THE FAUNA OF BEDFORD PURLIEUS

R.C. Welch

The fauna of Bedford Purlieus is less well known than the flora. Very few groups of animals have been studied in the wood and of these most have received fairly limited attention. Published records appear to be non-existant and such information so far discovered is in the form of personal collections and notes, a number of which have kindly been made available to me.

AMPHIBIA, REPTILIA & MAMMALIA

All three British species of newt have been recorded in the wood. The colony of Palmate Newt in the static water tank in C 46D is the only known present day locality in Vice County 32 (Northamptonshire & Soke of Peterborough). There are no records of Common toad or frog. Four species of reptile are recorded, Adder, Grass snake, Common lizard and Slow-worm. Bedford Purlieus is one of the few remaining known localities, in this area, for the adder although it has also been observed at Wakerley Wood in recent years. When the western half of the wood was cleared in the mid-nineteenth century newts and snakes were found under roots of trees.

The largest, if not the most frequently seen, mammals in the wood are the Fallow deer. A small herd frequents every compartment in the wood and their tracks often provide the only easy access to some of the denser scrubby areas. An annual cull maintains the population at about twenty individuals which move between many of the small woodlands in the district. There are reports of recent sightings of Chinese muntjac and there is a mid-eighteenth century record of Red deer being introduced into the wood.

Other mammals recorded include Fox, Badger, Stoat, Weasel, Brown rat, Grey squirrel, Brown hare, Rabbit, Mole, Wood mouse, Bank and Field Voles. Most of these are regarded as vermin by gamekeepers and they have been subject to a variety of control measures. The Grey squirrel is a serious pest in young plantations and is rigorously controlled. The remaining predatory species threaten only the pheasant rearing activities of the shooting syndicate. There appear to be no recent records of any shrews, bats or hedgehog, although this probably only reflects the fact that nobody has specifically looked for them. Dormouse and Hedgehog were both recorded during the nineteenth century clearance, and the former species is still present at other sites in Rockingham Forest.

AVES

I am indebted to past and present wardens of Castor Hanglands National Nature Reserve for bird records. R.V. Collier recorded 71 species in the period 1961-69, of which 49 were known to be breeding in the wood. J. Robinson has provided the following notes on observations made during 1972-74.

Of the predatory birds there is one record of a Sparrow hawk whilst Kestrels occur generally in the area, mainly on the outskirts of the wood. Little Owls frequent the wood's western boundary and make use of the adjacent farmland. There are possibly two or three pairs of Tawny owls resident although the lack of large trees with suitable nesting cavities is similar to conditions prevailing at Castor Hanglands. Tawny owls will nest on old pigeon nests etc., but prefer holes. Nest boxes can be used and seven pairs have nested in a relatively small area at Castor. However, it appears that Tawny owls are dominant over Long-eared owls which now no longer nest at Castor. It is of interest to note that a Long-eared owl's nest was found for the first time in 1974 in pines in C 40A. One live and one dead fledgeling were seen on the ground beneath the nest in early May.

All three Woodpeckers occur in the wood with the Great-spotted, breeding in birch, being the most numerous. Green woodpeckers were recorded nesting in oak and birch in 1973. Their apparent decline in numbers is thought probably to be due to the reduction in suitable grassland feeding sites, although the wood ants provide an additional specialised food source for this species.

Nightingale numbers are decreasing, as at Castor. Although coppice is their frequently quoted ideal habitat, at these two sites they show a preference for nesting in areas of old scrub which have accumulations of dead material around the base. Chaffinch, Greenfinch, Bullfinch and Goldfinch are common and Lesser redpolls were more abundant during 1974, although this reflects a general trend. Blackcap, Whitethroat, Lesser whitethroat and Garden warbler are all present in fair numbers but the lack of suitable understory in most areas appears to be causing a local decline in numbers. On the other hand ideal conditions exist to suit the feeding and breeding requirements of the Woodcock.

The domestic hen has also been introduced into Bedford Purlieus in the small pens used for rearing pheasants for the shooting syndicate.

BIRDS RECORDED FROM BEDFORD PURLIEUS SINCE 1961.

+ indicates breeding confirmed

ANSERIFORMES

ANATIDAE

+ Anas platyrhynchos L. Mallard

FALCONIFORMES

ACCIPITRIDAE

Accipiter nisus (L.) Sparrowhawk

FALCONIDAE

Falco tinnunculus L. Kestrel

GALLIFORMES

PHASIANIDAE

+ Alectoris rufa (L.) Red-legged partridge

+ Perdix perdix (L.) Partridge

+ Phasianus colchicus L. Pheasant

GRUIFORMES

RALLIDAE

+ Gallinulla chloropus (L.) Moorhen

CHARADRIIFORMES

CHARADRIIDAE

Vanellus vanellus (L.) Lapwing

SCOLOPACIDAE

Gallinago gallinago (L.) Snipe

+ Scolopax rusticola L. Woodcock

COLUMBIFORMES

COLUMBIDAE

+ Columba oenas L. Stock dove

+ C. palumbus L. Wood pigeon

+ Steptopelia turtur (L.) Turtle dove

CUCULIFORMES

CUCULIDAE

+ Cuculus canorus L. Cuckoo

STRIGIFORMES

STRIGIDAE

Athene noctua (Scopoli) Little owl

+ Strix aluco L. Tawny owl

+ Asio otis (L.) Long-eared owl

PICIFORMES

PICIDAE

+ Picus viridis L. Green woodpecker

+ Dendrocopus major (L.) Great-spotted woodpecker

D. minor (L.) Lesser-spotted woodpecker

PASSERIFORMES

ALAUDIDAE

Alauda arvensis L. Skylark

HIRUNDINIDAE

+ Hirundo rustica L. Swallow

Delichon urbica (L.) House martin

Riparia riparia (L.) Sand martin

CORVIDAE

Corvus corone L. Carrion crow

C. frugilegus L. Rook

+ C. monedula L. Jackdaw

Pica pica (L.) Magpie

+ Garrulus glandarius (L.) Jay

PARIDAE

+ Paris major L. Great tit

+ P. caeruleus L. Blue tit

P. ater L. Coal tit

+ P. palustris L. Marsh tit

+ P. montanus von Baldenstein Willow tit

AEGITHALIDAE

+ Aegithalos caudatus (L.) Long tailed tit

CERTHIIDAE

+ Certhia familiaris L. Treecreeper

TROGLODYTIDAE

+ Troglodytes troglodytes (L.) Wren

TURDIDAE

+ Turdus viscivorus L. Mistle thrush

T. pilaris L. Fieldfare

+ T. philomelos Brehm Song thrush

T. iliacus L. Redwing

+ T. merula L. Blackbird

Phoenicurus phoenicurus (L.) Redstart

+ Luscinia megarhynchos Brehm Nightingale

+ Erithacus rubecula (L.) Robin

SYLVIIDAE

+ Locustella naevia (Boddaert) Grasshopper warbler

+ Acrocephalus schoenobaenus (L.) Sedge warbler

+ Silvia atricapilla (L.) Blackcap

+ S. borin (Goddaert) Garden warbler

+ S. communis Latham Whitethroat

+ *S. curruca* (L.) *Lesser whitethroat*

+ Phylloscopus trochillus (L.) Willow warbler

+ P. collybita (Vieillot) Chiffchaff

P. sibilatrix (Bechstein) Wood warbler

REGULIDAE

+ Regulus regulus (L.) Goldcrest

MUSCICAPIDAE

+ *Muscicapa striata (Pallas) Spotted flycatcher*

PRUNELLIDAE

+ Prunella modularis (L.) Dunnock

MOTACILLIDAE

+ Anthus trivialis (L.) Tree pipet

Motocilla alba L. Pied wagtail

STURNIDAE

+ Sturnus vulgaris L. Starling

FRINGILLIDAE

Coccothraustes coccothraustes (L.) Hawfinch

+ Carduelis chloris (L.) Greenfinch

+ C. carduelis (L.) Goldfinch

+ Acanthis cannabina (L.) Linnet

+ A. flammea (L.) Redpoll

+ Pyrrhula pyrrhula (L.) Bullfinch

+ Fringilla coelebs L. Chaffinch

F. montifringilla L. Brambling

IMBERIZIDAE

+ Emberiza citrinella L. Yellow hammer

+ E. schoeniclus (L.) Reed bunting

PLOCEIDAE

+ Passer domesticus (L.) House sparrow

+ P. montanus (L.) Tree sparrow

INVERTEBRATA

The invertebrates of Bedford Purlieus have received scant attention over the years, with the possible exception of the Lepidoptera, and there appear to be no published records for the site. During 1974 several specialists paid visits to the wood at rather short notice in an effort to record and collate past records for the Lepidoptera, Coleoptera, Isopoda, Mollusca and earthworms, for which separate accounts follow.

For many insect Orders there appear to be no records or information of any description. However, the late W.E. Russell was one of the few entomologists, interested in orders other than Lepidoptera, who visited the wood. His main interest was sawflies, although his collection, which is now at Monks Wood Experimental Station, provided additional Heteroptera records.

The only other records, resulting from casual collecting, amount to three species of flea:- *Ceratophyllus fringillae* Walk. 13 July 1972, common in Blue Tit's nest in C 38B; *Hystrichopsylla t. talpae* (Curt.) and *Ctenophthalmus n. nobilis* Rothsch. 7 May and 22 October 1974 in small numbers in moles' nests in C 38B and C 39C.

In a wood with such diverse soils, overlain with an equally variable vegetation cover, comparative studies are extremely difficult. However, ten sampling sites were selected as follows (Soil types and pH of top 10 cm as described above by Stevens):-

Site 1 C 43A (East), Soil type 1 over Lower Lincolnshire Limestone, pH 4.5-5.5 but very close to highly alkaline area, near large oak with young beech and some birch, sycamore and *Rubus*, deep litter layer.

Site 2 C 40B (South west), Soil type 1, over Lower Lincolnshire Limestone, pH 5.5-6.5 but adjacent to highly alkaline area, Scots pine planted 1951, some *Rubus*, *Endymion* and *Mercurialis* surviving, thin needle litter.

Site 3 C 40A (North), Soil type 2a, borders of Upper Lincolnshire Limestone and Upper Estuarine Series, pH >7.5, Scots pine planted 1942, *Mercurialis* and *Deschampsia*, ground vegetation better developed than on Lower Lincolnshire Limestone, thin needle litter plus some moss.

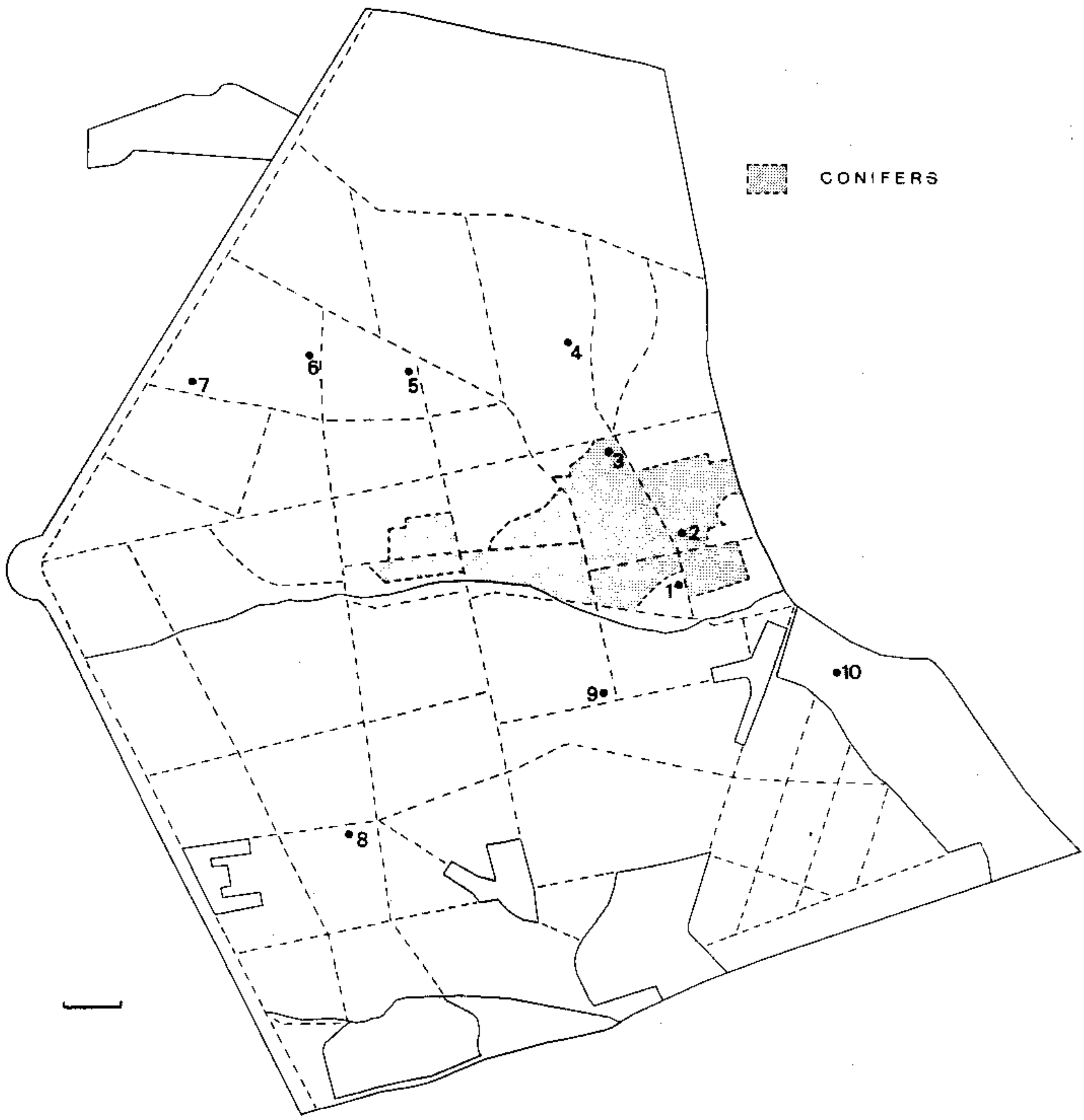
Site 4 C 33 (East), Soil type 5/6/7a, over Upper Estuarine Series, pH 4.5, rows of oak planted 1935, with some coppiced sweet chestnut stools, *Pteridium* and fairly deep litter.

Site 5 C 36A (East), site at junction of soil types 1, 9 and 5/6/7a, boundaries of Upper Estuarine Series, Blisworth Limestone and outlying pocket of Chalky Boulder Clay, pH >7.5, large old lime stools and some oak, moderate litter layer.

Site 6 C 35A (East), Soil type 1, over Blisworth Limestone, pH >7.5, large old lime stools, some oak, moderate litter layer.

Site 7 C 35A (West), Soil type 5/6, over Blisworth Clay, pH 4.5-5.5, scattered lime much *Crataegus* and *Rubus*, moderate litter layer.

37. SITES USED FOR INVERTEBRATE SAMPLING IN 1974.



Site 8 C 45C (North), Soil type 10, over Chalky Boulder Clay, pH 4.5-5.5, scattered limes and some young coppice stools, shallow litter layer.

Site 9 C 42B (South east), Soil type 23, over Upper Estuarine Series, although close to boundary with Lower Lincolnshire Limestone, pH $<$4.5, birch over Pteridium, deep litter layer.

Site 10 C 48A (North east), restored quarry site not sampled by Stevens although G.F. Peterken recorded soil pH of 8.3 at two sites in this compartment, Corsican pine planted 1969, no litter layer and sparse herb layer in area sampled.

The position of these sites is shown on Fig. 37.

Pitfall trap samples were collected at all ten sites; litter samples from all except site 10 and earthworms were sampled at sites 1-5 only. All the records for Mollusca and Opiliones relate to these sites as do most of those for the Myriapoda. 160 species of Coleoptera were caught in pitfall traps and 61 in litter samples of which 21 had not been taken in the pitfall traps. 29 species were recorded only from compartments planted with Scots pine. Of these five were extracted from Formica rufa nests and are doubtless present in nests in other parts of the wood. Only three of the remaining species are dependent upon the presence of pines. These are the two bark beetles Hylurgops palliatus and Hylastes ater, and Atomaria affinis which Joy (1932) describes as "rare, in Scotch Pine". Pitfall traps in the two pine sites caught the lowest numbers of spiders. Site 2 was regarded as poor for molluscs and site 3 only average. However, the biomass of earthworms from soils under pines was higher than at the nearest site (1) under mixed deciduous tree species. The low pH of the soils at site 4 had a far more dramatic effect on the earthworm populations, reducing them to a very low level. Conversely site 4 had the highest numbers of Millipedes due mainly to a relative abundance of the pill millipede, Glomeris marginata. The centipede Geophilus carpophagus was also more numerous on the site, while the small woodlouse, Trichoniscus pusillus was most abundant at sites 1 and 5. Site 5 also proved exceptionally rich in both earthworms and molluscs. Site 6 produced by far the highest numbers of harvestmen, over half of which were the one species, Oligolophus tridens. The common litter-frequenting silphid beetle Nargus velox was also most numerous at this site. The reconstituted quarry (site 10) presented an extreme contrast to the nine woodland sites. Although planted with Corsican Pines five years ago these have taken a long time to become established and much of the soil still remains bare and uncolonised by any plants. Such conditions particularly favour many predatory ground beetles and spiders and many species trapped here were not found within the wood.

By sampling from only ten sites for a very limited period of time one cannot hope to understand the complex factors which determine the distribution and abundance of species in a wood such as Bedford Purlieus. It does however give a hint as to the variation which exists. As has been shown at Monks Wood National Nature Reserve, only by frequent visits by specialists over many years can a true picture of the invertebrate fauna be gradually built up. A field excursion by the British Entomological and Natural History Society is planned for May 1975 which should result in a number of new records.

ANNELIDA : LUMBRICIDAE (Carole E. Lawrence)

Five sites for sampling earthworms were chosen on the basis of a range of soil types and pH, both of which had been provisionally mapped by G.F. Peterken. These same general areas were later used as sites 1-5 in the programme of pitfall trapping carried out by R.C. Welch, except that half of sample 5 was taken from the north west corner of C 36C. Further details are given above and their positions shown on Fig. 37. The method of sampling used was digging and handsorting on site, the sample size being 1 cu. ft. and eight such samples were taken at each site. Sampling was carried out during mild spells in the periods 21-25 January and 26-28 February 1974. Specimens collected in this way were taken back to the laboratory for weighing and identification. Soil from four samples from each site were retained for pH determination.

Table 17

Total numbers of adult individuals per site (i.e. from 8 cu. ft. of soil)					
Sampling site no.	1	2	3	4	5
Allolobophora caliginosa (Savigny)	9	10	8	-	14
A. rosea (Savigny)	1	7	3	1	5
Bimastos muldali Omodeo	8	-	-	-	7
Dendrobaena rubida (Savigny)	-	-	-	1	-
Octolasion cyaneum (Savigny)	1	4	2	1	4
Lumbricus castaneus (Savigny)	-	-	-	-	7
L. ? festivus (Savigny)	1	-	-	-	-
L. terrestris L.	1	4	3	-	4
Total biomass (g) including immatures	28.4	39.7	31.5	3.5	72.5
pH values (average of 4 samples)	7.01	6.09	7.83	4.05	7.50
Depth of litter layer (inches)	>2	<0.5	<0.5	1-1.5	1

Of the eight species of earthworm collected all are generally common with a widespread distribution, except *Bimastos muldali*. This is a species which is rarely recorded in Britain but is probably overlooked as eight specimens were collected in Monks Wood National Nature Reserve in January and February 1973.

MOLLUSCA (M.J. Bishop)

The Mollusca are better suited to the needs of the historical ecologist than are most other groups of invertebrates (Evans, 1972). Not only can conclusions be drawn from the present day distributions of species, but well stratified soils containing sub-fossil shells may record the faunal changes at a site in great detail. At Bedford Purlieus a tufa rich in shells has been reported, but faunal analyses have yet to be made.

Evidence for the presence of two species of snails at Bedford Purlieus has been provided only by the presence of their empty shells. These are the operculate Pomatias elegans (Mueller) and the large edible Helix pomatia L. Bedford Purlieus lies near the northern limit of the ranges of both species in Britain, and they may be extinct at this site. The distribution of Pomatias has been discussed by Kerney (1968) and the distribution of Helix pomatia by Pollard (1974).

The living Mollusca of Bedford Purlieus have been investigated during 1974 by pitfall trapping from 18 March to 18 July and by hand searching and litter sifting on 16 April and 7 and 30 May. Material from pitfall traps was provided by Dr. R.C. Welch from the first nine sites described above. Pitfall trapping is not a particularly efficient method of sampling Mollusca, but eighteen species were caught in this way. The traps caught slugs and medium sized snails, and a species list together with the total number of individuals caught during the trapping periods is presented in Table 18 below. In terms of individuals caught site 5 ranks as very good, sites 6 and 7 as good, sites 1, 3, 4, 8 and 9 as average and site 2 as poor. The same sort of order is observed in species numbers except that site 6 becomes only average. These observations are immediately interpretable in terms of soils and vegetation. The richest sites are in deciduous woodland on brown rendzina with the pH ranging above 7.5, whilst the poorest site is in conifer plantation on the same soil type but with some acidification (pH below 7.0). It is difficult to disentangle the factors affecting the average group.

Additional records of the small litter inhabiting species were obtained by sifting the substrate. Those species which were not caught by pitfall trapping are:- Carychium tridentatum (Risso), Acanthinula aculeata (Mueller), Columella edentula (Draparnaud) seg., Euconulus fulvus (Mueller), Punctum pygmaeum (Draparnaud).

'"Woods" is evidently not a significant category for the Mollusca' (Boycott, 1934). Because of their requirement for shelter, the diverse structure provided by old hedges serves the Mollusca as well as old woods. They are above all exploiters of the ecotone. Of the thirteen species selected by Boycott as having special woodland alliances, only once (Cochlodina) is reported from Bedford Purlieus. The reasons for this are largely geographical. Iphigena rolphi (Turton) is however known from the nearby Carlton Purlieus. Rates of colonisation are such that all the Bedford Purlieus species can be found in eighteenth century plantations.

Table 18

Mollusca obtained from pitfall traps at Bedford Purlieus during 1974									
Sites	1	2	3	4	5	6	7	8	9
Aegopinella nitidula (Drap.)	10	2	8	-	13	28	12	-	-
A. pura (Alder)	-	-	1	-	-	-	-	-	-
Arion ater (L.) ssp. ater	-	-	-	2	3	2	4	3	3
A. circumscriptus Johnston	-	-	-	2	-	2	-	-	-
A. hortensis Ferussac	-	-	-	2	6	2	2	5	2
A. intermedius Normand	4	3	7	6	11	2	1	3	8
Cochlicopa lubrica (Muell.)	-	-	-	-	-	1	2	-	1
Cochlodina laminata (Montagu)	2	-	-	-	-	-	-	-	-
Deroceras reticulatum (Muell.)	1	-	-	-	14	1	5	6	-
Discus rotundatus (Muell.)	2	-	4	1	2	-	-	1	2
Ena obscura (Muell.)	-	-	-	-	1	-	-	-	-
Limax maximus L.	-	-	-	-	-	-	3	-	-
Nesovitrea hammonis (Stroem)	-	-	1	-	-	-	1	-	2
Oxychilus alliarius (Muell.)	-	4	-	7	-	-	1	-	1
O. cellarius (Muell.)	-	1	1	1	10	-	3	-	-
Trichia hispida (L.)	-	-	-	-	2	-	-	1	-
Vitrea contracta (West.)	-	-	1	-	-	-	-	-	-
Vitrina pellucida (Muell.)	1	-	-	-	2	-	-	-	-
Total individuals	20	10	23	21	64	38	34	19	19
Total species	6	4	7	7	10	7	10	6	7

CRUSTACEA (P.T. Harding)

TERRESTRIAL ISOPODA

The six species of woodlice recorded during 1974 are all common and widespread in lowland Britain. Four species have been recorded from the woodland, and a further two species from the surrounding grassland/ scrubland on the site.

Trichonisus pusillus (Brandt)

Represented by both sub-species (pusillus and provisorius) in a mixed population. A low percentage of provisorius males were taken in litter samples. Probably the commonest species of woodlouse in the woodland, mainly in leaf litter.

Platyarthrus hoffmannseggi Brandt

Recorded only once in a nest of Lasius niger (L.) under a piece of concrete in the grassy area of C 50D. Although Formica rufa L. nests were examined for this species throughout the wood only one specimen was found by R.C. Welch in C 40A on 28 September 1967.

Philoscia muscorum (Scop.)

Common in the grassland/scrub areas of the R.A.F. clearings, C 50D and the western edge, occasionally seen within the wood on drier soils.

Oniscus asellus L.

Common in dead wood and leaf litter.

Porcellio scaber Latr.

Occasional in dead wood within the wood and in surrounding grassland. Also recorded from nests of Formica rufa.

Armadillidium vulgare (Latr.)

Common in the R.A.F. clearings, C 50D and on the western edge. Only found under closed canopy at the Centre Tree.

All the above mentioned species are typical of the habitats in which they were found, however, several more species could be expected to occur at Bedford Purlieus, and do occur in north Northamptonshire.

Trichoniscus pygmaeus Sars - a soil dwelling species, probably only overlooked owing to the difficulty of sampling for the species.

Haplophthalmus danicus B.-L. - occurs in almost every other large ancient wood in Rockingham Forest. Its particular micro-site - moss covered, well decayed large logs, is very scarce at Bedford Purlieus, but several suitable samples were examined.

Trachelipus rathkei (Brandt) - an early colonist of reconstituted quarry sites in the area. A very thorough search was made for this species in seemingly suitable habitats.

Porcellio spinicornis Say - a common inhabitant of dry stone walls in the area. It does not seem to occur in the wall along the southern edge although it is common 750 m to the south in the wall beside the road between Old Sulehay and Ring Haw.

AMPHIPODA

Gammarus pulex (L.)

Recorded from small pools in the dry stream bed during the summer and autumn. Not recorded when the stream was flowing.

OPILIONES & CHELONETHI

Although no specific search was made for Harvestmen 9 species, almost half the total number recorded from Britain, were collected in pitfall traps and litter during 1974 from the ten sample sites (Table 19). An average of six species was recorded from each site.

TROGULIDAE

Anelasmocephalus cambridgei (Westw.)

One sieved from litter at site 6 on 30 May. Scattered, mainly single specimens in pitfall traps (sites 2, 3, 5, 6 and 8) during April, May and July, although three specimens were taken in one trap at site 6 during July.

NEMASTOMIDAE

Platybunus triangularis C.L. Koch

Common throughout the areas sampled from late March to the end of May. Most abundant in late May and July on the reconstituted quarry site 10.

Phalangium opilio L.

Single immature specimens sieved from leaf litter on 16 April (site 5) and 30 May (site 1). One specimen was recorded on 4.6.67 on a sticky band on a pine tree in C 40A. This species is more characteristic of open grassland.

Mitopus morio (F.)

Two single specimens in pitfall traps during March (site 3) and July (site 5). This species is also uncommon in Monks Wood.

Lacinius ephippiatus (C.L. Koch)

A late summer species abundant in pitfall traps in July, occurring at all sites except 5 and with only a single doubtful immature specimen recorded from site 10.

Odiellus palpinalis (Hbst.)

Very few immature specimens in pitfall traps at sites 7, 8 and 9 during July.

Oligolophus tridens (C.L. Koch)

The most abundant phalangid in litter and pitfall traps on all sites except 10 during April and May with very few immatures trapped at sites 4 and 9 in July. By far the largest numbers trapped at site 6.

Leiobunum rotundum (Latr.)

Immatures taken in pitfall traps in small numbers at all sites except 4 during April and May. Only two adults taken in one trap at site 5 during July.

Almost all the Pseudoscorpions collected from litter and pitfall traps proved to be Chthonius ischnocheles (Hermann), which was taken at all sites

Table 19

OPILIONES, MYRIAPODA AND ISOPODA FROM BEDFORD PURLIEUS

(COMBINED TOTALS OF SPECIMENS COLLECTED IN PITFALL TRAPS AND LITTER SAMPLES DURING 1974)

SITE NOS.	1	2	3	4	5	6	7	8	9	10*
OPILIONES										
Anelasmocephalus cambridgei	-	1	3	-	1	8	-	1	-	-
Nemastoma lugubre	3	4	15	4	1	2	1	3	9	-
Platybunus triangularis	5	6	4	1	19	10	3	6	1	34
Phalangium opilio	1	-	-	-	1	-	-	-	-	-
Mitopus morio	-	-	1	-	1	-	-	-	-	-
Lacinius ephippiatus	37	45	6	3	-	62	20	35	19	1
Odiellus palpinalis	-	-	-	-	-	-	3	3	2	-
Oligolophus tridens	27	27	17	43	22	109	17	26	21	2
Leiobunum rotundum	8	3	1	-	4	7	4	2	6	2
	81	86	47	51	49	198	48	76	58	39
DIPLOPODA										
Glomeris marginata	26	13	20	53	30	14	7	37	9	-
Polydesmus angustus	2	6	11	6	2	-	1	2	8	-
P. denticulatus	3	1	2	5	3	-	1	17	-	-
Iulus scandinavius	-	-	-	-	5	7	2	-	1	-
Ophyiulus pilosus	11	7	3	2	3	16	9	4	-	-
Cylindoiulus punctatus	3	6	3	7	-	1	2	8	5	-
Schizophyllum sabulosum	-	2	-	-	1	-	-	-	-	-
Tachypodoiulus niger	4	2	5	-	6	8	6	2	2	-
	49	37	44	73	50	46	28	70	25	0
CHILOPODA										
Strigamia acuminata	4	-	-	2	3	-	1	1	-	-
Geophilus carpophagus	-	8	8	17	-	-	2	9	8	-
Lithobius variegatus	3	1	2	4	1	4	3	-	-	-
L. forficatus	1	-	-	-	1	-	2	-	-	-
L. dubosqui	4	2	6	1	2	-	-	-	2	-
L. crassipes	11	1	2	2	4	2	3	6	7	-
L. curtipes	1	-	-	2	-	-	-	1	2	-
	24	12	18	28	11	6	11	17	19	0
ISOPODA										
Trichoniscus pusillus agg.	36	2	10	7	34	16	2	4	10	-
T. pusillus provisioris	2	-	-	-	3	-	-	-	-	-
Philoscia muscorum	-	-	-	-	-	1	-	-	-	1
Oniscus asellus	9	4	9	4	3	21	6	2	1	-
Porcellio scaber	2	-	1	2	1	-	-	-	1	-
	49	6	20	13	41	38	8	6	12	1

* No litter samples collected from Site 10

except 10. Two other species were also recorded. Single females of Neobisium muscorum (Leach) were taken in the same pitfall trap at site 9 in late March and early July. Two tritonymphs of Allochernes dubius (O.P.-Cambridge) were extracted from litter collected under pines at site 3 on 30 May.

A small collection of spiders taken during this sampling programme have been lodged with Dr. E.A.G. Duffey.

MYRIAPODA

A total of 9 species of millipede and 7 species of centipede were recorded in the wood. Apart from one or two casual observations the records were all from pitfall traps or litter samples (Table 19). No Myriapoda were taken at site 10 on the reconstituted quarry.

DIPLOPODA
GLOMERIDAE

Glomeris marginata (Vill.)

Common at all sites from March to July. Largest numbers taken at site 4.

CRASPEDOSOMIDAE

Polymicrodon polydesmoides (Leach)

A single record by P.T. Harding on 2 August from under logs in woodland ride.

POLYDESMIDAE

Polydesmus angustus Latz.

Taken in pitfall traps in low numbers from April to July at all sites.

P. denticulatus C.L. Koch

In general less common than preceding species. Not taken at sites 6 and 9 but more numerous at site 8 in May.

IULIDAE

Small numbers of unidentified immature iulids were collected from most sites throughout the sampling period March to July.

Iulus scandinavius Latz.

Taken in small numbers in pitfall traps during March, May and July from sites 5, 6 and 7. Only a single specimen found elsewhere at site 9.

Ophyiulus pilosus (Newport)

Recorded in small numbers from pitfall traps at all sites except 9, mainly during March, May and July. Also recorded from a Formica rufa nest in C 40A on 28.9.67.

Cylindroiulus punctatus (Leach)

Collected regularly in litter and pitfall traps from March to May at all sites except 5. A single specimen was trapped at site 9 in July and P.T. Harding recorded one in a drystone wall on the south edge of the wood on 7 October.

<u>Schizophyllum sabulosum</u> (L.)

Only three specimens collected in pitfall traps during March, two at site 2 and one at site 5.

<u>Tachypodoiulus niger</u> (Leach)

Taken regularly in pitfall traps in low numbers from March to May at all sites except 4.

<u>CHILOPODA</u>
GEOPHILIDAE

<u>Strigamia acuminata</u> (Leach)

Small numbers extracted from leaf litter collected on 16 April and 30 May from sites 1, 4, 5, 7 and 8. Recorded by P.T. Harding in leaf litter near Centre Tree on 2 October. No specimens taken in pitfall traps. Also recorded from <u>Formica rufa</u> nest in C 40 on 28.9.67.

<u>Geophilus carpophagus</u> Leach

Only recorded from litter samples collected on 11 March, 16 April and 30 May mainly as immature specimens from all sites except 1, 5 and 6. Most numerous at site 4.

LITHOBIIDAE

A few very small immature <u>Lithobius</u> could not be identified to species. Of the five species taken only <u>L. crassipes</u> proved to be at all numerous.

<u>Lithobius variegatus</u> Leach

In small numbers in litter and pitfall traps from March to July in all sites except 8 and 9.

<u>L. forticatus</u> (L.)

Four single specimens of this common woodland species taken in pitfall traps at sites 1, 5 and 7 from March to May.

<u>L. dubosqui</u> Brolemanu

Small number taken in litter and pitfall traps from March to July in all sites except 6, 7 and 8.

<u>L. crassipes</u> C.L. Koch

Taken regularly in small numbers in litter and pitfall traps from all sites throughout the sampling period 11 March to 18 July. Also recorded from a mole's nest in C 38B on 7 May.

<u>L. curtipes</u> C.L. Koch

Three adults from litter collected 16 April and 30 May at sites 4 and 9. Two immatures from sites 1 and 8 on the earlier date, and one adult in a pitfall trap at site 9 in July. Also recorded from <u>Formica rufa</u> nest in C 40A on 28.9.67.

ORTHOPTERA

The orthopteran fauna of Bedford Purlieus is extremely poor and to some extent this is a reflection of the lack of suitable habitats. However, even where good grassland communities do exist, such as in C 45A, no grasshoppers were seen, and in C 50C only one specimen was collected. Only six species were recorded during 1974:-

TETTIGONIIDAE

Meconema thalassinum (Deg.)

Beaten from oak foliage on western edge of C 38A by P.C. Tinning on 7 August.

Pholidoptera griseoaptera (Deg.)

Recorded on 7 October by P.T. Harding along St. John's Ride west of C 41A and C 44A and along the north-western edge of C 50A. This species was also heard singing on 22 October in wartime clearance area in C 45C and D.

Leptophyes punctatissima (Bosc)

Swept by P.C.T. on 7 August in the region of the Centre Oak, from tall herbage and limestone grassland.

ACRIDIDAE

Chorthippus brunneus (Thunb.)

One only recorded by P.C.T. on 7 August in short grassland on disturbed ground in C 50C.

C. parallelus (Zett.)

Also recorded on 7 August by P.C.T. on limestone grassland in North Gate Ride west of C 29.

TETTRIGIDAE

Tetrix undata (Sowerby)

A single female on 5 June in short grassland between C 50A and B.

HEMIPTERA

No special study has been made of this Order but three species of Homoptera were noted by P.C. Tinning on 7 August 1974. Six species of Heteroptera in the late W.E. Russell's collection bear Bedford Purlieus locality labels and a further three species were taken in pitfall traps or by sweeping during 1974.

HOMOPTERA

CERCOPIDAE

Aphrophora alni (Fall.)
Beaten from oak foliage near Centre Tree, and by disturbed ground in C 50C.

CICADELLIDAE

Cicadella viridis (L.)
Swept from limestone grassland in disturbed ground in C 45A.

Iassus lanio (L.)
Beaten from oak foliage bordering St. John's Ride.

HETEROPTERA

ARADIDAE

Aradus depressus (F.)
2 April 1970.

ANEURIDAE

Aneurus avenius (Duf.)
13 July 1972, 1♂ swept from ride through C 36 (R.C.W.). Southwood and Leston (1959) give distribution as "south of a line from Cambridge to Gloucester". It is the rarer of the two species of bark bug in this genus but has been taken in Monks Wood.

LYGAEIDAE

Megalonotus antennatus (Schill.)
6 May 1968.

Drymus sylvaticus (F.)
28 July 1966.

NABIDAE

Himacerus mirmicoides (Costa)
16 April 1974, 3 in leaf litter, site 2 (R.C.W.).

MIRIDAE

Macrolophus nubilis (Herr.-Sch.)
20 May 1967.

Calocoris norvegicus (Gmel.)
22 July 1966.

Phytocoris ulmi (L.)
1 August 1966.

Capsus ater (L.)
13 July 1972 swept from ride between C 37 and C 38 (R.C.W.).

SALDIDAE

Saldula orthochila (Fieber)
4-18 July 1974, 1 adult, 2 nymphs in pitfall traps, site 10 (R.C.W.).

HYMENOPTERA

No visitor to Bedford Purlieus can fail to notice the numerous large nest mounds of the wood ant Formica rufa L. The distribution of those nests occupied during 1974 is shown on Fig. 38. Thornhaugh is one of the localities listed by Enid Nelmes (1938) in her survey of the distribution of the wood ant in England, Wales and Scotland which was begun in 1933. These ants are popularly believed to have been introduced into the wood but no records can be traced to substantiate this, although Nelmes (p.92) states that "in some places they have been introduced as food for pheasants; such as Harleston Firs, Northants". Introduced or not their present distribution within the wood is difficult to explain. 155 nests were occupied during 1974. Of these 54 are under conifers and approximately 35 are situated along the northern edge of rides running in an east-west direction. This is a favoured position for catching the most sun. Another 20 nests are associated with the wartime clearance area in C 45C and C, many of which are situated at the edge of the hut bases. On the other hand more than 90 nests correlate with the well drained brown rendzina soils over the various limestones.

Four other species of ant were noted in the wood during 1974. A single worker of Stenamma westwoodii Westw. was swept from a ride running through C 37 on 13 July. Collingwood and Barrett (1964) give the distribution of this ant as "south to Midlands" and list Northamptonshire as a record not confirmed since 1900. It has been recorded from Monks Wood on several occasions since 1968. Three other species were taken in pitfall traps:- Formica fusca L. 4-18.7.74 and Lasius niger (L.) 15-29.5.74, both at site 10 on the reconstituted quarry, and Myrmica ruginodis Nyl. 29.5.-12.6.74 at site 3.

The late W.E. Russell visited Bedford Purlieus on at least three occasions in 1956, 1967 and 1973 and recorded 17 species of sawfly. These, together with 7 additional recent records, are listed below. Records of a wasp and 5 species of bumblebee mostly noted by J.C. Felton in 1973 are also included.

38. DISTRIBUTION OF WOOD ANT *(FORMICA RUFA L.)* NEST SITES OCCUPIED DURING 1974.

HYMENOPTERA RECORDED FROM BEDFORD PURLIEUS

SYMPHYTA (SAWFLIES)

All records W.E. Russell unless otherwise stated.

ARGIDAE

Arge cyanocrocea (Forst.) 5 June 1973, east edge C 50B (R.C. Welch)

CIMBICIDAE

Zaraea fasciata (L.) 12 August 1956

TENTHREDINIDAE

Melisandra morio (F.) 29 June 1972 (G.J. Moller)
Dolerus gonager (F.) 5 June 1973, east edge C 50B (R.C.W.)
Athalia cordata Lep. 30 August 1967 (G.J.M.); 26 May 1973 and 5 June 1973, east edge C 50B (R.C.W.)
Empria tridens (Kon.) 5 June 1973 on young birch, C 44B (R.C.W.)
E. alector Bens. 26 May 1973
E. luteiventris (Klug.) 5 June 1974, east edge C 50B (R.C.W.)
Strombocerus denticulatus (Fall.) 26 May and 24 June 1973
Parna tenella (Klug.) 26 May 1973
Allantus truncatus (Klug.) 26 May 1973
Eutomostethus ephippium (Pz.) 26 May 1973
Aglaostigma fulvipes (Scop.) 10 May and 4 June 1967, and 26 May 1973
A. aucupariae (Klug.) 10 May 1967
Tenthredopsis litterata (Geoff.) 26 May 1973
T. nassata (L.) 26 May 1973 and 5 June 1974 east edge C 50B (R.C.W.)
Rhogogaster punctulata (Klug.) 4 June 1967 and 26 May 1973
R. chlorosoma (Bens.) 26 May 1973
R. viridis (L.) 26 May 1973
Tenthredo temula Scop. 29 May 1974 swept in C 34 (R.C.W.)
T. mesomelas L. 26 May 1973
T. amoena Gr. 11 August 1956
Macrophya duodecimpunctata (L.) 10 June 1967
Pristophora pallidiventris (Fall.) 26 May 1973

APOCRITA

All records by J.C. Felton on 15 August 1973 except B. lapidarius.

VESPIDAE

Vespula vulgaris (Wesm.) 1 worker

APIDAE

Bombus terrestris L. 1♂
B. agrorum Fab. 1♂
B. pratorum (L.) 1♂
B. lapidarius (L.) 15.5.74, one dead in road, edge of 43C (R.C.W.)
Psithyrus vestalis (Geoff. in Fourc.) 1♂

LEPIDOPTERA (J. Heath)

Although this wood was considered by many local lepidopterists to have an exceptionally good fauna in the immediate post-war period it was probably no better than the other remnants of Rockingham Forest. It does not appear to have been as rich as Castor Hanglands National Nature Reserve and was certainly much poorer than some southern woodland areas such as Box Hill in Surrey. Comparative species totals for these localities are:

Table 20

Site	Butterflies	"macro" moths
Bedford Purlieus	39	275
Castor Hanglands	38	398
Monks Wood	40	330
Box Hill area	44	485

(The butterfly present in Bedford Purlieus but not Castor Hanglands was Boloria selene)

Entomological activity in Bedford Purlieus, as elsewhere, reached its peak in the middle 1950's when collecting with MV lights was a relatively new "sport" and entomologists were intensively exploring all "good" localities. Most of our knowledge of the lepidoptera of Bedford Purlieus is due to the work of Mr. P.J. Gent of Northampton and Mr. S.W. Pooles, then resident in Peterborough.

Prior to 1961, 39 species of butterfly had been recorded but of these Thymelicus lineola, Thecla betulae, Quercusia quercus, Aricia agestis, Apatura iris, Boloria selene, Argynnis adippe, Argynnis aglaja, Argynnis paphia and Melanargia galathea have not been noted since 1960. Of the remaining 29 species six would now appear to have been lost from this site. Callophrys rubi, Lysandra coridon and Boloria euphrosyne were last seen in 1963, Strymonidia pruni in 1966, Carterocephalus palaemon in 1971 and Hamearis lucina in 1973. Therefore of the original total of 39 only 23 butterflies remain, and most of these are in small numbers whereas all the species were once abundant.

The destruction of much of the calcareous grassland on the western edge of the wood, the development of a more uniform tree cover within the wood and changes in climate will all have contributed to the disappearance of these species.

A similar picture of change can be seen with the macro moths (data is not available for the smaller species). Prior to 1940 only 70 species had been recorded but of these 15 have not been noted subsequently. Four of these, Cymatophorima diluta, Lymantria monacha, Xestia rhomboidea, and Cosmia diffinis were on the edge of their range and are species which have possibly contracted nationally. Another, Nola confusalis, has suffered a national decline and three, Achlya flavicornis, Chloroclysta miata and Conistra ligula may well have been overlooked as they occur either very early or late in the year. Of the seven remaining species five, Eulithis prunata, Harpyia bifida, Tholera cespitis, Amphipyra pyramidea, and Apamea scolopacina, should not have been missed if they were still present but the remaining two, Eupithecia subfuscata and Ipimorpha subtusa, could easily have been overlooked. The latter is a species which seems to always occur only in very low numbers.

Since 1960 only 81 species of moth have been recorded but it is known that there has been very little activity by lepidopterists working at night during this period. Whilst no assessment of changes is possible it is interesting to note that three species have been added to the list during the last fourteen years. One, the stem borer in Viburnum lantana, Conopia anthraciniformis, was doubtless overlooked in earlier years but both of the other two, Ptilodontella cucullina, and Gortyna flavago seem to have increased nationally in recent years.

THE MACRO-LEPIDOPTERA OF BEDFORD PURLIEUS

The nomenclature and arrangement in the following list is that of Kloet & Hincks, 1972, A check list of British Insects, 2nd Edition (revised) Part 2, Lepidoptera. Handbk. Ident. Brit. Ins. 11(2).

HEPIALIDAE

Hepialus humuli (L.)
H. sylvina (L.)
H. hecta (L.)
H. lupulinus (L.)

LIMACODIDAE

Apoda avellana (L.)

SESIIDAE

Conopia anthraciniformis (Esp.)

HESPERIIDAE

Carterocephalus palaemon (Pall.)
Thymelicus sylvestris (Poda)
T. lineola (Ochs.)
Ochlodes venata (Bremer & Grey)
Erynnis tages (L.)
Pyrgus malvae (L.)

PIERIDAE

Colias croceus (Geoff in Fourc.)
Gonepteryx rhamni (L.)
Pieris brassicae (L.)
P. rapae (L.)
P. napi (L.)
Anthocharis cardamines (L.)

LYCAENIDAE

Callophrys rubi (L.)
Thecla betulae (L.)
Quercusia quercus (L.)
Strymonidia w-album (Knoch)
S. pruni (L.)
Lycaena phlaeas (L.)
Aricia agestis (D. & S.)
Polyommatus icarus (Rott.)
Lysandra coridon (Poda)
Celastrina argiolus (L.)

NEMEOBIIDAE

Hamearis lucina (L.)

NYMPHALIDAE

Ladoga camilla (L.)
Apatura iris (L.)
Vanessa atalanta (L.)
Cynthia cardui (L.)
Aglais urticae (L.)
Inachis io (L.)
Polygonia c-album (L.)
Boloria selene (D. & S.)
B. euphrosyne (L.)
Argynnis adippe (D. & S.)
A. aglaja (L.)
A. paphia (L.)

SATYRIDAE

Pararge aegeria (L.)
Lasiommata megera (L.)
Melanargia galathea (L.)
Pyronia tithonus (L.)
Maniola jurtina (L.)
Coenonympha pamphilus (L.)
Aphantopus hyperantus (L.)

LASIOCAMPIDAE

Poecilocampa populi (L.)
Malacosoma neustria (L.)
Philudoria potatoria (L.)

DREPANIDAE

Drepana binaria (Hufn.)
D. cultraria (F.)
D. falcataria (L.)
Cilix glaucata (Scop.)

THYATIRIDAE

Thyatira batis (L.)
Habrosyne pyritoides (Hufn.)
Ochropacha duplaris (L.)
Cymatophorima diluta (D. & S.)
Achlya flavicornis (L.)

GEOMETRIDAE

Archiearis parthenias (L.)
Alsophila aescularia (D. & S.)
Geometra papilionaria (L.)
Comibaena pustulata (Hufn.)
Hemithea aestivaria (Hübn.)
Hemistola chrysoprasaria (Esp.)
Jodis lactearia (L.)
Cyclophora punctaria (L.)
Scopula imitaria (Hübn.)
S. immutata (L.)
S. floslactata (Haw.)
Idaea biselata (Hufn.)
I. fuscovenosa (Goeze)
I. seriata (Schrank)
I. subsericeata (Haw.)
I. emarginata (L.)
I. aversata (L.)
Xanthorhoe spadicearia (D. & S.)
X. ferrugata (Clerck)
X. quadrifasiata (Clerck)
X. montanata (D. & S.)
X. fluctuata (L.)
Scotopteryx bipunctaria (D. & S.)
S. chenopodiata (L.)
Epirrhoe tristata (L.)
E. alternata (Müller)
E. rivata (Hübn.)
E. galiata (D. & S.)
Camptogramma bilineata (L.)
Larentia clavaria (Haw.)
Anticlea badiata (D. & S.)
A. derivata (D. & S.)
Lampropteryx suffumata (D. & S.)
Cosmorhoe ocellata (L.)
Eulithis prunata (L.)
E. mellinata (Fabr.)
E. pyraliata (D. & S.)
Ecliptopera silaceata (D. & S.)
Chloroclysta siterata (Hufn.)
C. citrata (L.)
Cidaria fulvata (Forst.)
Plemyria rubiginata (D. & S.)
Thera firmata (Hübn.)
Electrophaes corylata (Thunb.)
Colostygia pectinataria (Knoch)
Hydriomena furcata (Thunb.)
Horisme vitalbata (D. & S.)
Melanthia procellata (D. & S.)
Triphosa dubitata (L.)
Philereme vetulata (D. & S.)
P. transversata (Hufn.)
Epirrita autumnata (Borkh.)
Perizoma alchemillata (L.)
P. flavofasciata (Thunb.)
P. didymata (L.)
Eupithecia exiguata (Hübn.)
E. venosata (F.)
E. centaureata (D. & S.)
E. subfuscata (Haw.)
E. succenturiata (L.)

Chloroclystis v-ata (Haw.)
Aplocera plagiata (L.)
Hydrelia flammeolaria (Hufn.)
Abraxas sylvata (Scop.)
Lomaspilis marginata (L.)
Ligdia adustata (D. & S.)
Semiothisa alternaria (Hübn.)
S. liturata (Clerck)
Petrophora chlorosata (Scop.)
Plagodis dolabraria (L.)
Opisthograptis luteolata (L.)
Apeira syringaria (L.)
Ennomos alniaria (L.)
E. fuscantaria (Haw.)
Selenia dentaria (F.)
S. tetralunaria (Hufn.)
Odontopera bidentata (Clerck)
Crocallis elinguaria (L.)
Ourapteryx sambucaria (L.)
Colotois pennaria (L.)
Lycia hirtaria (Clerck)
Biston strataria (Hufn.)
B. betularia (L.)
Menophra abruptaria (Thunb.)
Peribatodes rhomboidaria (D. & S.)
Alcis repandata (L.)
Ectropis bistortata (Goeze)
Aethalura punctulata (D. & S.)
Bupalus piniaria (L.)
Lomographa bimaculata (F.)
L. temerata (D. & S.)
Campaea margaritata (L.)
Perconia strigillaria (Hübn.)

SPHINGIDAE

Sphinx ligustri L.
Mimas tiliae (L.)
Smerinthus ocellata (L.)
Laothoe populi (L.)
Deilephila elpenor (L.)
D. porcellus (L.)

NOTODONTIDAE

Harpyia bifida (Brahm)
Stauropus fagi (L.)
Notodonta dromedarius (L.)
Eligmodonta ziczac (L.)
Pheosia gnoma (F.)
P. tremula (Clerck)
Ptilodon capucina (L.)
Ptilodontella cucullina (D. & S.)
Pterostoma palpina (Clerck)
Drymonia ruficornis (Hufn.)
Diloba caeruleocephala (L.)

LYMANTRIIDAE

Dasychira pudibunda (L.)
Euproctis similis (Fuessly)
Lymantria monacha (L.)

ARCTIIDAE

Miltochrista miniata (Forster)
Nudaria mundana (L.)
Atolmis rubricollis (L.)
Cybosia mesomella (L.)
Eilema lurideola (Zinck.)
Spilosoma lubricipeda (L.)
S. luteum (Hufn.)
Phragmatobia fuliginosa (L.)
Tyria jacobaeae (L.)

NOLIDAE

Nola cucullatella (L.)
N. confusalis (H.-S.)

NOCTUIDAE

Euxoa tritici (L.)
E. nigricans (L.)
Agrotis segetum (D. & S.)
A. exclamationis (L.)
A. ipsilon (Hufn.)
A. puta (Hübn.)
Axylia putris L.
Ochropleura plecta (L.)
Noctua pronuba (L.)
N. comes (Hübn.)
N. fimbriata (Schreb.)
N. janthina (D. & S.)
Graphiphora augur (F.)
Diarsia mendica (F.)
D. brunnea (D. & S.)
Xestia c-nigrum (L.)
X. ditrapezium (D. & S.)
X. triangulum (Hufn.)
X. baja (D. & S.)
X. rhomboidea (Esp.)
X. castanea (Esp.)
Cerastis rubricosa (D. & S.)
Polia nebulosa (Hufn.)
Heliophobus reticulata (Haw.)
Melanchra persicariae (L.)
Lacanobia thalassina (Hufn.)
L. oleracea (L.)
Ceramica pisi (L.)
Hecatera bicolorata (Hufn.)
Hadena rivularis (F.)
H. perplexa (D. & S.)
H. confusa (Hufn.)
H. bicruris (Hufn.)
Tholera cespitis (D. & S.)
Panolis flammea (D. & S.)
Orthosia cruda (D. & S.)
O. miniosa (D. & S.)
O. populeti (F.)
O. gracilis (D. & S.)
O. stabilis (D. & S.)
O. incerta (Hufn.)
O. munda (D. & S.)
O. gothica (L.)
Mythimna conigera (D. & S.)
M. ferrago (F.)
M. impura (Hübn.)
M. pallens (L.)
M. comma (L.)
Cucullia chamomillae (D. & S.)
C. umbratica (L.)
Cleoceris viminalis (F.)
Aporophyla lutulenta (D. & S.)
Xylocampa areola (Esp.)
Blepharita adusta (Esp.)
Polymixis flavicincta (D. & S.)
Eupsilia transversa (Hufn.)
Conistra vaccinii (L.)
C. ligula (Esp.)
Agrochola circellaris (Hufn.)
A. macilenta (Hübn.)
A. litura (L.)
A. lychnidis (D. & S.)
Atethmia centrago (Haw.)
Xanthia citrago (L.)
X. aurago (D. & S.)
X. togata (Esp.)
X. icteritia (Hufn.)
X. gilvago (D. & S.)
Acronicta megacephala (D. & S.)
A. aceris (L.)
A. leporina (L.)
A. alni (L.)
A. psi (L.)
Amphipyra pyramidea (L.)
A. tragopoginis (Clerck)
Rusina ferruginea (Esp.)
Thalpophila matura (Hufn.)
Euplexia lucipara (L.)
Phlogophora meticulosa (L.)
Ipimorpha subtusa (D. & S.)
Enargia paleacea (Esp.)
Cosmia affinis (L.)
C. diffinis (L.)
C. trapezina (L.)
C. pyralina (D. & S.)
Apamea monoglypha (Hufn.)
A. lithoxylaea (D. & S.)
A. crenata (Hufn.)
A. characterea (Hübn.)
A. unanimis (Hübn.)
A. anceps (D. & S.)
A. sordens (Hufn.)
A. scolopacina (Esp.)
Oligia strigilis (L.)
O. fasciuncula (Haw.)
Mesoligia furuncula (D. & S.)
M. literosa (Haw.)
Mesapamea secalis (L.)
Photedes minima (Haw.)
P. extrema (Hübn.)
P. fluxa (Hübn.)
P. pygmina (Haw.)
Eremobia ochroleuca (D. & S.)
Luperina testacea (D. & S.)

Hydraecia micacea (Esp.)
Gortyna flavago (D. & S.)
Charanyca trigrammica (Hufn.)
Hoplodrina blanda (D. & S.)
Caradrina morpheus (Hufn.)
Chilodes maritimus (Tausch.)
Lithacodia pygarga (Hufn.)
Pseudoips fagana Warren
Colocasia coryli (L.)
Diachrysia chrysitis (L.)
Polychrysia moneta (F.)
Autographa gamma (L.)
A. pulchrina (Haw.)
A. jota (L.)
Abrostola trigemina (Wern.)
A. triplasia (L.)
Catocala nupta (L.)
Tyta luctuosa (D. & S.)
Lygephila pastinum (Treits.)
Scoliopteryx libatrix (L.)
Laspeyria flexula (D. & S.)
Rivula sericealis (Scop.)
Hypena proboscidalis (L.)
Polypogon tarsipennalis (Treits.)
P. nemoralis (F.)

COLEOPTERA

Despite the comparative lack of larger trees and the extensive felling and replanting which has taken place in a large percentage of the remaining woodland of Bedford Purlieus, the coleopterous fauna remains relatively rich. A total of 474 species has been recorded in, or adjacent to, the wood in the past 40 years. J. Omer-Cooper (1926) lists many records by J. Willoughby-Ellis from Wansford, only 1½ miles east of Bedford Purlieus. It is not inconceivable that some of these records refer to this wood. However, no specimens in his collection, deposited at York Museum, have so far been found to bear Bedford Purlieus data labels. The earliest definite records are those of D. Tozer for May 1935 when he recorded Elater elongatus and Osphya bipunctata. The latter species has a very localised distribution centred around Huntingdonshire with Bedford Purlieus as one of its northernmost known sites (Steele and Welch, 1973 p.213). Of the 38 species recorded by Tozer between 1935 and 1970 all except 7 species have probably not been recorded there for the past 30 years. S.O. and S.A. Taylor collected in the wood between 1936 and 1945 and their collection and notebooks are deposited at the Leicester Museum and Art Gallery. Of the species listed by them 30 remain the only known records, although a further four species were also recorded by Tozer; Trachys minuta on hazel, Saperda populnea on aspen, Agapanthia villoso-virescens on hogweed and Mordella villosa on flowers. The last species was recently recorded by P. Skidmore (1972) under the name M. fasciata F., from "an umbel at the edge of a cornfield" near Kingscliffe Woods, 3 miles to the west of Bedford Purlieus, and he remarks that this "represents a slight northern extension of its known range". Skidmore also took Laemophloeus bimaculatus (Pk.) and Synchita humeralis (F.) on a dead standing beech and comments "their capture supports the conviction held by the writer that all remnants of old forest areas should contain interesting rare insects". Certainly two species still present in the wood, Acalles roboris and Orchesia minor are regarded by R.A. Crowson (pers. comm.) as good indicators of a primary woodland site.

Many of the species listed by Tozer and the Taylors reflect a woodland with many mature trees. From experience gained in Monks Wood National Nature Reserve it can be hoped that a number of these species may still be present at very low densities. One species listed in the Taylors' notebooks, but not represented in their collection, is Rhagium inquisitor. It would appear unlikely that this northern species occurred "in numbers" in Bedford Purlieus. However, this species was also recorded from Monks Wood in 1925 at a time when pines were known to be present (Steele & Welch, 1973) but again no known specimens are extant.

Tozer records five species from verges outside, or bordering, the wood and one, Harpalus ardosiacus, from "fields around Bedford Purlieus". C.H. Lindroth (1974) describes the British distribution of this species as "north to Norfolk and Yorks. In open fields with limestone and chalk". H. obscurus, another very local southern species on chalk and limestone was recorded in C 38B and C 48D by J.W. Turner in 1956.

One unexpected record is that of three Odontaeus armiger taken by Tozer in June 1964 in a mercury vapour light trap. This species is more characteristic of open countryside although it flies at dusk and has been caught in this manner on three occasions in Buckinghamshire by Sir Eric Ansorge (1963).

Over the past three years particular attention has been paid to the Coleoptera frequenting different species of fungi in Bedford Purlieus. This has provided some interesting records, especially in the genus *Gyrophaena* (Staphylinidae):-

Table 21

Species of Agaric fungus	Species of Gyrophaena									
	pulchella	affinis	gentilis	bihamata	fasciata	williamsi	poweri	minima	angustata	hanseni
Collybia dryophila		+		+						
C. maculata		+								
Galerina mutabilis		+			+					
Hebeloma crustiliniforme								+		
Hypholoma fasciculare		+	+	+	+		+	+	+	+
Inocybe asterospora				+						
I. corydalina				+						
Lepiota cristata				+	+					
Mycena galericulata	+									
Pluteus lutescens				+	+					
Tricholoma fulvum	+									
Tricholomopsis platyphylla		+	+	+	+	+			+	

One male *G. williamsi* was collected from *T. platyphylla* on 13 July 1972 in C 38C. This species was first described from material taken at St. Albans in 1933. There appear to be no other published British records but E.W. Aubrook informs me that this species was numerous in a very rotten (unidentified) fungus in a wood near Harlow Carr, Harrowgate, Yorks on 23 September 1971. S.A. Williams also caught a single specimen in his "autocatcher" at Seal, near Sevenoaks, Kent, on 3 August 1973. Scheerpeltz and Hoefler (1948) did not find *G. williamsi* during an intensive study of fungicolous Coleoptera in Germany. More recently Batten (1973) collected 57 examples in Holland, all in *Tricholomopsis rutilans*, and concluded that *G. williamsi* is restricted to that species of fungus. One specimen of *T. rutilans* was collected in Bedford Purlieus but it only contained three common species of Staphylinidae; *Proteinus ovalis*, *Autalia impressa* and *Oxypoda alternans*.

A second species, *G. poweri*, of which one male was taken in *Hypholoma fasciculare* in C 35C on 29 June 1972, is only slightly less rare in Britain. Joy (1932) gives its distribution as "England S.E. to Leicestershire". I have seen specimens from the following southern localities:- New Forest, Hants; Caterham, Esher, Shirley and Mickleham, Surrey; Epping Forest, Essex; and Windsor Forest, Berks. There is also a specimen in the Manchester University Museum labelled Killarney 25.x.31. Scheerpeltz and Hoefler recorded *G. poweri* from three species of *Hypholoma* (including *H. fasciculare*), Pluteus cervinus and Tricholanopsis platyphylla. Two male G. hanseni were also taken in H. fasciculare on 3 September 1972 in C 35. This species, added to the British List by Welch (1969), is still only known from about a dozen localities in the southern half of England. A single specimen of Phloiophilus edwardsi was sieved from litter at site 1 on 30 May 1974. Crowson (1962) states that this species "seems to be specifically attached to the fungus Phlebia merismoides growing chiefly on dead branches of oak", and Sheila Wells does list this species from another compartment in the wood.

A recent immigrant into Southern Britain, Leistus rufomarginatus, is still actively extending its range. Although known from Norfolk, records from Monks Wood (Welch, 1968) and more recently from a beech plantation just north of Kettering, Northants (Welch, 1973) were the northern known limits of its spread into central England. Thus the record of a single specimen caught in a pitfall trap in July 1974 slightly increases its known range.

For much of the year the stream flowing through the centre of the wood is reduced to a series of small pools. Specimens of Atheta elongatula have been taken running along the dry stream bed where Oreodytes halensis, a species regarded by F. Balfour-Browne (1940) as a "fen species, restricted to East Anglia and Lincs, usually in drains and moving water", has been found under stones. After heavy rain the stream frequently overflows its banks and large accumulations of flood refuse are deposited both in the stream and along its banks. Although most of the species collected from such debris belong to the family Staphylinidae, several specimens of Trechus rivularis were also taken. Lindroth (1974) is somewhat out of date in describing this carabid as "In dark forest swamps with sphagnum among damp sedge litter, Hunts and Cambs, very rare, but many taken at Wicken Fen". Present knowledge of its distribution shows that it is probably widely distributed in woodlands in the east Midlands and Central Lincolnshire. E.W. Aubrook (pers. comm.) has also taken it in Yorkshire.

If the Formica rufa were originally introduced into the wood a number of myrmecophilous Coleoptera must have been introduced with the nest material. These include the staphylinids Leptacinus formicetorum, Xantholinus atratus, Thyasophila angulata and Zyras humeralis; the rhizophagid Monotoma conicicollis and the ptiliid Acrotrichis montandoni, which Johnson (1967) describes as a "frequent inhabitor of the nests of larger ants (Formica spp.)".

Several other species are associated with the nests of various mammals, birds and social insects. Quedius othiniensis, Oxyletus saulcyi, Ptenidium laevigatum and Leptacinus testaceus were found in moles' nests, and the last species also, perhaps more typically, in a small mammal's nest. A single Lomechusa emarginata was caught in a pitfall trap on site 10 during July 1974. According to Donisthorpe (1927) this species of staphylinid is found in the nests of Formica fusca during the summer months, moving into the nest of a species of Myrmica for the winter months. This specimen was probably in the process of just such a migration.

A further 26 species were caught in pitfall traps on this restored quarry site and were not seen elsewhere in the wood. Ten of these were Carabidae including the Green Tiger beetle Cicindella campestris which shows a preference for a sandy or heathy habitat. The larvae of a species of Dyschirius were also caught in pitfall traps on site 10. These may not be the common D. globosus but may be one of the predatory species found in the burrows of species of Bledius, since B. fracticornis was recorded from the same site. The weevil Gronops lunatus is also associated with sandy areas although the other Curculionidae and Chrysomelidae recorded here were most probably associated with the sparse herb layer.

The remaining grassy areas proved to be rather disappointing with regard to the Coleoptera but the opening up of some of the rides within the wood should provide additional herb-rich areas. A larva of the Glowworm Lampyris noctiluca was found in the wartime site in C 45D and many phytophagous species are present particularly along the south and west margin of the reconstituted quarry and in the marginal strip up the complete western edge of the wood.

If as much time had been spent in studying Bedford Purlieus as has gone into the study of Monks Wood National Nature Reserve, the list of Coleoptera given in Appendix 5 would probably have been almost twice its present length.

COLEOPTERA RECORDED FROM BEDFORD PURLIEUS

The majority of the 474 species in the following list have been recorded during 1974, many in pitfall traps which were used during four two-weekly periods:- 18.3.74 - 1.4.74, 16-30.4.74, 15-29.5.74 and 4-18.7.74. Four traps were placed at nine different sites, within the wood, for the first period, with a tenth site, on the reconstituted quarry, added for the remaining dates. In the following list these records are shown thus:- "P.F.T., 5/74, 50A" i.e. May 1974, C 50A. All other records give, where possible, date of collection, habitat details, compartment number and collector's initials in brackets. All records are by R.C. Welch unless indicated by initials of the following additional collectors:- J.N. Greatorex-Davies, P.T. Harding, H.E. Henson, W.E. Russell, D. Tozer, J.W. Turner and Sheila E. Wells. I.M. Evans kindly abstracted records from the notebooks of S.O. and S.A. Taylor deposited at the Leicester Museum and Art Gallery. These were most probably all collected by the father and are indicated by the initials S.O.T. Tozer's records are mainly undated and refer to the broad period 1935-1970 unless stated otherwise.

In the following list the families are arranged according to Crowson (1956, Handbk. Ident. Brit. Ins. 4 Pt. 1) with the exception of the Anisotomidae, part of which is added to the Silphidae with the rest in the Leiodidae following a manuscript list in the British Museum (Natural History) which will form the Coleoptera part of the revised second edition Kloet & Hincks. Nomenclature for the Staphylinidae is that of Tottenham (1949, The generic names of British Insects, Pt. 9, R. ent. Soc. Lond. Comm. of Generic Nomenclature) with the exception of the Oxytelinae which follow Hermann's world revision (1970, Bull. Amer. Mus. Nat. Hist., 142) and the genus *Sepedophilus* following Hammond's revision (1973, Entomologist's mon. Mag., 108). Nomenclature for *Meligethes* and *Euparea* (Nitidulidae) is after Sporncraft in Freude, Harde & Lohse (1967, Die Kafer Mitteleuropas, 7) and that for the Lathridiidae follows Walkley (1952, Proc. Ent. Soc. Wash., 54 pt. 5). The remaining families follow Kloet & Hincks (1945, Checklist of British Insects) and those parts of the Handbooks for the Identification of British Insects so far published by the Royal Entomological Society of London.

CARABIDAE

Cicindela campestris L. P.F.T., 5/74, 50A.

Carabus nemoralis Muell. P.F.T., 4/74, 36A; 7/74 larva, 33.

C. problematicus Hbst. P.F.T., 7/74, 50A.

Cychrus caraboides (L.) 7.5.74, pupa under rotten stump, 35; 24.10.74, under rotten birch stump, 42A (N.G-D.).

Leistus spinibarbis F. 7.10.74, under stone on edge of quarry site, 50A (P.T.H.).

L. rufomarginatus Duft. P.F.T., 7/74, 35.

L. fulvibarbis Dej. 19.6.56, common, under stones, 39B, 48D (J.W.T.); P.F.T., 3/74, 35, 4/74 larva, 35.

L. rufescens F. 29.6.72, under stone in dried-up pond; 13.7.72, sweeping ride through 38; 15.5.74, in litter, 35; P.F.T., 5/74 and 7/74, 35, 36A.

L. ferrugineus (L.) 19.6.56, fairly common, under log, 38B; 12.5.74, fairly common, under wood chips, 34 (J.W.T.).

Nebria brevicollis (F.) 12.5.74, very common, under stones and branches, 39D (J.W.T.); 11.3.74, larva in litter, 43A; P.F.T., 3/74, 35, 42B, 43A, 4/74, 35, 40B, 43A, 5/74, 35, 40B, 43A, 50A, 7/74, 35, 50A, 4/74 larvae 35, 43A.

Notiophilus biguttatus (F.) 13.7.72, in flood refuse in dry stream bed, 39; 12.5.74, occasional in stream litter, 39D (J.W.T.); 15.4.74, in ride between 32 and 36; 21.10.74, in F. rufa nest, 43E; 11.3 and 16.4.74, litter, 33, 36A and 40A; P.F.T., 3/74, 35, 40A and B, 42B, 4/74, 35, 36A, 40A, 43A, 50A, 5/74, all except 50A, 7/74, all except 33, 40A and 50A.

N. rufipes Curt. P.F.T., 5/74, 40A.

Loricera pilicornis (F.) 12.5.74, common, in stream litter, 39D (J.W.T.); P.F.T., 3/74, 35, 40B, 4/74, 43B, 45B, 7/74, larvae, 35.

Dyschirius sp. P.F.T., 7/74 two larvae, 50A.

Clivina fossor (L.) 7.5.74, under stone, 37B; 7.5.74, under stone on path, 37.

Trechus obtusus Er. 13.7.72, sweeping ride through 37; 3.9.72, in fungus 35; 7.8.74, oak litter, 44C (P.T.H.); P.F.T., 3/74, 36A, 42B, 45B, 4/74, 43A, 45B, 5/74, 45B, 7/74, 35, 36A, 43A, 45B.

T. rivularis (Gyll.) 13.7.72, in flood refuse in dry stream bed, 39; P.F.T., 7/74, 33, 45B.

Asaphidion flavipes (L.) 15.4.74, in ride between 32 and 36; 11.3.74, litter, 40B and 43A; P.F.T., 4/74, 35, 5/74, 35, 42B.

Bembidion (Metallina) lampros (Hbst.) 13.7.72, running in ride, 37; 12.5.74, occasional, in stream litter, 39D (J.W.T.); P.F.T. 4, 5 and 7/74, 50A.

B. (Metallina) properans Steph. P.F.T., 5/74, 50A.

B. (s.str.) quadrimaculatum (L.) P.F.T., 5/74, 50A.

B. (Phila) obtusum (Serv.) 20.6.55, occasional, under log, 39A (J.W.T.); 30.9.74, in flood refuse in dry stream bed, 43C.

B. (Philochthus) guttula (F.) P.F.T., 4/74, 35.

B. (Peryphus) tetracolum Say P.F.T., 4 and 7/74, 50A.

Stomis pumicatus (Pz.) P.F.T., 5/74, 35.

Pterostichus diligens (Sturm) P.F.T., 7/74, 45B.

P. longicollis (Duft.) P.F.T., 3/74, 45B, 4/74, 33.

P. madidus (F.) 3.6.56, very common, under stones etc, 38B and D, 39B (J.W.T.); P.F.T., 4/74, 35, 5/74, 35, 36A, 50A, 7/74, 33, 35, 40A, 45B.

P. melanarius (Ill.) 15.5.56, common, in old log, 39B; 12.5.74, common, under stones, 37B and 39D (J.W.T.).

P. nigritus (F.) 12.5.74, uncommon, in old log, 37B (J.W.T.).

P. strenuus (Pz.) 16.4.74, cut grass, 37B; 15.5.74, in dry straw, 17B.

Abax parallelepipedus (Pill. & Mitt.) 12.5.74, fairly common, under stone, 34 (J.W.T.); P.F.T., 4/74, 35, 36A, 43A, 5 and 7/74 all except 50A.

Calathus fuscipes (Goez.) P.F.T., 7/74, 50A.

Agonum assimile (Pk.) 28.10.51, fairly common, under stones, 38D, 39B (J.W.T.).

A. dorsale (Pont.) 28.10.51, very common, under stones, logs etc, 39D (J.W.T.); P.F.T., 5/74, 50A.

A. obscurum Hbst. 28.10.51, very common, under stones, 39B and D (J.W.T.).

Amara familiaris (Duft.) 29.6.72; 12.5.74, occasional, under bark on old log, 37B (J.W.T.); 16.4.74, cut grass, 37B; 7.5.74, in litter, 40A; 11.3, 16.4 and 30.5.74, litter, 35, 36A and 40A; P.F.T., 4/74, 40A, 5/74, 35.

A. ovata (F.) 20.6.55, fairly common, under log, 43B, 48D (J.W.T.).

A. plebeja (Gyll.) 20.6.55, uncommon, under log, 48D (J.W.T.).

A. communis (Pz.) 15.5.56, fairly common, under leaf debris, 38B (J.W.T.).

Harpalus (Pseudophonus) rufipes (Deg.) P.F.T., 7/74, 50A.

H. (s.str.) aeneus (F.) 19.6.56, very common, under stones, 39A and B, 48D (J.W.T.); P.F.T., 4 and 5/74, 50A.

H. (s.str.) obscurus F. 3.6.56, occasional, under stones, 39B, 48D (J.W.T.).

H. (Ophonus) ardosiacus Lut. in fields around Bedford Purlieus (D.T.).

Trichocellus placidus (Gyll.) 13.7.72, sweeping ride between 37 and 38.

Badister sodalis (Duft.) not common (D.T.); 13.7.72, sweeping ride through 37; 7.5.74, in litter 32B; 7.8.74, oak litter, 44C (P.T.H.); P.F.T., 4/74, 36A, 5/74, 35, 40A, 7/74, 35, 36A.

Lebia chlorocephala (Hoff.) not common (D.T.); 13.9.36 (S.O.T.); 5.5.68, (W.E.R.).

Demetrias atricapillus (L.) 12.5.74, occasional, in leaf litter, 39A (J.W.T.); 16.4.74, cut grass, 37B; 16.4.74, litter, 35.

Dromius linearis (Ol.) 28.10.51 and 12.5.74, fairly common, behind bark, 39D and 43B (J.W.T.).

D. melanocephalus Dej. 29.6.72; 15.5.74, sweeping ride between 17B and 37C.

D. quadrimaculatus (L.) 28.10.51, common, behind bark, 39D, 43B (J.W.T.); 15.11.72, under bark of fallen lime, 36.

Metabletus truncatellus (L.) P.F.T., 5/74, 50A.

M. foveatus (Geoff. in Fourc.) P.F.T., 4/74, 50A.

DYTISCIDAE

Oreodytes halensis (F.) 13.7.72, under stone in dried-up stream bed, 39.

Hydroporus memnonius Nic. 13.7.72, in pool in wheel rut in ride between 36 and 39.

H. palustris (L.) in brook through wood (D.T.).

H. tessellatus Drap. 13.7.72, under stone in dry stream bed, 39.

HYDROPHILIDAE

Sphaeridium scarabaeoides (L.) 11.3.74, litter, 40A.

S. lunatum F. 23.7.74, in dog dung, 45A.

Cercyon terminatus (Marsh.) P.F.T., 5/74, 35.

Megasternum obscurum (Marsh.) 7.8.74, oak litter, 44C (P.T.H.); 22.10.74, small mammal's nest, 39C; P.F.T., 7/74, 36A, 45B.

Anacaena globulus (Pk.) in flood refuse in dry stream bed, 13.7.72, 39, 30.9.74, 43C; P.F.T., 3/74, 50A, 4/74, 35, 7/74, 35, 45B.

PTILIIDAE

Ptenidium laevigatum Er. 15.5.74, in mole's nest, 38B.

P. nitidum (Heer) 16.4.74, cut grass, 37B.

Acrotrichis fascicularis (Hbst.) 16.4.74, cut grass, 37B.

A. intermedia (Gillm.) 15.5.74, in dry straw, 35; 7.8.74, oak litter, 44C (P.T.H.).

A. grandicollis (Man.) 13.7.72, sweeping ride through 37.

A. montandoni (Allib.) 28.9.67 in Formica rufa nest, 40A.

SILPHIDAE

Nicrophorus humator (Goez.) 3.9.72, in dead rabbit in ride between 37 and 38.

N. vespilloides (Hbst.) 3.9.72, in dead rabbit in ride between 37 and 38.

Thanatophilus rugosus (L.) 23.7.74, in dog dung, 45A.

Ablataria laevigata (F.) recorded by (D.T.).

Ptomophagus subvillosus (Goez.) 7.5.74, in litter, 35; P.F.T., 3/74, 40A, 5/74, 40B, 45B, 7/74, 35.

Nargus velox (Spence) 15.11.72, in fungus, 38; 31.10.73, in fungi, 43C; 7.5.74, in fungus, 17B; 22.10.74, small mammal's nest, 39C; 30.5.74, litter, 35; P.F.T., 3/74, 35, 36A, 40B, 4/74, all except, 35, 40B, 42B, 50A, 5/74, all except 50A, 7/74, 35.

N. wilkini (Spence) 11.3 and 16.4.74, litter, 33 and 36A; P.F.T., 3/74, 33, 35, 36A, 43A, 4/74, 36A, 40A, 43A, 5/74, 33, 40A, 43A.

Catops coracinus (Kell.) 13.7.72, in dead blackbird and in dog dung in ride between 35 and 36; 29.5.74, in dog dung on path between 40B and 43C.

C. fuliginosus Er. P.F.T., 5/74, 43A, 45B, 50A, 5/74.

C. nigricans Spence 22.10.74, small mammal's nest, 39C; P.F.T., 5/74, 40A.

C. nigrita (Er.) P.F.T., 3/74, 40A, 43A, 5/74, 40A.

C. tristis (Pz.) P.F.T., 5 and 7/74, 40A.

Sciodrepa watsoni (Spence) 29.6.72, in dead thrush; P.F.T., 5/74, 40A, 7/74, 33.

S. fumatus (Spence) 29.6.72, in dead thrush; 13.7.72, in dead blackbird in ride between 35 and 36; 29.5.74, in dog dung on path between 40B and 43C.

Colon brunneum Lat. P.F.T., 7/74, 35, 45B.

LEIODIDAE

Leiodes dubia (Kug.) P.F.T., 7/74, 50A.

Amphicyllis globus (F.) P.F.T., 7/74, 33.

Agathidium atrum (Pk.) P.F.T., 5/74, 45B.

A. piceum Er. 11.3.74, litter, 40B; P.F.T., 3/74, 40A.

LEPTINIDAE

Leptinus testaceus Muell. 30.9.74, in mole's nest, 36C; 22.10.74, two in small mammal's nest, 39C.

SCYDMAENIDAE

Cephennium gallicum Gang. 11.3.74, litter, 36A and 43A; P.F.T., 4/74, 36A, 43A, 5/74, 35, 40B, 7/74, 33.

Stenichnus collaris (Muell. & Kunze) P.F.T., 7/74, 35, 42B.

MICROPEPLIDAE

Micropeplus staphylinoides (Marsh.) 11.3, 16.4 and 30.5.74, litter, 33, 35, 40A and 43A; P.F.T., 3/74, 36A, 4 and 5/74, 35, 40A, 43A.

STAPHYLINIDAE

Proteinus ovalis Steph. 15.11.72, in fungi, 40; 7.5.74, in moss and fungus, 17B; 29.5.74, in dog dung on path between 40B and 43C; P.F.T., 4 and 5/74, 40A; 30.9.74, flood refuse in dry stream bed, 43C.

P. brachypterus (F.) 31.10.73, in fungi, 32, 33 and 40B; 22.10.74, deer dung, 39; 30.9.74, flood refuse in dry stream bed, 43C.

P. atomarius Er. 22.10.74, in rotten fungus, 40A.

P. macropterus (Gyll.) P.F.T., 5/74, 35.

Megarthrus depressus (Pk.) 16.4.74, on the wing, 36.

Eusphalerum (s.str.) primulae (Steph.) 15.5.74, in Primula vulgaris flower, 42B.

E. (Onibathum) luteum (Marsh.) 29.6. and 13.7.72, abundant on umbel flowers, 37; 13.7.72, 1 in Collybia platyphylla, 38; 23.7.74, on umbels in ride between 32A and 35.

Omalium rivulare (Pk.) 29.5.74, in dog dung on path between 40B and 43C.

O. caesum Gr. 30.5.74, litter, 40A.

Phloeonomus (s.str.) punctipennis Th. 30.5.37 (S.O.T.).

Anthobium atrocephalum (Gyll.) 31.10.73, in fungi, 43C; 7.5.74, in fungi, 35; 11.3 and 16.4.74, litter, 35, 36A, 42B, 43A and 45B; P.F.T., 3/74, all except 50A, 4/74, all except 40B and 50A, 5/74, 33, 35, 36A, 40B, 42B, 43A.

A. unicolor (Marsh.) in fungi, 15.11.72, 38; 7.5.74, 35; 11.3, 16.4 and 30.5.74, litter, 35, 36A, 43A and 45B; P.F.T., 3, 4 and 5/74, all except 50A.

Olophrum piceum (Gyll.) 11.3.74, litter, 35; P.F.T., 3/74, 33, 35, 36A, 42B, 45B, 4/74, 36A, 45B; 30.9.74, flood refuse in dry stream bed, 43C.

Lesteva longo-elytrata (Goez.) in flood refuse in dry stream bed, 13.7.72, 39; 30.9.74, 43C.

Coryphium angusticolle Steph. 22.10.74, under bark of elm log, 48A.

Carpelimus (s.str.) elongatulus (Er.) 13.7.72, sweeping ride through 36.

Oxyxtelus sculpturatus (Gr.) 13.7.72, sweeping, 37, in dog dung in ride between 35 and 36, in deer dung in ride through 36; deer dung, 30.9.74, 43C, 22.10.74, 39; P.F.T., 3/74, 36A, 40A, 5/74, 36A, 7/74, 35, 36A; 30.9.74, flood refuse in dry stream bed, 43C.

O. tetracarinatus (Block) 13.7.72, sweeping ride through 37, in deer dung in ride through 36; 16.4.74, cut grass, 37B; P.F.T., 5/74, 50A.

O. saulcyi Pand. 15.5.74, in mole's nest, 38B.

Anotylus rugosus F. 13.7.72, in flood refuse in dry stream bed, 39; 11.3, 16.4 and 30.5.74, litter, 36A and 40B; P.F.T., 4/74, 35, 50A.

Platystethus (s.str.) arenarius (Fourc.) 13.7.72, in dog dung in ride between 35 and 36; 22.10.74, in horse dung, 40A.

P. (Craetopycrus) nitens Sahlb. 29.6.72; 15.5.74, sweeping ride between 17B and 37C; P.F.T., 5/74, 50A.

Bledius (Hesperophilus)fracticornis (Pz.) P.F.T., 5 and 7/74, 50A.

Oxyporus rufus (L.) in fungi (D.T.).

Stenus (s.str.) clavicornis (Scop.) 13.7.72, sweeping ride between 37 and 38; 16.4.74, cut grass, 37B; 15.5.74, sweeping ride between 35 and 37C.

S. (Hemistenus) flavipes Steph. 13.7.72, sweeping ride between 37 and 38.

S. (Hemistenus) picipes Steph. 13.7.72, sweeping ride between 37 and 38.

S. (Parastenus) impressus Germ. 13.7.72, sweeping 37 and ride through 38; 3.9.72, sweeping ride between 37 and 38 and 39 and 42; 16.4. and 30.5.74, litter, 35 and 45B.

Astenus longelytratus Palm 29.6.72; 13.7.72, sweeping ride through 36.

Sunius propinquus (Bris.) P.F.T., 5/74, 50A.

Lithocharis ochraceus (Gr.) P.F.T., 4/74, 40A.

Lathrobium (s.str.) fulvipenne (Gr.) 13.7.72, sweeping ride through 36; 15.5.74, in dry straw, 17B; P.F.T., 3/74, 36A.

L. (s.str.) punctatum (Fourc.) 7.5.74, under rotten log, 37C; 16.4.74, cut grass, 37B; 7.5.74, in leaves in ditch, 36A; in mole run under log, 37C; 16.4 and 30.5.74, litter, 33 and 45B; P.F.T., 5/74, 45B.

L. (s.str.) longulum Gr. 28.9.67, in Formica rufa nest, 40A.

L. (Lobrathium) multipunctum Gr. 6.6.37 (S.O.T.).

Achenium depressum (Gr.) not common (D.T.).

Leptacinus formicetorum Maerk. 28.9.67, very common in F. rufa nest, 40A.

Xantholinus (s.str.) tricolor (F.) 30.5.74, litter, 42B; P.F.T., 5/74, 36A, 43B, 45B, 7/74, 36A.

X. (s.str.) linearis (Ol.) 28.9.67, in F. rufa nest, 40A; 16.4.74, cut grass, 37B; 11.3.74, litter, 40A; P.F.T., 5/74, 33, 45B, 7/74, 50A.

X. (s.str.) longiventris Heer 30.5.74, litter, 40A; P.F.T., 3/74, 35, 42B, 4/74, 50A.

X. (Hyponygrus) angustatus (Steph.) 15.5.74, on wing, 43C.

X. (Hyponygrus) atratus Heer 28.9.67, in F. rufa nest, 40A.

Atrechus affinis (Pk.) 13.7.72, sweeping ride between 35 and 36; 3.9.72, under bark of pine log, 43.

Gyrohypnus punctulatus Goez. 11.3 and 30.5.74, litter, 33 and 36A; P.F.T., 3/74, all except 40A, 4/74, 33, 36A, 42B, 43A, 45B, 5/74, 33, 35, 40B, 43B, 43A, 45B, 7/74, 35, 42B.

G. laeviusculus (Steph.) 5.6.74, sweeping edge of 50B.

G. myrmecophilus (Kies.) 7.8.74, in oak litter, 44C (P.T.H.); 11.3, 16.4 and 30.5.74, litter, 33, 36A, 40A and B, 42B and 45B; P.F.T., 3/74, 33, 36A, 40A, 42B, 43A, 4/74, 33, 42B.

Philonthus (s.str.) laminatus (Creutz.) 16.4.74, on the wing, 43C; 11.3.74, litter, 40A; P.F.T., 3/74, 42B.

P. (s.str.) succicola Th. 13.7.72, in dead blackbird in ride between 35 and 36; 3.9.72, in dead rabbit in ride between 37 and 38.

P. (s.str.) potitus (L.) 3.9.72, in dead rabbit in ride between 37 and 38.

P. (Bisnius) decorus (Gr.) P.F.T., 3/74, 35, 4/74, 35, 36A, 5 and 7/74, 35.

P. (Bisnius) cognatus Steph. 16.4.74, on the wing, 43C; P.F.T., 4/74, 50A.

P. (Bisnius) varians (Pk.) 23.7.74, in dog dung, 45A.

Ocypus (Alapsodus) winkleri (Bern.) 22.10.74, under pieces of wood, 39C.

Creophilus maxillosus (L.) 28.10.51, in dead bird, 38C (J.W.T.); 3.9.72, in dead rabbit in ride between 37 and 38.

Quedius (s.str.) fuliginosus (Gr.) 30.5.74, litter, 36A; P.F.T., 7/74, 35, 45B.

Q. (s.str.) subfuliginosus (Britt.) 22.10.74, under pieces of wood, 39C.

Q. (Microsaurus) othiniensis Joh. in mole's nests, 7.5.74, 38B; 30.9.74, 36C.

Q. (Sauridus) picipes (Man.) 4.8.40 (S.O.T.); 30.9.74, flood refuse in dry stream bed, 43C.

Q. (Sauridus) fumatus (Steph.) 7.8.74, oak litter, 44C (P.T.H.).

Q. (Sauridus) nemoralis Baudi P.F.T., 4/74, 35.

Habrocerus capillaricornis (Gr.) 13.7.72, in flood refuse in dry stream bed, 39; 15.5.74, in dry straw, 17B; P.F.T., 5/74, 40B.

Mycetoporus (s.str.) splendidus (Gr.) P.F.T., 5/74, 40B.

M. (s.str.) longicornis Maekl. P.F.T., 4/74, 40B, 43A.

M. (Schinomosa) nigricollis Steph. 3.9.72, in straw heap, 39.

M. (Schinomosa) rufescens (Steph.) P.F.T., 3 and 5/74, 40B.

Bolitobius inclinans (Gr.) P.F.T., 4/74, 35, 7/74, 33, 42B.

Lordithon (s.str.) thoracicus (F.) in fungi, 13.7.72, 35C and 38C; 3.9.72, 42; 31.10.73, 32, 34 and 40B; 4.7.74 (S.E.W.); 30.5.74, litter, 33; P.F.T., 7/74, 36A.

L. (s.str.) exoletus (Er.) 31.10.73, in fungus, 34.

L. (Bobitobus) lunulatus (L.) 13.7.72, in fungus, 35.

Sepedophilus marshami (Steph.) 15.5.74, dry straw, 35.

S. pedicularis (Gr.) 13.7.72, in fungus, 35.

Tachyporus (s.str.) chrysomelinus (L.) 16.4.74, cut grass, 37B; 15.5.74, in dry straw, 35, hawthorn blossom, 41B; 11.3, 16.4 and 30.5.74, litter, 33, 40A and B, 43A; P.F.T., 3/74, 35, 36A, 40A, 45B, 4/74, 35, 43A, 5/74, 35, 43A, 45B.

T. (s.str.) pallidus Sahlb. 29.6.72, 13.7.72, sweeping rides through 36, 37 and 38; 7.5.74, in mole run under log, 37C.

T. (s.str.) hypnorum (F.) 13.7.72, sweeping ride through 38; 31.10.73, in fungus, 32; 5.6.74, sweeping edge of 50B; 21.10.74, in F. rufa nest, 43E; 11.3 and 16.4.74, litter, 35, 36A and 45B; P.F.T., 3/74, 33, 36A, 43A, 45B; 30.9.74, flood refuse in dry stream bed, 43C.

T. (s.str.) obtusus (L.) 13.7.72, sweeping ride between 37 and 38; 5.6.74, sweeping edge of 50B.

T. (s.str.) nitidulus (F.) 29.6.72; 11.3, 16.4 and 30.5.74, litter, 33, 40A and B; P.F.T., 4 and 5/74, 40B, 50A, 7/74, 40B.

Tachinus (s.str.) signatus Gr. 7.5.74, in leaves in ditch, 36A; in moss, 35; 30.5.74, litter, 36A; P.F.T., 3/74, 36A, 42B, 43A, 4/74, all except 33, 35 and 50A, 5/74, all except 33, 40A and 50A, 7/74, all except 33, 40A and B, 50A.

Cypha longicornis (Pk.) 13.7.72, sweeping ride through 36; P.F.T., 4/74, 45B; 30.9.74, flood refuse in dry stream bed, 43C.

Gyrophaena (s.str.) pulchella Heer 31.10.73, 2♂♂ in fungus, 33; 18.9.74, in fungus (S.E.W.); 11.3.74, litter, 36A.

G. (s.str.) affinis (Sahlb.) in fungi, 13.7.72, 35 and 38C; 3.9.72, 35; 9.7.74 and 6.8.74 (S.E.W.).

G. (s.str.) gentilis Er. 13.7.72, in fungi, 35 and 38C, 1♀ sweeping along ride through 36; 3.9.72, fungus, 35.

G. (s.str.) bihamata Th. many in fungi, 29.6.72, 35; 13.7.72, 35 and 38C; 3.9.72, 35; 31.10.73, 40B; 4, 9 and 18.7.74 and 29.8.74 (S.E.W.).

G. (s.str.) fasciata (Marsh.) abundant in fungi, 29.6.72, 35; 13.7.72, 35 and 38C; 3.9.72, 35; 4 and 18.7.74 and 6.8.74 (S.E.W.).

G. (s.str.) williamsi Strand 13.7.72, 1♂ in fungus, 38C.

G. (s.str.) poweri Crotch 29.6.72, 1♂ in fungi, 35.

G. (s.str.) minima Er. in fungi, 29.6.72, 35; 31.10.73, 32 and 34.

G. (s.str.) angustata (Steph.) in fungi, 29.6.72, 35; 13.7.72, 38C.

G. (s.str.) joyi Wend. 13.7.72, 1♂ swept from Mercurialis perennis, 39D.

G. (s.str.) hanseni Strand 3.9.72, 2♂♂ in fungus, 35.

Agaricochara latissima (Steph.) 22.10.74, in Piptoporus betulinus, 43C.

Homalota plana (Gyll.) 22.10.74, under bark of elm log, 48A.

Anomognathus cuspidatus (Er.) 3.9.72, under bark of fallen lime, 36; 22.10.74, under bark of elm log, 48A.

Leptusa (s.str.) fumida (Er.) 3.9 and 15.11.72, under bark of fallen lime, 36; 16.4.74, under bark of fallen elm, 43C.

L. (Pachygluta) ruficollis (Er.) 13.7.72, under bark of dead elm, 38A; 15.2.74, in fungus (S.E.W.).

Bolitochara (s.str.) lucida (Gr.) 13.7.72, in Trametes on old hazel stool, 37C.

B. (Ditropalia) bella Maerk. 13.7.72, sweeping ride through 37.

B. (Ditropalia) obliqua Er. 13.7.72, in Trametes on old hazel stool, 37C; 3.9.72, in straw heap, 39.

Autalia impressa (Ol.) 15.11.72, in fungi, 40.

A. rivularis (Gr.) 13.7.72, in dead blackbird in ride between 35 and 36; in deer dung in ride through 36.

Falagria (Falagrioma) thoracica Curt. 3.9.72, in straw heap, 39; P.F.T., 7/74, 40A.

Dadobia immersa (Er.) 13.7.72, sweeping ride through 38.

Amischa analis (Gr.) 29.6.72; 13.7.72, in dead blackbird in ride between 35 and 36, sweeping ride between 37 and 38 and ride through 38; 11.3 and 16.4.74, litter, 40A and 43A; P.F.T., 4/74, 40B, 50A.

A. decipiens (Shp.) 11.3.74, litter, 40A and B.

Sipalia circellaris (Gr.) 11.3, 16.4 and 30.5.74, litter, 33, 36A, 40B and 45B; P.F.T., 3/74, 33, 7/74, 33, 35.

Atheta (Aloconota) gregaria (Er.) 29.6.72; 16.4.74, on the wing, 36.

A. (Philhygra) elongatula (Gr.) 13.7.72, running in dried-up stream bed, 39.

A. (Dinaraea) angustula (Gyll.) 29.6.72.

A. (Plataraea) nigriceps (Marsh.) P.F.T., 5/74, 40B.

A. (Enalodroma) hepatica (Er.) P.F.T., 7/74, 35.

A. (Tetropla) liturata (Steph.) 29.6.72, in fungi, 35.

A. (Tetropla) gagatina (Baudi) 3.9.72, in fungi, 39; P.F.T., 7/74, 33.

A. (Tetropla) sodalis (Er.) 7.5.74, in fungus, 35.

A. (Tetropla) britanniae Bern. & Scheer. 13.7.72, in fungi, 38C; 3.9.72, in fungi, 39.

A. (Tetropla) crassicornis (F.) 13.7.72, in dead blackbird and dog dung in ride between 35 and 36, in fungi, 35C; 3.9.72, in dead rabbit between 37 and 38, in fungi, 39; 31.10.73, in fungi, 32 and 40B; P.F.T., 5/74, 36A, 40A.

A. (Tetropla) xanthopus (Th.) 13.7.72, sweeping ride between 37 and 38.

A. (Tetropla) triangulum (Kr.) 16.4.74, litter, 40B.

A. (Stethusa) castanoptera (Man.) 13.7.72, in fungi, 38C and 37, in dead blackbird in ride between 35 and 36.

A. (Stethusa) pertyi (Heer) 13.7.72, in dog dung in ride between 35 and 36.

A. (Liogluta) oblongiuscula (Shp.) P.F.T., 3/74, 35, 4/74, 35, 45B, 5/74, 36A, 43A, 45B, 7/74, 35, 42B, 45B.

A. (Dimetrota) atramentaria (Gyll.) 30.9.74, flood refuse in dry stream bed, 43C.

A. (Dimetrota) marcida (Er.) 31.10.73, in fungi, 32, 33, 40A.

A. (Dimetrota) laevana (Muls. & Rey) 13.7.72, in dog dung in ride between 35 and 36.

A. (Dimetrota) setigera (Shp.) 22.10.74, in horse dung, 40A.

A. (Dimetrota) cinnamoptera (Th.) 22.10.74, deer dung, 39.

A. (Datomicra) nigra (Kr.) 3.9.72, in dead rabbit in ride between 37 and 38; in fungi, 42.

A. (Acrotona) aterrima (Gr.) 3.9.72, in dead rabbit in ride between 37 and 38.

A. (Acrotona) fungi (Gr.) 29.6.72; 13.7.72, commonly swept along rides in 37 and 38, in flood refuse in dry stream bed, 39D; 3.9.72, in straw heap, 39; 7.5.74, in litter, 17B and 40A; 15.5.74, in dry straw, and leaf litter, 35; 29.5.74, under elm log bark, between 43 and 48; 11.3, 16.4 and 30.5.74, litter, 35, 36A, 40A and B, 43A; P.F.T., 3/74, 45B, 4 and 5/74, 40A, 7/74, 40A and B.

A. (Acrotona) laticollis (Steph.) 11.3.74, litter, 36A.

A. (Amidobia) indubia (Shp.) 13.7.72, in dead blackbird in ride between 35 and 36, in deer dung in ride through 36; 22.10.74, in fungus, 40A.

Zyras (Pella) humeralis (Gr.) P.F.T., 4/74, 45B, 5/74, 33, 40A and B, 42B, 43A, 7/74, 33, 43A, 45B.

Lomechusa emarginata (Pk.) P.F.T., 7/74, 50A.

Chiloporata longicornis (Er.) 29.6.72, swept in centre and other rides.

Ocalea picata (Steph.) 7.8.74, in oak litter, 44C (P.T.H.); P.F.T., 3/74, 35, 45B, 7/74, 36A, 45B; 30.9.74, flood refuse in dry stream bed, 43C.

O. badia Er. 31.10.73, in fungus, 43C; P.F.T., 7/74., 35, 43A, 45B.

Oxypoda (s.str.) lividipennis Man. P.F.T., 3/74, 36A, 40B, 45B, 5/74, all except 33 and 50A.

O. (s.str.) opaca (Gr.) P.F.T., 3/74, 40A.

O. (s.str.) vittata Maerk. P.F.T., 7/74, 35; 25.10.74, under deer dung, 44C (J.N.G-D.).

O. (Podoxya) brevicornis (Steph.) 13.7.72, in flood refuse in dry stream bed, 39, in dead blackbird in ride between 35 and 36; P.F.T., 4/74, 43A, 5/74, 42B; 30.9.74, flood refuse in dry stream bed, 43C.

O. (Mycetodrepa) alternans (Gr.) in fungi, 3.9.72, 35; 15.11.72, 38 and 40; 31.10.73, 32 and 40A.

O. (Bessopora) amoena Fairm. & Lab. P.F.T., 4/74, 40B.

O.(Sedomoma) annularis (Man.) P.F.T., 5/74, 40A, 45B; 30.9.74, flood refuse in dry stream bed, 43C.

O. (Sedomoma) brachyptera (Steph.) P.F.T., 5/74, 42B.

Thyasophila angulata (Er.) 28.9.67, in Formica rufa nest, 40A.

Tinotus morion Gr. 11.3.74, litter, 40A.

Aleochara (s.str.) bipustulata (L.) 23.7.74, in dog dung, 45A; P.F.T., 5/74, 50A.

A. (Copiata) curtula (Goez.) 3.9.72, in dead rabbit in ride between 37 and 38.

A. (Baryodma) intricata Man. 23.7.74, in dog dung, 45A.

A. (Ceranota) ruficornis Gr. 19.7.36 (S.O.T.).

PSELAPHIDAE

Euplectus piceus Mots. P.F.T., 7/74, 40B.

Bryaxis puncticollis (Denny) 30.5.74, litter, 36A.

LUCANIDAE

Dorcus parallelopipedus L. in rotting logs (D.T.).

GEOTRUPIDAE

Geotrupes stercorarius (L.) 22.10.74, under horse dung, 40A.

G. spiniger Marsh. 2.11.73, crawling on ground, 48 (S.E.W.).

SCARABAEIDAE

Onthophagus ovatus (L.) recorded by (D.T.).

Odontaeus armiger (Scop.) 27.6.64, 3 at M/V light (D.T.).

Homaloplia ruricola (F.) on grassy verges outside wood, sometimes abundant (D.T.).

DASCILLIDAE

Dascillus cervinus (L.) on verges of wood (D.T.).

BYRRHIDAE

Simplocaria semistriata (F.) 11.3.74, litter, 40B.

BUPRESTIDAE

Agrilus laticornis (Ill.) 5.6.74, sweeping edge of 50B.

Trachys minuta L. beating hazels (D.T.), 4 and 19.7.36 (S.O.T.).

T. troglodytes Schoen. 4.7.36 (S.O.T.).

ELATERIDAE

Elater pomonae Steph. several in old log (D.T.).

E. elongatulus F. several beaten off birch May 1935 (D.T.).

Athous haemorrhoidalis (F.) 29.6.72; 30.6.74, fairly common, beating hawthorn, 44B (J.W.T.); 5.6.74, on hawthorn, 44B; 11.3.74, larva in litter, 40B.

A. hirtus (Hbst.) 30.6.74, occasional, in log, 41B (J.W.T.).

A. bicolor (Goez.) 19.6.56, in old log, 39A (J.W.T.).

A. vittatus (F.) On oaks (D.T.); 30.6.74, occasional, beating hawthorn, 44B (J.W.T.); 15.5.74, sweeping between 17B and 37C.

Corymbites incanus (Gyll.) 5.6.74, sweeping, 44B.

Prosternon tessellatum (L.) 30.5.37 (S.O.T.).

Agriotes pallidulus Ill. 29.6.72; 5.6.74, sweeping edge of 50B; P.F.T., 5/74, 40A and B.

A. sputator (L.) 30.5.74, litter, 45B.

A. acuminatus (Steph.) 29.6.72; 13.7.72 sweeping ride between 37 and 38; 29.5.74, hawthorn blossom, 42B; 5.6.74, sweeping edge of 50B; P.F.T., 5/74, 40B.

Adrastus nitidulus (Marsh.) 12.5.74, 34 (H.E.H.).

Denticollis linearis (L.) 29.6.72, sweeping centre and other rides.

Dalopius marginatus (L.) 13.7.72, sweeping ride through 36; 12.5.74, 34, (H.E.H.); 16.4.74, litter, 33.

TRIXAGIDAE

Trixagus dermestoides (L.) 16.4.74, litter, 42B; P.F.T., 5/74, 45B, 7/74, 50A.

EUCNEMIDAE

Melasis buprestoides L. 12.5.74, 37B (H.E.H.).

LAMPYRIDAE

Lampyrus noctiluca (L.) 22.10.74, larva under asbestos sheet, 45D.

CANTHARIDAE

Cantharis rustica Fall. 5.6.74, sweeping edge of 50B.

C. nigricans (Muell.) 29.5.74, sweeping grass, 34.

C. pellucida F. 5.6.74, sweeping, 44B.

Metacantharis clypeata (Ill.) 5.6.74, sweeping, 44B.

Rhagonycha fulva (Scop.) 13.7.72, sweeping ride between 37 and 38; 5.6.74, on oak, 44B.

R. translucida Kryn. 29.6.72, sweeping centre and other rides.

R. limbata Th. 7.5.74, pupa under rotten stump, 17B; 5.6.74, sweeping, 44B and edge of 50B, on hawthorn, 44B.

R. lignosa (Muell.) 29.6.72; 5.6.74, sweeping edge of 50B and hawthorn, 44B.

Malthinus flaveolus (Pk.) 13.7.72, sweeping ride through 36; P.F.T., 7/74, 45B.

M. fasciatus (Ol.) 29.6.72; 13.7.72, sweeping ride through 36.

M. balteatus Suff. 13.7.72, sweeping ride between 37 and 38.

Malthodes marginatus (Lat.) 13.7.72, sweeping ride between 37 and 38.

M. minimus (L.) 29.6.72; 13.7.72, sweeping ride between 37 and 38 in through 37; 5.6.74, sweeping edge of 50B; P.F.T., 7/74, 40A, 42B.

M. pumilus (Bréb.) 29.6.72; 13.7.72, sweeping ride between 37 and 38 and rides through 37 and 39.

ANOBIIDAE

Grynobius excavatus (Kug.) 30.5.37 (S.O.T.).

CLERIDAE

Necrobia violacea (L.) 30.6.74, 38B (H.E.H.).

PHLOIOPHILIDAE

Phloiophilus edwardsi Steph. 30.5.74, litter, 43A.

NITIDULIDAE

Kateretes pedicularis (L.) 30.7.39 (S.O.T.).

Brachypterus glaber Steph. 13.7.72, sweeping ride between 37 and 38; 5.6.74, on hawthorn, 44B.

B. urticae (F.) 15.4.74, sweeping ride between 35 and 37.

Meligethes atratus (Ol.) 15.5.74, on hawthorn blossom, 41B.

M. flavimanus Steph. 3.9.72, sweeping ride between 37 and 38.

M. lumbaris Sturm 29.5.74, hawthorn blossom, 42B.

M. aeneus (F.) sweeping rides, 13.7.72, between 37 and 38; 3.9.72 between 32 and 36; 15.5.74, on hawthorn blossom, beating field maple, 36A; 29.5.74, hawthorn, 42B; 5.6.74, hawthorn, 44B.

M. ovatus Sturm 29.6.72; sweeping centre and other rides.

M. brunnicornis Sturm 5.6.74, sweeping edge of 50B.

M. nigrescens Steph. 13.7.72, sweeping ride through 36 and between 37 and 38; 15.5.74, on hawthorn blossom, 41B; 5.6.74, hawthorn, 44B.

<u>M. erythropus</u> (Gyll.) 29.5.74, hawthorn blossom, 42B.

<u>Epuraea unicolor</u> (Ol.) 11.3.74, litter, 40B; P.F.T., 3/74, 36A.

<u>E. pusilla</u> (Ill.) 3.9.72, in fungus, 39.

<u>Librodor hortensis</u> (Fourc.) 3.9.72, in fungus, 39; 15.5.74, on the wing in ride between 34 and 40B.

RHIZOPHAGIDAE

<u>Rhizophagus bipustulatus</u> (F.) P.F.T., 3/74, 35.

<u>R. perforatus</u> Er. P.F.T., 4/74, 40A.

<u>R. dispar</u> (Pk.) 3.9.72, under bark of pine log, 43; P.F.T., 3/74, 40B.

<u>R. cribratus</u> Gyll. 12.7.45 (S.O.T.).

<u>Montoma conicicollis</u> Aubé 28.9.67, in <u>Formica rufa</u> nest, 40A.

PHALICRIDAE

<u>Stilbus testaceus</u> (Pz.) 29.6.72; 13.7.72, sweeping ride between 37 and 38, and through 38; 5.6.74, sweeping edge of 50B; 22.10.74, in fungus, 40A; 30.9.74, flood refuse in dry stream bed, 43C; P.F.T., 4/74, 35.

SILVANIDAE

<u>Silvanus unidentatus</u> (Ol.) 4.7.36 (S.O.T.).

CRYPTOPHAGIDAE

<u>Cryptophagus setulosus</u> Sturm 3.9.72, in fungus, 39.

<u>Atomaria atricapilla</u> Steph. 29.6.72; 13.7.72, sweeping ride through 36 and 37 and between 37 and 38; 15.5.74, sweeping ride between 17B and 37C; 11.3.74, litter, 33.

<u>A. apicalis</u> Er. 13.7.72, sweeping 37; 15.5.74, on <u>Salix</u>, 45B.

<u>A. ruficornis</u> Marsh. 29.6.72; 13.7.72, in flood refuse in dry stream bed, 39.

<u>A. linearis</u> Steph. 13.7.72, sweeping ride between 37 and 38 and through 38.

<u>A. affinis</u> Sahlb. P.F.T., 3/74, 40B.

<u>A. fuscicollis</u> Man. 29.6.72; 13.7.72, sweeping rides through 36 and 37 and in flood refuse in dry stream bed, 39.

EROTYLIDAE

<u>Dacne bipustulata</u> (Thunb.) 30.4.72 (H.E.H.).

BYTURIDAE

<u>Byturus ochraceus</u> Scriba 15.5.74, on hawthorn blossom, 41B; 29.5.74, hawthorn, 42B; 5.6.74, hawthorn, 44B.

<u>B. urbanus</u> (Lind.) 29.6.72; sweeping centre and other rides.

ENDOMYCHIDAE

<u>Sphaerosoma piliferum</u> (Muell.) 13.7.72, in <u>Trametes</u> on old hazel stool, 37C.

<u>Endomychus coccineus</u> (L.) 30.4.72, 38B (H.E.H.).

COCCINELLIDAE

Micraspis sexdecimpunctata (L.) 15.5.74, on grass, 43C; 5.6.74, sweeping, 44B.

Adalia bipunctata (L.) 29.6.72; sweeping centre and other rides.

A. decempunctata (L.) 11.3.74, litter, 35 and 36A.

Coccinella septempunctata L. 29.6.72; sweeping centre and other rides.

C. undecimpunctata (L.) P.F.T., 7/74, 50A.

Calvia quattuordecimguttata (L.) 29.6.72, sweeping centre and other rides.

Halyzia sexdecimguttata (L.) 29.5.74, sweeping rides.

Propylea quatuordecimpunctata (L.) 29.6.72; 16.4.74, litter, 40B.

Chilocorus bipustulatus (L.) 30.7.39 (S.O.T.).

LATHRIDIIDAE

Stethostethus lardarius (Deg.) 29.6.72; 13.7.72, sweeping ride through 36; 7.5.74, in mole run under log, 37C; 15.5.74, on Salix, 45B; 30.9.74, flood refuse in dry stream bed, 43C.

Aridius nodifer (Westw.) 13.7.72, in Trametes, 37C; 3.9.72, in fungi, 35 and 39; 7.5.74, in fungi, 35; 30.5.74, litter, 40A; P.F.T., 7/74, 42B.

A. bifasciatus (Reitt.) 29.6.72; 13.7.72, sweeping ride between 37 and 38; 3.9.72, in fungus, 39; 7.5.74, under rotten log, 37C; 15.5.74, on hawthorn blossom, 41B, young birch seedlings, 45B; 5.6.74, hawthorn, 44B, and sweeping edge of 50B; 30.5.74, litter, 40A.

Enicmus transversus (Ol.) 29.6.72; 13.7.72, sweeping ride between 37 and 38, in Trametes, 37C; 3.9.72, in fungus, 35; 16.4 and 30.5.74, litter, 42B and 45B; P.F.T., 4/74, 42B, 5/74, 40B.

E. histrio Joy P.F.T., 7/74, 35, 42B.

Corticaria pubescens (Gyll.) 13.7.72, sweeping ride between 37 and 38 and through 38; P.F.T., 4/74, 50A.

Corticarina gibbosa (Hbst.) 29.6.72; 3.9.72, in fungus, 39; 15.5.74, sweeping ride between 35 and 37C, on hawthorn blossom, 41B, on Salix, 45B; 29.5.74, hawthorn, 42B; 5.6.74, sweeping edge of 50B; 16.4 and 30.5.74, litter, 33 and 45B; P.F.T., 3/74, 35, 40B, 4/74, 35, 5/74, 50A.

CISIDAE

Cis boleti (Scop.) 13.7.72, adults and pupae in Trametes, 37C.

Octotemnus glabriculus (Gyll.) 13.7.72, in Trametes, 37C, 2 swept from ride through 36.

COLYDIIDAE

Ditoma crenata (F.) under bark of logs (D.T.).

MYCETOPHAGIDAE

Mycetophagus quadripustulatus (L.) 30.4.72, 38B (H.E.H.).

M. atomarius (F.) 29.6.72; sweeping centre and other rides.

TENEBRIONIDAE

Hypophloeus bicolor (Ol.) 22.10.74, under bark of elm log, 48B.

LAGRIIDAE

Lagria hirta (L.) by sweeping (D.T.); 30.6.74, fairly common, beating hawthorn blossom, 41B (J.W.T.).

ALLECULIDAE

Isomira murina (L.) 29.6.72; sweeping centre and other rides.

Cteniopus sulphureus (L.) by sweeping on damp, reedy ground (D.T.).

SALPINGIDAE

Lissodema quadripustulatum (Marsh.) on old hazels (D.T.).

Salpingus reyi (Abeille) on old hazels (D.T.).

PYROCHROIDAE

Pyrochroa serraticornis (Scop.) 19.5.71 (H.E.H.); 13.7.72, larvae under bark of dead standing elm, 38A.

OEDEMERIDAE

Oedemera lurida (Marsh.) 4.7.36, 17.7.37 (S.O.T.).

MELOIDAE

Meloe violaceus Marsh. 30.5.37 (S.O.T.).

MELANDRYIDAE

Orchesia minor Walk. on old hazels (D.T.).

O. undulata Kr. under park of oak logs (D.T.).

Conopalpus testaceus (Ol.) 4.7.36 (S.O.T.).

Osphya bipunctata (F.) abundant on oaks in May and June 1935 (D.T.).

SCRAPTIIDAE

Anaspis rufilabris Gyll. 29.6.72; 13.7.72, beating oak, 39; 29.5.74, hawthorn, 42B; 5.6.74, hawthorn, 44B.

A. frontalis (L.) 29.6.72, on umbel flowers; 13.7.72, sweeping ride between 37 and 38; 29.5.74, hawthorn, 42B; 5.6.74, hawthorn, 44B.

A. regimbarti Schil. 5.6.74, beating hawthorn, 44B.

A. maculatus Geoff. in Fourc. 13.7.72, sweeping ride between 37 and 38, in fungi, 35C; 15.5.74, on hawthorn blossom, 41B; 29.5.74, hawthorn, 42B; 5.6.74, hawthorn, 44B.

MORDELLIDAE

Mordella villosa (Schr.) on flowers (D.T.); 12.7.45 (S.O.T.).

Mordellistina pumilla (Gyll.) on flowers (D.T.).

M. abdominalis (F.) on flowers (D.T.).

M. humeralis (L.) on flowers (D.T.).

CERAMBYCIDAE

Rhagium mordax (Deg.) 1950's, near Centre oak (H.E.H.); 3.9.72, larva under bark of fallen lime, 36.

R. inquisitor (L.) 30.5.37, "in numbers" (S.O.T.).

Grammoptera ruficornis (F.) 13.7.72, sweeping ride between 37 and 38 and through 38; on hawthorn blossom, 15.5.74, 41B; 29.5.74, 42B; 5.6.74, 44B.

Strangalia maculata (Poda) 13.7.72, on Filipendula in ride between 37 and 38.

S. melanaria (L.) 4.7.36 (S.O.T.); 5.6.74, sweeping edge of 50B.

Clytus arietus (L.) 30.6.74, occasional, beating hawthorn blossom, 44B (J.W.T.).

Anaglyptus mysticus (L.) 30.6.74, occasional, beating hawthorn blossom, 44B (J.W.T.).

Pogonocherus hispidus (L.) 30.4.72 (H.E.H.).

Agapanthia villosoviridescens (Deg.) generally common on Hogweed in June (D.T.); 4.7.36 and 4.8.40 (S.O.T.).

Saperda populnea (L.) on aspens (D.T.); 4.7.36 (S.O.T.).

BRUCHIDAE

Bruchus loti Pk. 4.7.36 and 30.5.37 (S.O.T.).

CHRYSOMELIDAE

Zeugophora subspinosa (F.) 4.7.36 (S.O.T.).

Lema cyanella (L.) roadside verges (D.T.).

L. melanopa (L.) 13.7.72, sweeping ride between 37 and 38.

Cryptocephalus coryli (L.) a few off hawthorn (D.T.).

C. moraei (L.) 4.7.36 and 17.7.37 (S.O.T.); 3.7.66 (H.E.H.).

C. fulvus Goez. 19.7.36 (S.O.T.).

C. pusillus F. 20.8.37 (S.O.T.).

Chrysolina sanguinolenta (L.) September 1957, on Toadflax outside wood (D.T.).

C. hyperici (Forst.) 4.7.36, 17.7.37 and 30.7.39 (S.O.T.).

C. varians (Schal.) 13.9.36 (S.O.T.); 23.7.74, larvae on Hypericum perforatum along North Gate Ride opposite 35.

Phaedon cochleariae (F.) 15.5.74, beating field maple, 36A.

Phyllodecta vulgatissima (L.) 30.6.74, very common, beating aspen, 41B (J.W.T.).

P. laticollis Suff. 21.5.37 (S.O.T.).

Phyllotreta vittula Redt. 3.9.72, sweeping ride between 32 and 36.

P. cruciferae (Goez.) 4.7.36 (S.O.T.).

Longitarsus pratensis (Pz.) P.F.T., 4/74, 50A.

L. gracilis Kuts. P.F.T., 7/74, 50A.

L. dorsalis (F.) P.F.T., 4/74, 50A.

L. luridus (Scop.) P.F.T., 4/74, 35.

L. melanocephalus (Deg.) 11.3.74, litter, 36A.

Haltica brevicollis Foud. 5.6.74, beaten from hawthorn, 44B.

Hermaeophagus mercurialis (F.) 4.7 and 13.9.36 (S.O.T.); 29.5.67, 32C and 12.5.74, 34 (H.E.H.); 30.4.72 (W.E.R.); 29.6. and 13.7.72, on Mercurialis perennis in rides between 35 and 37, 37 and 38, and in 39.

Batophila rubi (Pk.) 29.6.72; P.F.T., 3/74, 36A, 4/74, 35, 40A, 43A, 5/74, 36A.

Chalcoides aurea (Geoff. in Fourc.) on Salix, 15.5.74, 45B; 5.6.74, 44B.

C. aurata (Marsh.) 15.5.74, on Salix, 45B.

C. nitidula (L.) 19.7.36 (S.O.T.).

Epitrix atropae Foud. on Belladonna (D.T.).

Chaetocnema concinna (Marsh.) 13.7.72, sweeping ride between 37 and 38; 15.5.74, sweeping ride between 35 and 37C.

C. sahlbergii (Gyll.) 13.9.36 (S.O.T.).

Sphaeroderma testaceum (F.) 13.7.72, sweeping ride between 37 and 38.

Psylliodes dulcamarae (Koch, J.D.W.) 12.7.45 (S.O.T.).

Cassida flaveola Thunb. 13.7.72, sweeping ride through 38; 5.6.74; sweeping edge of 50B.

C. vibex L. 16.4.74, cut grass, 37B.

C. rubiginosa Muell. 15.5.74, on young birch seedlings, 45B.

C. nobilis L. borders of wood, by sweeping (D.T.).

ANTHRIBIDAE

Platystomos albinus (L.) a few by beating old hazel and birch (D.T.).

ATTELABIDAE

Caenorhinus aeneovirens (Marsh.) 30.4.72 (H.E.H.).

C. germanicus (Hbst.) 13.7.72, sweeping ride between 37 and 38; 5.6.74, sweeping edge of 50B.

C. interpunctatus (Steph.) 12.6.37 (S.O.T.); 30.4.72 (H.E.H.).

Deporaus betulae (L.) 12.5.74, 47A (H.E.H.).

APIONIDAE

Apion radiolus Kirby 4.8.40 (S.O.T.).

A. loti Kirby 5.6.74, sweeping edge of 50B; P.F.T., 7/74, 50A.

A. aethiops Hbst. 5.6.74, sweeping edge of 50B.

A. minimum Hbst. P.F.T., 5/74, 50A.

A. simile Kirby 30.7.39 (S.O.T.); 29.6.72; sweeping centre and other rides.

A. subulatum Kirby 4.7.36 (S.O.T.).

A. dichroum Bedel 10.3.68 (H.E.H.); 29.6.72; 13.7.72; sweeping ride between 37 and 38; 15.5.74, sweeping ride between 17B and 37C; 5.6.74, sweeping edge of 50B.

A. nigritarse Kirby 10.3.68 (H.E.H.); P.F.T., 5/74, 50A.

CURCULIONIDAE

Otiorrhynchus singularis (L.) 11.3.74, litter, 40A.

Phyllobius parvulus (Ol.) 13.7.72, sweeping ride between 37 and 38; 30.6.74, 38B (H.E.H.).

P. pyri (L.) 15.5.74, on young birch seedlings, 45B; 5.6.74, oak, 44B; 5.6.74, sweeping edge of 50B.

P. maculicornis Germ. P.F.T., 7/74, 50A.

P. argentatus (L.) 5.6.74, oak, 44B, and sweeping edge of 50B; 30.5.74, litter, 35.

Polydrosus pterygomalis Boh. 13.7.72, sweeping ride through 36; 30.5.74, litter, 35; P.F.T., 5/74, 36A.

P. cervinus (L.) 29.6.72; 13.7.72, on oak, 39; 15.5.74, on young birch seedlings, 45B.

Sciaphilus asperatus (Bons.) 13.7.72, sweeping ride through 36 and between 37 and 38; 12.5.74, 38B (H.E.H.); P.F.T., 3/74, 43A, 5/74, 40B.

Barypithes araneiformis (Schr.) 15.5.74, in dry straw, 17B; 16.4 and 30.5.74, litter, 35, 43A and 45B; P.F.T., 3/74, 35, 36A, 4/74, 36A, 43A, 5/74, 33, 35, 40B, 42B, 7/74, all except 40A and B, 43A and 50A.

Barynotus moerens (F.) 5.5.68 (W.E.R.); 12.5.74, 38B (H.E.H.); P.F.T., 5/74, 40A, 7/74, 33.

Sitona lineatus (L.) 29.6.72; 5.6.74, sweeping edge of 50B; 11.3.74, litter, 33 and 35; P.F.T., 4/74, 35, 5/74, 50A.

S. sulcifrons Thunb. P.F.T., 4/74, 50A.

S. lineellus Bonsd. 13.7.72, sweeping rides through 36 and between 37 and 38.

S. hispidulus (F.) P.F.T., 4/74, 50A.

S. humeralis Steph. P.F.T., 5 and 7/74, 50A.

Dorytomus taeniatus (F.) 30.6.74, 47A (H.E.H.).

Miccotrogus picirostris (F.) 13.7.72, sweeping ride through 36.

Anthonomus inversus Bedel 30.6.74, 38B (H.E.H.).

Curculio (s.str.) villosus F. 30.4.72 (H.E.H.).

C. (Balanobius) rubidus (Gyll.) on birch (D.T.).

C. (Balanobius) pyrrhoceras Marsh. 30.4.72 (H.E.H.); sweeping rides, 13.7.72, between 37 and 38; 3.9.72, between 39 and 42; 15.5.74, between 35 and 37C; 29.5.74, hawthorn, 42B; 5.6.74, sweeping edge of 50B.

C. (Balanobius) salicivorus Pk. 5.6.74, on Salix, 44B.

Liosoma deflexum (Pz.) 13.7.72, sweeping ride through 38; 30.5.74, litter, 45B; P.F.T., 5/74, 42B and 50A.

Phytonomus nigrirostris (F.) P.F.T., 4/74, 50A.

P. posticus (Gyll.) P.F.T., 5/74, 50A.

Gronops lunatus (F.) P.F.T., 4/74, 50A.

Acalles roboris (Curt.) 30.5.74, litter, 45B.

A. ptinoides Marsh. P.F.T., 4/74, 42B.

A. turbatus Boh. 30.6.74, 38B (H.E.H.).

Coeliodes dryados (L.) 12.5.74, 47A (H.E.H.).

Cidnorhinus quadrimaculatus (L.) 12.5.74, 34 (H.E.H.).

Ceuthorhynchus assimilis (Pk.) 15.5.74, sweeping ride between 35 and 37C.

C. quadridens (Pz.) P.F.T., 5/74, 40B.

C. pollinarius (Forst.) 12.5.74, 34 (H.E.H.).

C. erysimi (F.) 13.7.72, sweeping ride between 37 and 38.

C. contractus (Marsh.) 13.7.72, sweeping ride through 38 and between 37 and 38.

Rhinoncus perpendicularis (Reich.) 12.5.74, 34 (H.E.H.).

Amalorrhynchus melanarius (Steph.) 30.7.39 (S.O.T.).

Gymnetron pascuorum (Gyll.) 5.6.74, sweeping edge of 50B.

Miarus graminis (Gyll.) 12.7.45 (S.O.T.).

M. plantarum (Germ.) 4.8.40 (S.O.T.).

M. campanulae (L.) 13.9.36 and 17.7.37 (S.O.T.).

Cionus scrophulariae (L.) 12.5.74, 34 (H.E.H.).

C. hortulanus (Geoff.) 12.5.74, 34 (H.E.H.).

Cleopus pulchellus (Hbst.) 30.4.72, 34 (H.E.H.).

Anoplus plantaris Naez. 13.7.72, on birch, 37.

Rhynchaenus quercus (L.) 30.4.72 (H.E.H.).

R. pilosus (F.) 30.4.72 (H.E.H.).

R. pratensis Germ. by sweeping (D.T.).

SCOLYTIDAE

Scolytus scolytus (F.) 19.5.71, near centre oak (H.E.H.); 22.10.74, dead in bark of elm log, 48B.

S. multistriatus (Marsh.) under bark of dead elm, 13.7.72, 38A; 16.4.74, 43C; 22.10.74, dead in bark of elm log, 48B.

Hylurgops palliatus (Gyll.) 3.9.72, common under bark of pine logs, 43; P.F.T., 3/74, in numbers, 40A and B, 4/74, 40B.

Hylastes ater (Pk.) P.F.T., 3/74, 40B.

Trypodendron domesticum L. 27.3.67 (H.E.H.).

Xyleborus dryographus (Ratz.) 13.7.72, dead in bark of dead elm, 38A.

ADDENDA TO COLEOPTERA RECORDED FROM BEDFORD PURLIEUS

During a brief visit to Bedford Purlieus on 1st September 1975 with Dr. R.A. Crowson a number of previously unrecorded species of Coleoptera were collected. Those species marked with an asterisk (taken by R.C. Welch) were all sieved from a pile of pine bark chippings in Compt. 40B, adjacent to Main Ride, unless stated otherwise. Dr. Crowson's list also includes some older records for 11th April 1959. Most of his recent captures were from Compts. 40 and 43 under bark of fallen and cut timber, by sieving litter and in a dead pigeon. Two species of Chrysomelidae recorded pre-war have been confirmed. Cryptocephalus pusillus F. (recorded by the Taylors on 20.8.37) was sieved from the pine chippings, and Dr. Crowson notes Chalcoides nitidula L. (recorded by the Taylors on 19.7.36) as near its northern British limit at this site.

The following 34 species are additional to the preceeding list, and bring the total species known from the wood to 507:-

CARABIDAE

* Trechus quadristriatus (Shr.)
* Bembidion (Nepha) genei Kuest. s.sp. illigeri Netol.
  B. (Bembidionetolitzkya) tibiale Duft.

DYTISCIDAE

* Agabus guttatus Pk. 1 under piece of wood in dry stream bed, Compt. 39D.

PTILIIDAE

* Acrotrichis rugulosa Rossk. 1♀
* A. silvatica Rossk. 1♂ 3♀♀ (see C. Johnson, Entomologist, 100 : 132-136, 1967).
  Ptinella aptera (Er.)

SILPHIDAE

* Catops kirbii (Spence) 1♂ in dead pigeon, Compt. 40B.

STAPHYLINIDAE

  Lathrobium (s.str.) geminum Kr.
  Xantholinus (Hyponygrus) fracticornis (Muell.)
  Philonthus (s.str.) tenuicornis Muls. & Rey
  P. (Bisnius) varius (Gyll.)
  P. (Bisnius) fimetarius (Gr.)
  P. (Bisnius) cephalotes (Gr.)
* Quedius (Microsaurus) cruentus (Ol.) 1♂
* Lordithon trinotatus (Er.) 2
* Sepedophilus littoreus (L.) 3♂♂ 1♀

* <u>Tachinus (s.str.) laticollis</u> Gr. 1♀

<u>T. (s.str.) marginellus</u> (F.)

<u>Atheta (Dinaraea) aequata</u> (Er.)

<u>A. (Dinaraea) linearis</u> (Gr.)

PSELAPHIDAE

<u>Bibloporus bicolor</u> (Denny)

ANOBIIDAE

<u>Ptilinus pectinicornis</u> (L.)

NITIDULIDAE

<u>Cychramus luteus</u> (F.)

LATHRIDIIDAE

<u>Enicmus testaceus</u> (Steph.)

CISIDAE

<u>Cis nitidus</u> (F.)

<u>C. vestitus</u> Mellie

<u>C. bilamellatus</u> Fowl.

CHRYSOMELIDAE

<u>Chaetocnema hortensis</u> (Geof.)

APIONIDAE

<u>Apion immune</u> Kirby

CURCULIONIDAE

<u>Brachysomus echinatus</u> (Bons.)

<u>Sitona striatellus</u> Gyll.

<u>Anthonomus rubi</u> (Hbst.)

<u>Ceuthorrhynchus floralis</u> (Pk.)

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In addition to the collectors listed elsewhere, who generously permitted me to include their records, I would like to express my gratitude to Mrs. S.A. Bell, R.A. Plant and J.N. Greatorex-Davies who assisted in field work particularly in connection with the mapping of the distribution of the Formica rufa nests; P.C. Tinning, M.J.L. Skelton and P.T. Harding for Orthoptera and various other insect records; P.E. Jones for identifying the Pseudoscorpions; Mrs. P. Rixon for making records by members of the Northants Naturalist's Trust available to me and to Mrs. S.E. Wells for identifying fungi.

MANAGEMENT

Contributions on management were made by representatives of the Forestry Commission and the Nature Conservancy Council. Both gave a personal opinion which does not necessarily represent the official views of their respective organisations. They are complementary, for one represents the views of a forester with due regard to ecological aspects, and the other summarises the views of a number of ecologists who recognise the need for, and acceptability of, productive forestry on this site.

The first paper has been prepared by Mr. M.J. Penistan, formerly Conservator of Forests for the Forestry Commission's East England Conservancy. It was specially prepared for the meeting, presenting a Forester's point of view with due appreciation of the ecological value of Bedford Purlieus as a woodland area exceptional for its biological richness.

Bedford Purlieus belongs to the Forestry Commission and the production of timber from it has been the first objective, but with the conservation of wildlife, plants and animals, as an important secondary objective.

Mr. Penistan hoped that, following this meeting, when more details of the site would be made available, the Plan could be adopted formally by the Forestry Commission, accepted by the Nature Conservancy Council, and then put into practice.

The Plan has three parts: A, the basic facts; B, a summary of objectives and C, prescriptions. It was originally written following three days survey during the spring and summer of 1974 while Mr. Penistan was serving with the Forestry Commission. There is little reference in the Plan to detailed biological survey, though Mr. Penistan was accorded a sight of historical and biological data which was being assembled for the meeting. He acknowledges his debt to Dr. Peterken for this, and for the general encouragement.

The second paper, prepared by G.F. Peterken, reviews various aspects of management from the ecologists point of view, drawing on the preceding papers and discussion at the meeting.

Neither paper purports to be the final answer to management of Bedford Purlieus. This is the responsibility of the Forestry Commission, in consultation with other organisations and individuals, taking into account the facts and opinions presented at the meeting.

A MANAGEMENT PLAN

M.J. Penistan

This plan follows the format and style of a Gloucestershire Trust for Nature Conservation Management Plan. Some of the facts mentioned have been described in other contributions, but they are repeated here so that the Plan remains complete. It applies only to the land managed by the Forestry Commission.

A. Basic Facts

1. Location — County (New) Cambridgeshire
   Parish - Thornhaugh
   NG Reference 1:50,000 Sheet 141 Ref 040995
   Sheets 1:10,560 TF 00 SW 00 SE
   TL 09 NW 09 NE

2. Area — 513.631 acres = 207.6 ha

3. Purchased by the Forestry Commission in March 1933, subject to timber reservation for 8 years and sporting for 2 years.

   Between 1940 and 1946 approximately 150 acres (60.7 ha) were occupied by HM Forces. The western roadway and hardstandings in cpts 37, 38, 41, 45 and 50 were constructed in that period.

   In 1957 the major camp site on the southern boundary, now a chicken farm, was disposed, reducing the area from 525 to 513 acres (208 ha).

   The southern part of St John's Wood south of cpt 46, was not acquired by the Forestry Commission and is currently being quarried.

   3.1 In 1964 under emergency regulations for ironstone extraction 423 acres (171 ha), that is the whole area less most of the Bedlams, was leased to (then) Richard Thomas and Baldwins, (now the British Steel Corporation) for 35 years (to 1999) for mineral exploitation. The Corporation pay an annual occupation rent and annual compensation for loss of sporting. The two amount to £200 per annum.

   3.1.1 Between 1964 and 1966 minerals were exploited in Cocker Wood (cpts 48, 49, 50). The surface was restored in 1967-68 and the area handed back for planting in 1969/70.

   3.1.2 No further exploitation has been undertaken because of

   the inferior grade of ore obtained
   the costs of production compared with imported ores

   3.1.3 The Lessees are entitled to resume operations at any time until they surrender their interest or the lease expires. The Corporation is unwilling voluntarily to surrender its interests but is to reconsider in 1978. The option to surrender is entirely with them.

   3.1.4 In addition to the sporting held by the Corporation, sporting rights were granted to the Lessees for the Bedlams.

3.1.5 The lease allows the Forestry Commission to manage existing trees but it cannot replant any of the unexploited area without agreement with the Lessees. Extra-mural activities - recreation, etc. are subject to consultation with the Lessees.

3.2 In 1968 a reserve agreement for part of Upper Moiseys, Cromwell Sink Sale and Upper Forty Acres, cpts 37 and 38 was made with the Northamptonshire Naturalists Trust.

3.3 3.3.1 Access is good - there are public roads to the north and south, a private road to the west and rights of way on the east.

3.3.2 Fences and particularly gates have deteriorated recently and need maintenance.

3.3.3 While the Northampton Naturalists Trust have access, few other permissions have been granted formally. There is considerable informal use with the Commission's connivance for scientific survey.

There are no structures apart from deteriorating hard-standings and remains of concrete shelters on the site.

4. 4.1 Site The general high rating of the site, its geology, soils, vegetation and fauna is well known to official and non official nature conservation organisations. The area is an SSSI.

4.1.1 The ecological value of the site was made known to the Commission by Sir Edward Salisbury who visited it with the then Director of Forestry in England, Mr. O.J. Sangar, in 1954.

4.1.2 In 1961 the Nature Conservancy informed the Forestry Commission Research Branch of the high value and importance of the site and certain areas were recorded to be of special interest, supporting Ophrys apifera, Aquilegia vulgaris, Euphorbia lathyrus, Gagea lutea, Helleborus viridis, Ophrys insectifera, Lathyrus silvestris, Melica nutans and Convallaria majalis.

4.2 History

4.2.1 This is ancient woodland, though many signs of surface working for stone and ore exist, chiefly the northern and eastern part of the Purlieus, North Gate Sale, and Upper and Lower Moisey's. There is a history of formal coppice working over centuries.

4.2.2 Since the Forestry Commission's purchase almost the whole area has been cleared and planted. The main species planted has been oak and the method most used has been of strips or bands of three rows some 24 feet (c 8 metres) centre to centre alternating with natural broadleaf either cut into lanes or allowed to grow from cut over stools. The oak planting period ran from 1934/5 to 1942/3 in this sequence.

1934/35	North Gate Sale
1935/36	Upper Moisey's
1937/40	Lower Moisey's, Upper Forty Acres
1940/41	Pebblegate Sale, Cocker Wood
1942/43	Lower Forty Acres, St John's Wood

The planting was part of a grand plan for broadleaf forestry in Lowland Britain launched by Lord Robinson, the Commission's chairman, who died in 1953.

In 1941/42 the main Scots pine areas were planted in Lower Moisey's. There was a second planting of Scots pine in 1950/51.

In 1952/53 beech was planted in the birch areas of the Bedlams and in small clearances on the boundary of Upper Moisey's and Upper Forty Acres and under oak at the east margin of Lower Moisey's.

In 1953/54 much of the rest of the Bedlams was planted with alternate bands of three rows of beech and Norway spruce. The military site at the south east corner of Cocker Wood was planted with oak and Norway spruce.

In 1958/59 Western hemlock and Norway spruce was planted under the birch stands in the Bedlams and later Grand fir was added.

In 1967/68 the roadside verge on the west of the Purlieus was partially cleared and planted with Corsican pine.

Finally the open cast quarry in Cocker Wood was planted with Corsican pine in 1969/70.

4.2.3 The only stands relatively undisturbed by recent practice are the mixed broadleaf stands some 80 years old at the east corner of Upper Moisey's and where the stream leaves the wood in Lower Moisey's. The first is a very well grown stand of oak, lime, beech, chestnut and birch with some European larch. The streamside one has elm, sycamore, willow, hybrid poplar and lime. There is also a remnant at Centre Tree.

4.2.4 While the aspect of much the greatest part of the Purlieus is currently broadleaf, the 1:2500 maps (VII 5 & VII 9) of 1900, surveyed in 1884 revised in 1899, show conifer conventional signs in many areas (Fig. 10).

4.2.5 Following planting, management appears to have been intensive until the plants of whatever species were well established in competing vegetation. Subsequent cleaning appears, however, to have been sporadic and treatment has become less and less intensive. The areas of oak planting covering most of the Purlieus have become overgrown by the bands of broadleaved regrowth, or by invading birch. There are some thinned stands in North Gate Sale and Lower Forty Acres. The Scots pine plantations are marked for thinning. They have become chlorotic locally, and the younger stand is over stocked, partly blown and not impressive!

Some of the sheltering broadleaves over plantings of 1951/52 were girdled and the dead stems have been removed in the west, but not the east.

4.2.6 The lack of tending in the cleaning stage has resulted in the general presence of seminatural or pre existing broadleaves. Common lime is a feature in the northern and central parts. Ash, wych elm and birch dominate considerable areas. Gean occurs locally as does the wild service and most of the natural trees and shrubs. Sessile oak appears in North Gate Sale. There are oak coppice stools here and in St John's Wood. Sycamore and sweet chestnut and Horse chestnut locally, remain from earlier stands. There are a few Turkey oaks and laburnum.

4.2.7 The present stocking (Fig. 39) can be summarised thus:

	ac	ha
(1) Maturing broadleaf	12	5
(2) Tall pole broadleaf	149	60
(1) Birch with planted oak (27ac)		
(2) Ash, wych elm, birch (6ac)		
(3) Ash, wych elm with planted oak (26ac)		
(4) Ash, sycamore, wych elm, lime + oak (81ac)		
(5) Sycamore and ash (9ac)		
(3) Medium broadleaf poles	55	22
(1) Birch + oak (15ac)		
(2) Ash, sycamore + oak (40ac)		
(4) Small broadleaf poles	10	4
(5) Oak	119	48
(1) Tall poles (5ac)		
(2) Medium poles (54ac)		
(3) Small poles thickets (60ac)		
(6) Beech plantings	23	9
(1) In birch (16ac)		
(2) In other broadleaves (7ac)		
ALL BROADLEAVES	368	148
(7) Broadleaf - conifer plantings (all since 1953)	41	17
(1) Beech - Norway Spruce (26ac)		
(2) Birch - Western Hemlock (11ac)		
(3) Other BL - Western Hemlock (4ac)		

39. Stock Map, 1974. The numbered types are listed and described in paragraph A4.2.7.

(8) Conifers plantations	67	27
(1) Scots pine large poles (22ac) (2) Smaller poles (9ac) (3) Military Sites - Norway Spruce (8ac) (4) Western Verge (11ac) (5) Open cast, Corsican pine (17ac)		
ALL HIGH FOREST	476	193
(9) Coppice	27	11
(1) Hazel under birch and oak (13ac) (2) Oak (Sycamore) pole coppice (1ac) (3) Oak stools with standards (11ac) (4) Young sycamore and ash (2ac)		
TOTAL WOODLAND	573	204
(10) Ground not stocked	10	4
	523	208

4.2.8 During the 1960s Government policy required the Forestry Commission to give most emphasis to economic considerations and to concentrate on its most productive areas. While a case was made for the replacement of established broadleaf plantations with faster growing and much higher yielding conifers and much work was done to remove by chemical and mechanical means the broadleaf plantations in the Midlands, the stands in Bedford Purlieus were not so treated. On the other hand, probably with the possibility of mineral exploitation, no tending was done on the established stands of oak. This has led to the current situation. Some tending of the more recent plantings in the Bedlams has been done recently.

4.2.9 The aspect of almost all stands is one of considerable density. Rides have been kept open, with access for sporting the main object, but also for the control of fallow deer and rabbits and for inspection. Apart from the Bedlams and the small scattered clearings and partially planted military sites, the whole block is almost one-aged and without glades and clearings. The forever diversity of actively worked coppice has gone.

4.2.10 Policy first in terms of the Countryside Act and then congently following the Forestry Review of 1972 to 1974 has made it encumbent on management both to conserve broadleaf woodland and to give due regard to the conservation of amenity and wildlife. There is scope therefore, while managing Bedford Purlieus for the production of timber, to undertake this in terms of its environmental and scientific value.

A beginning in resumed management, in the form of thinnings and clearings including ride widening was made in 1972/73, and has continued. The Northants Trust has been consulted.

4.3 As a result of firm decision in the 1950s the coppice regime, abandoned when the estate sold out to a merchant prior to 1933, has been replaced by high forest. Most stands, however, retain the species worked as coppice or planted during the heyday of intensive management.

B. 1. Summary of Objectives

1.1 The production of timber is the first objective, done as efficiently as possible, aiming for a broadleaf forest, but influenced by

1.2 The need to conserve a site of very high conservation value in terms of the whole species assembly.

1.3 Incidental to the two first objectives to provide for continued monitoring of the environment and of the effect of forest practice on it.

1.4 Only as far as B 1.2 permits to provide public access and sport.

2. It has been said that there should be a strict precedence of conservation, timber production, game and recreation, justified by a site of such high conservation value. The normal order of objectives for the Forestry Commission where there are no legal restraints is timber production, amenity/conservation and recreation, with sport last. The objectives set out in B 1 give due weight to the site's importance and the Commission's object. The past tradition of timber production, with native species except during the past century, can be given priority, but the species grown should be the local natives over the greatest part of the area. The need to respect the site and its biological richness must always influence practice.

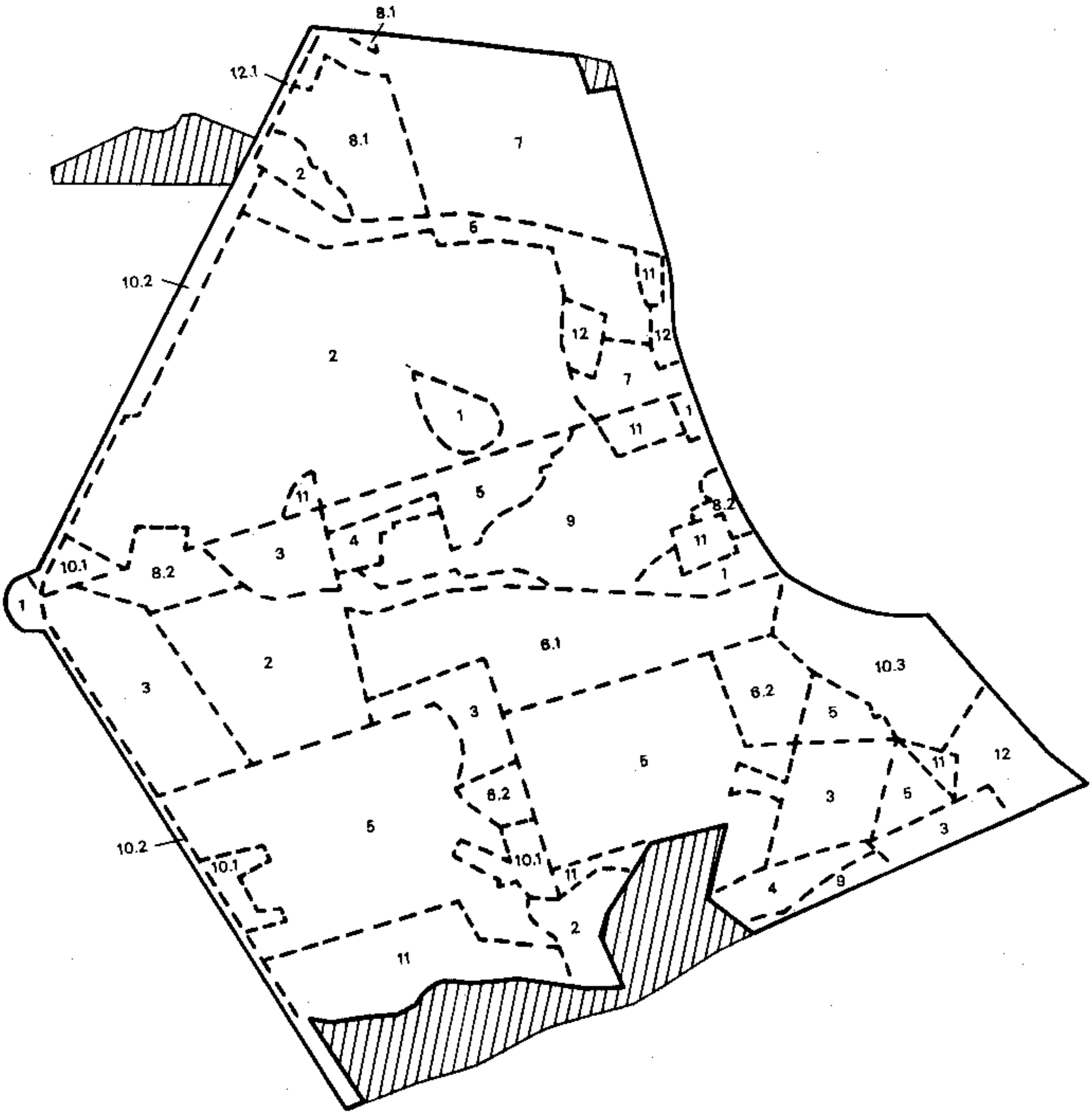
C. Prescriptions (Fig. 40)

1. Silviculture

1.1 The forester's first concern is the tending of the existing stands to ensure the health and vigour of the timber producing components for growth to useful, valuable timber. This tends to involve longer rather than shorter rotations in terms of the major planted species, oak. Birch, which plays a considerable role in the present stocking, being a short lived tree would tend to be only a small component of eventual maturing stands - though it is present in the old stand in Upper Moisey's, cpt 36c. While nearly the whole woodland was planted to oak in 1935-1943, only some 120 acres (47 ha), about 25%, remain as mainly oak woodland. Elsewhere ash, birch, wych elm and lime have competed successfully, as had the alien sycamore. The Scots pine plantations in Lower Moisey's with their rich mycology (some of it edible) occupy former mixed conifer/ broadleaf sites, suffer to some degree from chlorosis and

40. Treatment proposals, 1974.

1.	Maturing broadleaves - conserve.		
2.	Mixed broadleaves, tall poles	)	thin to best crowned
3.	" " medium poles	)	native trees; remove
4.	" " small poles	)	exotics progressively.
5.	Oak stands - thin to well spaced best crowns.		
6.1	Tall birch - fell and regenerate.		
6.2	Birch thickets - thin.		
7.	Mixed broadleaf-conifer plantations - tend towards mixed stands.		
8.1	Beech - thin.		
8.2	Beech - tend in broadleaf matrix.		
9.	Scots pine - thin.		
10.1	Open and scrub areas - keep clear.		
10.2	W. verge - keep open, or regenerate to thorn.		
10.2	Corsican pine - tend.		
11.	Coppice (also retain coppice margins to widened rides).		
12.	Open areas - maintain grassland.		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neglect but are for the most part capable of improvement. The mixed plantings in the Bedlams have enough broadleaf content to avoid complete dominance by conifer litter. The plantations on military sites are poorly stocked and show little sign of dominating the sites. There is a certain invasion of the restored mineral area planted with Corsican pine by broadleaved trees and shrubs which can be monitored. There are a few patches of coppice, of oak and sycamore chiefly in St John's Wood, which could be run on a pulpwood rotation. The area of surviving hazel, 12 acres, is small enough to be worked as a conservation project. There is no urgency to restock the small areas of bare ground.

1.2 The surviving oak plantations should be thinned vigorously to give scope for full crown development on a limited number of stems so that they can grow more quickly to timber size. They are classed according to produce, yielding pulp or turnery wood, stakewood or a mixture of the two. The process must be repeated at 8-10 year intervals up to, say, age 100 years, that is for 70 years from now.

1.3 The mixed broadleaf stands - the majority of the woodlands - are generally heavily overstocked but diverse. Crowns are small and much of the planted oak very compressed. Thinning here should be to favour predominant trees of whatever species but helping wherever possible the natural indigenous species - ash, wych elm, birch, and especially lime, sessile oak and wild service tree, at the same time removing exotics, sycamore, English elm (if not removed by disease) sweet chestnut and others.

The oldest stands can be conserved for at least fifty years, when the mature timber aspect will be more general than now. A certain amount of dead and fallen timber in specified places can be kept. In general, the recommendations of Steele (1972) should be followed.

1.4 The present clearings are small and local. There is no resemblance to the probable state of the woods when they were worked as coppice and at least 10% would be relatively open to sunlight. In fact the area is probably more closed now than at any earlier time of management. For this reason wider rides, maintained by coppicing, such as have been made recently, should be normal practice and the present areas of coppice, although usefully neglected, can be revived, producing stakes and pulpwood on say 20 year rotations.

1.5 The birch stands, 27 acres (11 ha) are drawn and at 40 years are maturing. They are being clear felled, and will regenerate naturally, partly as coppice, mostly as a seedling thicket.

1.6 Existing standards should be retained, wherever they occur, even if rough, provided they are of indigenous species.

1.7 The clearance of the military site plantings as their Christmas trees develop can be considered and the verge planting of Corsican pine would have a greater wildlife interest if kept open.

1.8 A ten year cycle of thinning will produce this annual programme:

Maturing Broadleaves	nil
Tall poles	
Birch (+ oak)	nil (27acs (11ha) being cut currently)
Mixed broadleaves	13 acs (5 ha)
Medium poles	
Birch (+ oak)	nil (15 acs (6 ha) could be cut leaving standards)
Mixed broadleaves (+ oak)	4 acs (2 ha)
Oak	6 acs (2 ha)
Small poles	
Birch (+ oak)	nil (grow on for brush wood leaving oak)
Oak	6 acs (2 ha)
Coppice	3 acs (1 ha)

The annual programme would be clear falls 4 acs (2 ha), large thinnings 13 acs (5 ha) medium thinnings 10 acs (4 ha), small thinnings 6 acs (2 ha), coppice 3 acs (1 ha). The theoretic annual coupe could be 4 to 5 acs (2 ha), in terms of a rotation of 120 years. The former annual coupe for coppice would have been about 27 acs (11 ha).

1.9 Current Forestry Commission practice is to sell broadleaf thinning standing to contractors. The self employed men work to better standards but have often other interests and are spasmodic workers. The pulpwood contractors work fast but are extremely untidy. It would seem desirable in the Purlieus to have good operators and strict control - not an impossible proposition - the sale standing policy can remain provided work is more intensively supervised.

1.10 Restocking is hardly for consideration at this stage, apart from coppice. Use of indigenous species from seed collected locally planted at wide spacing through a matrix of naturally regenerating trees and shrubs as recently prescribed in clay vale woodland is suitable to the Bedford Purlieus situation. Natural regeneration will ensure that the species mix will continue. Small coupes will be vulnerable to deer and rabbit browsing and control may be needed.

1.11 Parts of the woodland have been drained and, while woody growth is probably the best drainage agent, the existing system should be maintained particularly on ride sides.

1.12 Tending of young stands should be by edge tools. The control of sycamore or felling by chemical means can be considered. There shall be no extensive use of chemicals either as growth controllers, pesticides or to provide nutrients.

2. Biological study should be encouraged.

   2.1 There should be an annual consultation on short term management, both to safeguard special features and to review practice.

   2.2 At least every five years there should be a more formal review.

3. Every effort shall be made to end the mineral exploitation lease.

4. 4.1 With the termination of the mineral lease, the concurrent sporting rights should be kept in hand by the Commission. This would not preclude sporting under daily licence.

   4.2 While sporting continues to be let, there shall be annual consultation on practice.

   4.3 The present casual use of picnicking of the former military site in Cockshoot Wood should not be formalised. Public access should only be arranged on prescribed open days.

   4.4 Under present conditions special wardening would not appear necessary but arrangements for joint wardening by the Forestry Commission and the Nature Conservancy Council with possible help from County Trusts for Nature Conservation should be reviewed.

MANAGEMENT CONSIDERATIONS : ECOLOGIST'S VIEWPOINT

G.F. Peterken

The preceeding papers have described the present state of Bedford Purlieus, and how this state has developed. If the historical approach to woodland ecology and management has anything to offer, then it should be possible to derive some guidelines for future management from the preceding analysis.

This paper is concerned with the conservation aspects of management, the objectives of which can be stated in general terms to be:-

1. To maintain or enhance the quantity and variety of wildlife, and

2. To maintain features of scientific interest. (The term 'scientific' is somewhat inappropriate in this context, for features valuable to non-scientific disciplines are also present and worthy of consideration.)

The historical approach to woodland conservation has been summarised by Rackham (1971) and Peterken (1974). It was argued in the latter paper that the most important features to keep were those which cannot be re-created, namely (1) Primary woodland and older secondary woodland, (2) Semi-natural features in such woodland, and (3) structural features developed naturally over a long period.

The fate of the woodland on the present site of Bedford Purlieus in Roman times is unknown. A reasonable conjecture is that the local iron-smelting activity, needing a supply of fuel, obliged the Romans to retain woodland in an area of relatively dense settlement from which it would otherwise have been cleared. It is a curious co-incidence that, 2000 years later, its survival as a native, broadleaf woodland was ensured through a period of intensive coniferous reforestation by the renewed demand for iron ore.

The site as woodland

Most of the woodland could be primary, and is certainly at least one thousand years old. Such woodland cannot be replaced once destroyed. This firm case for retaining woodland of some sort would not normally be an issue in a Forestry Commission wood, but in this instance there is a possibility that the majority will be destroyed by quarrying.

Management system

The existing wildlife and features of interest have survived (or prospered) under a coppice system sustained for many centuries. Their continued survival can therefore be most reliably assured by continued coppicing.

Conversion to high forest in the present century is a substantial change, which may place the continued survival of some species and features at risk. Decline of the Black Hairstreak and Dormouse, both attributed to the abandonment of coppicing, suggests that this risk is real. Coppicing should therefore be reintroduced to the wood, at least on a small scale.

The case for some coppicing does not apply to the Bedlams. This has been a form of high forest since it originated, and is in any case of recent origin as woodland. Being recent secondary woodland, greater freedom of management action is possible without risking deleterious changes.

The Broadleaf-Conifer balance

Bedford Purlieus is traditionally a broadleaf, deciduous woodland, and the communities now present are presumably adapted to this condition. Introduction of evergreen conifers in pure stands has a substantial effect, which can be seen by comparing the ground flora below the mature Scots pine plantation and contemporary broadleaf stands nearby. Conifers may initiate podsolisation on some soils. On the other hand, the 1871 map (Fig. 10) shows that conifers have been present in substantial numbers, perhaps mixed with broadleaf species: an examination of these areas suggests that they had little direct effect, beyond perhaps reducing the coppice. Furthermore, the presence of some conifers does diversify the site to some extent.

The best recommendations appear to be:-

1. Keep a small proportion of conifers on the site indefinitely.

2. Therefore, keep those now present.

3. Future plantings of conifers should be in mixture with broadleaf species.

4. Future conifer plantings are best placed where they are already present. This confines their damaging effects to areas already damaged, and, more positively, allows communities associated with conifers to develop over a long period.

Broadleaf species

There is a reasonable presumption that most broadleaf species now present are native to the site. Some are certainly alien, but only beech and some elms cannot be placed into one or other class with confidence. Native status (and thus continuity) on the site is one of the natural features which should be preserved. This implies that:-

1. Broadleaf silviculture should be based on species native to the site.

2. Species alien to the site, but spreading naturally, should be controlled. This applies mainly to sycamore.

Genetic composition of native species

If it can be established that the genetic constitution of, for example, the oak population in a primary wood is natural, not altered by the introduction through planting of 'alien' genotypes, this would be a natural feature worthy of preservation. Such populations can, perhaps, be identified by their phenotypic heterogeneity, which contrasts with the uniformity often characteristic of planted stock.

Very little work has been done on this aspect of Bedford Purlieus, but in oak at least there is clear evidence of heterogeneity in the pre-1930's oak. However, the majority of the oak now present is certainly planted, its provenance unknown. Other native species have also been planted in the past. On balance, the history of planting and casual examination in the field suggests that local strains of native species are present, but that the present population is likely to have been much altered by introduced strains. One can therefore accept further planting of native species from sources outside the site, although it would be desirable to ensure that the local *Quercus petraea* is perpetuated, together with the small, possibly native beech population.

Distribution of broadleaf species

The distribution of broadleaf species within the wood cannot be related to either natural or management features, except in very broad terms, and in exceptional cases: this may, of course, mean only that the significant features have not been detected. Since there are distinct distributional features which may be controlled by unidentified natural factors, it can be argued that management should be designed to minimise changes in distribution. Some special features should be preserved for reasons explained under Trees and Shrubs, namely (i) Lime woodland on calcareous soils, (ii) Valley elm woodland, and (iii) the beech coppice.

Age structure

In the coppice system, mature timber is normally present as standard trees, boundary pollards and ancient coppice stools. Two boundary pollard oaks occur in the hedge by the road opposite Saint John's Wood : this is the ancient northern boundary of Sulehay Walk. Ancient coppice stools are infrequent, although there is only one large group of surviving high-cut lime stools : records of the clearance in the 19th century suggest that ancient stools were frequent then. Standard trees were a more or less constant part of the coppice system, and would normally be mainly oak, but there are records of other species as standards in the past, e.g. beech. Compared with the modal condition over the last few hundred years, it is likely that the present complement of mature trees is fewer in number, but greater in variety.

Increase in the quantity of old timber, both standing and lying would be likely to improve the fungi, epiphytic lichens and fauna. All existing mature trees should be retained, and the general maturity of the wood should be encouraged in the long term.

Field Layer Communities

These appear to be entirely natural. Their distribution within the site is related primarily to edaphic variation. They have survived through centuries of coppice management, and are thus able to survive periodic clearance of the trees and shrubs: many species including some of the rare ones, actually thrive on the kind of disturbance caused by coppicing. The field layer communities have also survived the intermittent grazing of stock and the near-continuous grazing by deer.

The long-term effects of coppicing are poorly known. One reasonable possibility is that species which grow mainly in spring will have been favoured against those which grow mainly in summer. Coppice casts a deep shade in summer, and in spring the light reaching the ground is at its annual maximum. The same may be said of broadleaf high forest canopies, but there the contrast between spring and summer is much reduced. The "vernal aspect" of woodlands may be partly the result of widespread coppicing, and conversion of coppice to high forest may eventually allow summer-growing species to spread at the expense of spring-growing (and flowering) species.

Special attention was paid during 1954 and 1955 by J.M.B. Brown and D.F. Fourt of the Forestry Commission (Alice Holt) to the measures needed for the preservation of certain herbaceous species. These were mainly Aquilegia vulgaris, Euphorbia lathyrus and Melica nutans, which were then thriving in C30, 37, 39 and 40 where recent forestry operations had disturbed and opened the canopy and (in C30) the soil. Discussions involving F.C. staff and Sir Edward Salisbury, then Director of the Royal Botanic Gardens, Kew, culminated in a meeting on 13 December 1954 at which it was decided to reserve small areas of coppice in C37 and C40. (Information from files at Alice Holt Research Station.)

Bryophytes (A.D. Horrill)

The bryophyte flora could be increased in number and quantity by:-

(a) having non-intervention areas which would not be subject to periodic desiccation caused by clear felling and coppicing

(b) leaving some timber on the ground after any felling

(c) refraining from vigorous clearance around streams and ditches.

Epiphytes (O. Gilbert)

The lichen flora is poor, and is believed to have been reduced by pollution, the paucity of mature timber, and the absence of glades. It could be increased by creating internal glades in the older part of the woodland, notably in the damp, sheltered valley area. This would stimulate the foliose lichens to colonise the larger trees. Further stimulus would result from allowing some ash, elm, oak, etc grow to very large size, especially in sheltered, well-illuminated sites.

Grassland and Rides

The grassland at North Gate is a surviving fragment of Thornhaw Particular Heath, which in this part takes the form of rich, limestone grassland. Like the coppice woodland, it owes its richness partly to its status as the surviving product of a traditional form of land use. Although it cannot be grazed in future, it should remain undisturbed. Moderate levels of traffic over the grassland would probably help to minimise the undesirable accumulation of litter.

The existing rides are a relatively recent creation. There is evidence that meadow species were deliberately introduced, and that the rides were cut for hay. More recently, the ride vegetation has been kept down by mowing to some extent. Thus, it is not unreasonable to regard the rides as a form of meadow grassland, and to maintain their open condition by mowing as late in the season as possible. The importance of retaining the rides in good condition is emphasised by the vascular flora, which owes its richness largely to the presence of grasslands.

Other grassland associated with wartime installations is remarkably rich for its recent origin. Much of the flora has probably colonised from the nearby tracks and rides, which have since been reduced in floristic value by mining, planting and withdrawal of grazing. The flora of the grassland is maintained by rabbit grazing, and this, together with the thin, immature soils, is probably what keeps the turf short in patches.

Invertebrates (R.C. Welch)

The widening of a number of the overgrown rides should provide sheltered, sunny herb-rich areas attractive to a wide range of invertebrates more especially the Lepidoptera and weak flying insects.

The wartime clearance sites vary considerably in their faunistic interest. The site in C43/47 is largely taken up with the sawbench and associated debris and can be discounted. The site in the southeast corner of C50 at present attracts a number of butterflies and should be managed as an open space but not developed into a picnic site. The present level of casual usage probably contributes towards maintaining the grassy sward. However some rotational scrub clearance will be necessary. The site in C45/46 still retains many concrete hut bases but is very overgrown. The few remaining poor specimens of early conifer plantings should be removed and the scrub controlled by periodic cutting (not all at once). Should hardcore be needed for ride improvement here is a ready source. The area of limestone grassland on the site in C45, adjacent to Saint John's Ride, is rapidly reverting to scrub and some mowing will be necessary to retain its present characteristics.

The strip to the west of Saint John's and North Gate Rides contain many plants and their associated insects which require a woodland margin habitat. Although some of these may later colonise the newly widened rides it is essential that every effort be made to conserve them. This could be tackled in one of three manners, in decreasing order of effectiveness.

1. Remove all conifers planted in this strip, and manage as grassland.

2. Clear patches where conifer establishment has been poor or patchy and keep scrub down by mowing.

3. Leave planted conifer strip as it is, do not beat up where there have been failures, and retain gaps as open grassland.

With roads on two sides, and open cast mining along much of the eastern margin the importance of this transitional zone between the hard wood edge and the arable farmland on the west side, cannot be stressed too much.

The reconstituted quarry site has developed a very interesting sandy heathland fauna which will be lost for the most part when the Corsican pines close canopy. At present a fairly wide strip remains along its western margin between the pines and the edge of C48. This should be allowed to remain as a sheltered grassy ride with a good scrubby margin against the wood, such bramble and scrub is essential as nesting sites for various warblers and in any scrub-clearance programme sufficient will need to be left every year.

The present spasmodic clearance of scattered areas of woodland for the erection of pheasant rearing pens results in the formation of small glades which provide a welcome break in the canopy. However, their siting and construction should be more rigidly controlled.

Any proposals for an increase in the area under active coppicing would be welcomed as a means of increasing habitat diversity within the wood and of providing areas with a different canopy height.

The streams through the wood should be retained, essentially in their present form. On no account should they be deepened or cleaned out although ducts under bridges could be usefully cleared of flood refuse and widened.

In such an even-aged woodland every effort should be made to retain any older trees still present and, wherever possible leave any fallen trees or branches in situ.

Soils (P. Stevens)

The uncultivated nature of the soils should be preserved and any form of ploughing or other disturbance should be avoided. The present management of opening rides and some compartments appears to have little lasting effect on the soils, although the use of heavy machinery on the heavier clay soils might cause compaction and drainage problems, which could be more permanent.

Much of the interest of some soils is in the different forms of litter, especially on the white, silty soils. Bracken, oak and to a small extent sweet chestnut have caused an accumulation of litter, which has locally developed a morlike, acid humus. Any plans to remove the bracken would remove the source of the litter and limit any tendency to podzolisation which may be taking place.

The whole of Bedford Purlieus can be considered as a valuable site for soil conservation in the sense that the soils present are now only rarely found in uncultivated form. The wood shows a wide cross-section of lowland soil types, but two of these - the typical brown earth on Glacial Sand and Gravel and the grey rendzina on calcareous tufa - are limited in extent: the small patches of these should be carefully safeguarded.

Management Records

The value of a detailed record of past management in developing management policies has been demonstrated by Bedford Purlieus. This value is probably greater when wildlife conservation is an object of management than when it is not. It follows that the records of recent and future management will eventually possess the same value, and that they should be retained and carefully archived.

ACCEPTABLE MANAGEMENT POLICIES

If the conservation value of Bedford Purlieus is to be retained, then three forms of management would be acceptable:-

1. Coppice-with-standards

2. High Forest of species native to the site

3. Non-intervention

Of these, the third can only be applied on a small scale, because this is also a productive wood in which utilisable timber will be grown. The non-intervention areas would be best located along the central valley, with small additional patches over the special soil types.

The main question is the relative level of coppice and high forest. The majority should be high forest for two reasons. The 20th century management has effectively converted most of the site to high forest, and the remaining coppice is thinly scattered. Coppice markets are uncertain, and prospects are better for timber of larger dimensions from high forest.

On the other hand, subsequent regeneration of high forest may not be possible by natural means, and the necessary planting would further reduce the semi-natural element in the tree and shrub distribution. Thus, coppice management should be adopted on a proportion of the wood, say 50-100 acres. This is best distributed where

(i) there is a good market, as for the birch already coppiced.

(ii) there is much of the original coppice remaining, as on the lime area of C32, C33, C35-37, and the elm area of C45.

(iii) it would assist other objectives, e.g. ride side coppice strips would keep rides open.

(iv) the flora is most likely to respond, as on the calcareous soils of C37 and C40, the areas which in 1954 the Forestry Commission agreed to coppice in part.

On this basis, a reasonable pattern of management emerges as one based on high forest of broadleaf species native to the site, with a small portion of conifer high forest on ground now occupied by conifers. Within this, a minority proportion is managed as coppice, both as small blocks and ride-side strips. A small area, mainly along the valley, should be left to develop without interference.

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Part of the 1635 map:-
"Discriptio hoc de Mannerio Thornhawes et Wallmesford ..."

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