OLD GRASSLAND

- ITS ARCHAEOLOGICAL AND ECOLOGICAL IMPORTANCE

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OLD GRASSLAND ITS ARCHAEOLOGICAL AND ECOLOGICAL IMPORTANCE

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Old Grassland: its archaeological and ecological importance

Programme

An extract from:

Conservation of Nature in England and Wales: report of the Wild Life Conservation Special Committee, presented to Parliament, July 1947, Cmd 7122.

Wild Life Conservation and Archaeology.

Paragraph 90.

"We are neither directed nor qualified to consider archaeological values; but, as we have tried to show, the interests with which we are concerned are closely involved, and we should like to see applied to archaeology principles of reservation and conservation similar to those we are seeking to apply to our own sciences. We therefore strongly recommend that a special committee fully competent to advise on those aspects should be set up without delay; and meanwhile, that in any proposed legislation provision should be made to include archaeological features in the general conservation and planning machinery".

SITES OF ARCHAEOLOGICAL INTEREST

A. D. SAUNDERS
Inspectorate of Ancient Monuments, Ministry of Public Building and Works.

It is doubtful whether any country has all the powers it would wish to have for the full protection of its archaeological sites and Great Britain is no exception. The first intervention of the State to assure preservation of ancient monuments in Great Britain did not come until the latter part of the nineteenth century. It resulted in the Ancient Monuments Act of 1882 whose provisions, while not so wide or so effective as those of later Acts, was of significance in that it constituted the first admission that the State should take an interest in the preservation of antiquities.

The term ancient monument used in 1882 was defined in the Act as - "prehistoric remains, dolmens, ancient forts and similar monuments." - and the scheduling of 68 such sites was attached to the Act. 29 of these were in England and Wales, 21 in Scotland and 18 in Ireland. Medieval and later structures were excluded not only in principle by the definition of what constituted an ancient monument but in practice by the naming of specific monuments. The Act was therefore very limited in scope and in addition contained no element of compulsion to ensure the preservation of an ancient structure. It was important, however, because it gave to a government body, the Commissioners of Works (what is now the Ministry of Public Building and Works) power to acquire a monument by purchase, gift and by bequest. It also gave them power to accept monuments in guardianship. This is an arrangement whereby the ownership of a monument remains unchanged but its maintenance becomes the responsibility of the State. The second important clause of the Act was that it provided for the appointment of Inspectors of Ancient Monuments whose duty it was to report to the Commissioners of Works on the condition of monuments and on the best methods of preserving them. The first Inspector so appointed was General Pitt-Rivers. The remarkable qualities which he possessed, which have led to his recognition as the father of modern scientific archaeology in Great Britain, were a particularly happy circumstance for the Commissioners and for the building up of the staff of specialists to deal solely with ancient monuments.

An Ancient Monuments Protection Act in 1910 extended the official

definition of an ancient monument to cover "any ancient or medieval structure, erection of monument or any remains thereof". Further Acts in 1913 and 1931 provided the basis for the protective measures employed today. As well as taking monuments into its direct care, the Ministry can make financial grants to owners to assist in preserving monuments and can give advice on the treatment of monuments. The Ministry must also publish a list containing those monuments reported by the Ancient Monuments Boards as being monuments the preservation of which is of national importance. As the original list was known as a schedule, the term scheduling has continued.

Scheduling affects the bulk of monuments (up to now these number about 8,000 in England) as opposed to the 700 or so monuments in the Ministry's care. Scheduling is a rather negative instrument and has limited effect but it does three things. It indicates which monuments are worth preserving. It offers a degree of protection by the statutory provision that three months' notice must be given of any action contemplated which may disturb a scheduled monument. This provides time for negotiation if the monument is threatened by damage and for deciding whether further measures of protection should be taken, or whether to arrange for archaeological recording, usually by means of excavation, in advance of destruction. Finally, it enables the Crown to prosecute a person who had damaged an ancient monument. If compulsion is needed to preserve a site an Interim Preservation Order followed by a Preservation Order is resorted to and the owner is compensated.

So much for the legislation available, what of the sites which concern us at this Symposium. Grassland sites of archaeological interest fall into the class of monuments known today as Field Monuments. They have an enormous date span, from men's earliest past to and including the last century. They are also enormously varied in size and in features. There are those built above the ground surface in the form of mounds, banks, walls or ramparts; and those excavated below the surface, graves, post-holes, ditches and pits for many purposes. In the Highland Zone of Britain stone constructions tend to pre-dominate though they may survive as grass-covered banks. In Lowland Britain, which is chiefly our concern at this Symposium, the above-ground structures are mainly earthworks, built of soil and of relatively easily moved-materials such as chalk and limestones, rubble, gravel, sand and clay.

Field monuments may be divided on the basis of function into five main classes. Under the headings of settlement, burial, defence, ritual and industry. Many sites, of course, fall into more than one of these categories. It goes without saying that such sites form the

surviving evidence for many of the activities of our own ancestors and form the raw material for the study of man's material past in the same way as documents are the basic source for the historian. Field monuments provide by their physical appearance some approximation of the landscape created by man, and when considered together they present a geographical picture of past human activity. They offer sites which can be excavated in order to reveal the pattern of events which have affected the site and can provide evidence for dating such structures. To some degree field monuments are also documents of natural history as well as human history since every structure which survives above ground protects the soil beneath. Largely by laboratory technique, plant and animal development can be studied and the pattern of environmental history established.

It can be readily appreciated that field monuments by their very nature and by their situation are easily damaged. How far has the protective legislation which exists catered for the destructive effect of modern intensive farming? First of all it must be realised that when the 1913 and 1931 Acts were being drafted the problems facing those concerned with protecting sites were very different from those which have faced us since 1945. Then the sites most in danger were the structures and standing monuments. Agricultural depression and largely traditional farming methods meant that field monuments were less open to damage. We must also take into account the fact that archaeological opinion and fashion before the war placed greater store by the upstanding monuments and less attention was given to earthworks. During the last war and, more especially since, the greater emphasis on increasing arable acreage has changed the countryside and the nature of the threat. At the same time archaeologists have become more and more aware of the archaeological value of what are often superficially insignificant sites. Because of this comparatively recent development only a small proportion of field monuments was scheduled before the war and it was not until 1954, when the Inspectorate's staff was increased for this very purpose, that attempts were made to achieve systematic scheduling county by county. Even now scheduling is far from complete.

The intensification of agriculture has meant that the great majority of field monuments are under the plough or could be threatened by ploughing. The size of the physical problem coupled with incomplete scheduling meant that the Ministry felt obliged to accept as inevitable the cultivation of monuments on agricultural land. Since it has not had the financial resources to stop ploughing of scheduled monuments by compulsion it has regarded "ordinary" cultivation (i.e. to a depth of 8-9") as inevitable on existing arable but has taken deep ploughing (over 9") as a major disturbance along with such drastic threats as bulldozing that require the statutory three months' notice. Unfortunately, since "deep" ploughing is now more and more carried out as "normal

cultivation" the Ministry is often not consulted by farmers.

The effect of ploughing monuments has been to cause steady erosion of those sites built above the ground surface and deeper ploughing has meant that the archaeological levels below ground are increasingly disturbed. The less obvious sites, like settlements and field systems, whose vestigial remains anyway are slight and whose occupation levels may be shallow, are being completely destroyed in one ploughing. Modern agriculture has also brought with it a vast increase in earth moving operations: removal of hedges, drainage schemes, etc. Afforestation particularly in the Highland Zone has increased and even where sites are not on arable,neglect has led to the rooting of trees and scrub and damage caused by the trampling of cattle.

Archaeologists have recognised the increasing damage to ancient earthworks and the ineffectiveness of present powers, not least those in the Ancient Monuments Inspectorate. In 1964 a survey was carried out in Wiltshire by the Ministry. Out of some 640 scheduled monuments more than 250 sites were found to have been destroyed or seriously damaged and over 150 less badly damaged within a period of 10 years. This sort of damage has been shown to be present in other parts of the country.

In the face of this evidence, the Minister set up an independent committee to inquire into the whole problem and make recommendations. Besides consulting archaeological opinion the committee consulted associations concerned with farming and the problems of land and land owning, as well as local authority associations. The Field Monuments Committee produced its report last year and has made a number of recommendations.

Without detailing all the Field Monument Committee's findings, the main suggestions are as follows:-

> To step up the rate of scheduling. More field monuments should be taken into guardianship by the Ministry and local authorities. Those scheduled monuments of most significance should be treated separately and starred in the printed lists. Agreements should be made with the owners of starred monuments to keep them free from cultivation and statutory powers used if necessary to make restrictive agreements. As for the bulk of scheduled monuments, acknowledgement payments should be made for those on arable or forest land so long as the monuments remain unploughed or unplanted. In essentials, the Field Monuments Committee has said that it is no longer enough for owners of this type of monument to be held responsible for maintenance. It has accepted that leaving earthworks unploughed is a nuisance and a financial loss for farmers and that they should receive some degree of compensation.

This is the revolutionary aspect of the Committee's recommendations and may require new legislation.

The recommendations are still being studied and it is not known whether the Minister will accept them all or in part. The financial aspect will bear most heavily with him and the Treasury. The Field Monuments Committee apart, the Ministry has in recent years been taking a more positive line where it can. Faced with the growing rarity of prehistoric settlement sites it has served an increasing number of preservation orders on sites of this sort and has included with them Romano-British sites, medieval monastic and moated sites and castle earthworks. Since proper compensation must be paid and in some cases we are dealing with sites covering 70 acres or more the bills are heavy. The Treasury made no additional sums available so that what is spent in compensation has to be found from the Ancient Monuments vote as a whole and something else has to be sacrificed. One telling argument in favour of the increasing use of preservation orders, however, is that frequently it is cheaper to compensate an owner than to excavate the site as a rescue operation. In addition to compulsion a number of agreements have been made mostly with respect to barrows whereby archaeologically harmful use of the land is restricted in return for an annual payment. Such agreements are temporary and are not entirely satisfactory since they do not run with the land. More field monuments have come into guardianship. The Minister has recently given his blessing for negotiations to start with the object of taking 7 deserted medieval villages in various parts of the country into care. Scheduling is being speeded up which, while it does not provide permanent preservation, serves to bring these sites to owners' notice and also to such bodies as the Ministry of Agriculture, Forestry Commission, Planning Authorities and the like. It is through agencies such as these that a good deal of co-operation can be achieved. Ploughing, however, is still the same threat and until some form of compensation can be paid to farmers to take ancient monuments out of cultivation it is likely that the bulk of our archaeological sites will continue to suffer.

Quite apart from the monuments already in the Ministry's care the increased number of field monuments preserved by one means or another from cultivation or damage presents a growing problem in land management. When a monument stands isolated in an arable field how are the weeds to be controlled? How can pasture be improved economically for grazing without ploughing? Sometimes the grazing of cattle itself can cause damage. There is a danger that preservation will mean large tracts reverting to waste with a long-term threat of unchecked vegetation. If the Field Monuments Committee's recommendations are accepted this problem will be accelerated. Close collaboration with bodies such as the Nature Conservancy will be necessary because of their similar interests. Management of grassland is something that the conservers of field monuments will have to take into account and I hope that the Symposium will aid our joint objects.

PAPER 2

SITES OF ECOLOGICAL INTEREST

A.E.SMITH
Society for the Promotion of Nature Reserves.

The purpose of this paper is first, to give some indication of the rate and extent of destruction of grassland areas of ecological interest in lowland England; and, secondly to describe the means available to safeguard such areas. I must say at the outset that I can give no detailed assessment of the losses in the last 20 years even of scheduled Sites of Special Scientific Interest (S.S.S.I.). No comprehensive register of these losses appears to have been kept or compiled. This serious defect should now be remedied because the Biological Records Centre is monitoring such schemes as the Biological Sites Recording Scheme. What I shall attempt to do is to indicate the extent of site losses in the context of the decline in the total area of old grassland.

This decline is primarily due to the far-reaching changes in agriculture in the last 30 years. The causes of these changes are well-known: they are partly economic and partly technical. Mechanisation and the extensive use of chemicals as fertilisers, herbicides and pesticides have enabled farmers to dispense with traditional rotational systems and have encouraged concentration on arable cropping. To facilitate this a new landscape pattern is coming into being: bigger fields, fewer hedges, the elimination of wet and 'waste' places, and, of course, much less permanent grass of the kind likely to be of ecological interest.

The destruction of old grassland - and, incidentally, of hedges, ponds and other semi-natural features -has been further encouraged by the post-war grant system of the Ministry of Agriculture. Until 1967 two levels of grant were available for ploughing: one, which it was possible to claim in retrospect, varied between £5 and £8 an acre for land which had been under grass for three years or more; the other, at £12 an acre, was available for land which had not been ploughed since before 1946 and which would cost more to bring into cultivation. Applications for this had to be made in advance. There is now only one rate, £12 an acre, and the prior approval of the Ministry is

required for ploughing if a grant is to be claimed.

There have been other periods in the last 200 years when concentration on arable production has led to a reduction in the acreage of permanent grass, but none so drastic as the present. There are, of course, very wide differences between eastern and western counties. Agricultural change still falls comparatively lightly upon most of western and northern England. In the east it is a different picture. Whereas in the north and west in 1966 there were nine counties with over 60% of their agricultural acreage under permanent grass and rough grazings and another 17 with between 40% and 60%, in the east and south-east there were 10 with less than 40% and nine with less than 20%. The last group comprised the East Riding of Yorkshire, all three parts of Lincolnshire, Huntingdonshire and the Soke of Peterborough, Cambridgeshire, Norfolk, Suffolk and Essex. Nearly all those counties had suffered an annual loss between 1963 and 1966 of between 4.1 and 6% of their previous year's acreage of permanent grass. There is every reason to believe that this rate of loss has continued since 1966. I am indebted to John Blackwood, the Nature Conservancy's Assistant Regional Officer in Lincolnshire, for these statistics.

It is quite clear that in some of the eastern counties - unless there is some totally unexpected and dramatic reversal of trends - permanent grass will soon be a thing of the past. There are, it is true, some preliminary signs in intensively arable areas of a return to a better balanced husbandry with more livestock. This may mean more grass, but it is likely to be in the form of temporary leys or improved permanent grass where this survives. There seems no likelihood of a reprieve for old, floristically rich meadow and pasture. And this applies to neutral grasslands just as much as it does to those on chalk and limestone. Indeed we may well find ourselves in some areas with relatively more calcareous than neutral grassland.

In the southern chalk counties the post-war years have witnessed the extensive destruction of downland (in the northern counties it had disappeared at a much earlier date) until now only scattered fragments remain and these only because of the difficulty of ploughing steep slopes or because of the protection afforded to them by the National Trust, the Nature Conservancy, the County Trusts and local authorities. By far the largest acreage of chalk grassland remaining in England is the Ministry of Defence Training Area on Salisbury Plain.

The total amount of permanent grass may, of course, still be misleading when we are considering ecological quality which is found in relatively few sites. In 1964 the Nature Conservancy found from a sample survey that 48 S.S.S.I.'s had been wholly or partially lost "due to land improvement and other operations". They also quoted estimates

that 90% of Sites in lowland England were "liable to a reduction or loss of scientific interest". A memorandum on chalk grasslands presented to the Nature Conservancy in 1966 by the Society for the Promotion of Nature Reserves listed 26 areas of chalk grassland and chalk heath of S.S.S.I. status or similar quality which had been destroyed by ploughing in the previous 20 years. This was a list compiled from the personal knowledge of three botanists without any search in the records and did not pretend to be complete. In a survey in Lincolnshire in 1965, M.E. Ball inspected 30 grassland sites where the Green-winged Orchid, Orchis morio, had been recorded in the previous 30 years. He found that about half had been converted to arable or reseeded and others had been "improved". In the remainder, orchids could be found in only five. Thus a plant relatively widespread in Lincolnshire 20 years ago has been reduced to the status of a rarity. The decrease of the Green Woodpecker in many parts of eastern England seems to be partly attributable to the loss of old grasslands with their abundant ant populations.

I will turn now to machinery which exists for protecting sites of ecological interest. First, there are the provisions of section 23 of the National Parks and Access to the Countryside Act, 1949. Under this section, the Natural Environment Research Council has a duty to notify the local planning authority of any area which "not being land for the time being managed as a nature reserve, is of special interest by reason of its flora, fauna or geological or physiographical features". Over 2,000 such sites have been scheduled and their owners notified. Should proposals be made for development within a S.S.S.I., the planning authority must inform the Council so that its views can be taken into account. This has been a valuable provision. Nearly all planning authorities have paid increasing regard to the value of S.S.S.I.'s and many have thereby been saved from development or the worst of its effects. In a few cases the notification of development has enabled a County Trust or other conservation body to negotiate for the acquisition or management of the site or a part of it. Unfortunately, the provision has a very grave weakness: agricultural and forestry operations do not constitute "development" within the meaning of the Town and Country Planning Act and are not therefore notifiable to the planning authority. The N.E.R.C. have inter-departmental arrangements with the M.A.F.F. and with the Forestry Commission for consultation, but usually changes only come to their notice when a grant is claimed. Until 1967 the lower rate of ploughing grant could be claimed in retrospect and some grassland S.S.S.I.'s were destroyed without any kind of warning. Even if consultation took place, the N.E.R.C. were in no position to offer compensation to a farmer for leaving grassland unploughed nor were the M.A.F.F. empowered to withhold ploughing or other grants on S.S.S.I.'s. In some cases public-spirited owners modified their plans to leave viable areas of an S.S.S.I. or sold it to a Naturalists' Trust; in others nothing could prevent the destruction of the site.

In an attempt to remedy this situation Mr. Marcus Kimball, M.P., presented a Private Member's Bill to Parliament in June, 1964 for the better protection of S.S.S.I.'s. It would have required owners or occupiers to give the Nature Conservancy six months notice of any operations affecting notified S.S.S.I.'s, but it contained no provision for compensation to an owner or occupier who might have suffered loss of development value. The Bill failed to get a Second Reading.

Discussions then took place between interested departments with a view to producing legislation acceptable to the Government. It was evident then and later that the M.A.F.F. was unwilling to accept any statutory restrictions of agricultural operations on S.S.S.I.'s. However, there was some tightening-up of inter-departmental liaison arrangements as a result of these discussions and the position was further improved after 1967 when ploughing grants ceased to be available without prior approval. The Countryside Act of 1968 included a provision (Section 15) which enabled the Natural Environment Research Council to enter into agreements with the owners, lessees and occupiers of S.S.S.I.'s for the land to be managed so as to maintain its scientific interest, and for payments to be made by the Council for that purpose. In enabling the N.E.R.C. to offer compensation for loss of development value the Section establishes an important principle which should prove to be of great value. It was stated during the passage of the Bill, however, that out of the 2,000 or so S.S.S.I.'s in Great Britain not more than 150 would eventually be selected for this treatment and that the N.E.R.C.'s resources would allow it to deal with only five or six each year. In fact, since the Act came into force on 3rd. July, 1968, no such agreement has been concluded.

The powers of the Countryside Act in respect of S.S.S.I.'s can be used only where owners are willing to negotiate and are satisfied with the financial provisions. Even then it appears that only a handful of sites will be safe-guarded by this means unless much greater resources of money and manpower are made available. This vast majority are still as vulnerable to agricultural operations as ever they were.

What other safeguards are there for old grassland sites? A few can be acquired or protected as nature reserves or open spaces. I have selected a sample to indicate the National Nature Reserve position. 13 counties in eastern and southern England have less than 30% permanent grassland but there are only 20 National Nature Reserves in the area. 8 of these contain grassland of one type or another (excluding sand-dune grassland) amounting at a rough estimate to 750 acres. Most of this is acid grassland and heath; there is some calcareous grassland but very little of the now equally vulnerable neutral grassland.

County Naturalists' and Conservation Trusts have achieved a great deal in a comparatively short time. They now own, lease or manage by agreement some 450 nature reserves comprising about 35,000 acres. I have no recent breakdown of this acreage into ecological types, but I estimate the acreage of grassland of all types to be between 12% and 15% of the total. As in national reserves, there is much less neutral than calcareous and acid grassland. I hope that more attention will be given to achieving a more balanced representation of grassland habitats in nature reserves and in the road verges which are now scheduled for protection in many counties. There is evidence that this is already happening. In Cambridgeshire for example, the Trust has acquired 300 acres of the Ouse Washes grasslands in the last few years and a further 700 have been purchased by the R.S.P.B. and the Wildfowl Trust; in Lincolnshire the Trust has recently acquired more than 100 acres of old meadow and pasture in three reserves.

Among owners of grassland open spaces the National Trust is obviously by far the largest. Local authorities also own considerable areas of grassland. In Surrey, for example, the County Council and District Councils own several thousand acres of downland and heath and the Hampshire County Council has acquired considerable areas of downland in recent years. It is encouraging that the Nature Conservancy and County Trusts are often consulted by the National Trust and local authorities.

I have tried to give some account of the present position regarding the conservation of old grassland. I will end by summarising what I consider to be the main needs for the future.

1. We need a monitoring system to provide a continuous assessment of the amount and quality of old grassland habitats left. This is being developed through the Biological Records Centre.

2. We need to plan a new strategy on a national as well as a local basis for the acquisition of grasslands and other habitats.

3. We shall need more money. The County Trusts have raised or are committed to raise well over £100,000 to purchase reserves in the last 18 months. The Government must be urged to play its part in making adequate funds available to the Nature Conservancy.

4. We need better protection for S.S.S.I.'s until they can be made into reserves.

5. We should seek the help of local authorities wherever possible in protecting sites and encourage them to use their powers to establish reserves wherever appropriate.

6. Finally, there should be much more collaboration between ecologists and archaeologists in the selection, acquisition and management of old grassland sites including interpretation services where there is public access. Many reserves and proposed reserves of the Nature Conservancy and County Trusts already have archaeological interest.

Old grassland is a fast-diminishing habitat in lowland England. can think of no other where the need for conservation is more urgent.

SUMMARY OF DISCUSSION

Regional differences in the rate of destruction of old grassland were referred to by many speakers and Mr. Blackwood's exhibit illustrated this. More grassland was being lost in the south and east of England than in the north and west, differences in topography, soil and type of farming being mostly responsible. Neutral grasslands (in Tansley's sense) were being ploughed-up more rapidly than acidic and calcareous grasslands; this being especially noticeable in the Midlands and East Anglia.

The meeting agreed that there was an urgent need to survey and identify sites of special importance for the archaeologist and ecologist. Scheduling of sites of archaeological interest by the Ministry of Public Building and Works and those of scientific interest by the Nature Conservancy did not necessarily protect these sites from destruction, although it was emphasised that in many cases scheduling of sites had been beneficial in that the owner was made aware of the interest there and often co-operated in preventing ploughing. Nevertheless, the meeting welcomed the concept of payment for managing sites of ecological interest which was proposed in the Countryside Act 1968 . Further protection of sites was afforded in part by decisions of the County Planning authorities which could prevent development on certain sites, but these decisions can be reversed on appeal if this method of protection should not be thought of as a substitute for protection by adequate Parliamentary legislation.

Ways of surveying field monuments and areas of ecological interest were discussed. The Nature Conservancy was currently undertaking a reviews of reserves and S.S.S.I.'s, in order to select the most important sites for protection. The Royal Commission on Historial Monuments was surveying selected parts of the country, nominating sites of greatest importance.

Two important points emerged from the discussion. They were:

Lists of sites worthy of protection should always be inspected

by both archaeologists and ecologists.

2. It should be axiomatic that when a site is being considered for protection, the advice of both archaeologists and ecologists should be sought.

The two speakers pointed out that the Ancient Monuments Branch/ Inspectorate (M.P.B.W.) and the Nature Conservancy (N.E.R.C.) should co-operate with one another wherever possible because they had a similar interest in protecting sites. The two bodies depended very heavily on public goodwill, and they used compulsory powers very reluctantly. When the M.P.B.W. is obliged to issue a Preservation Order, large sums of money may be paid in compensation. The meeting examined differences in the structure of the two bodies and in the statutory means of protecting field monuments and nature reserves. Only the Nature Conservancy has a number of regional offices, with many of its staff based in the regions. The M.P.B.W. may in the future appoint regional wardens to inspect protected sites and to provide a link with the farming community, but the Conservancy has much more experience in this field.

In answer to questions, the two speakers stressed the importance of voluntary bodies in the fields of protections and conservation. Mr. Saunders said that voluntary county correspondents inform the I.A.M. of newly-discovered sites of importance and sites needing protection. County museums often act as clearing-houses for local information. Mr. Smith thought that voluntary organisations do much survey work and play a large part in managing and acquiring sites.

Prefatory Note

The following two papers complement each other. They note the crucial importance of earthworks to archaeologists and the urgent need to select and effectively preserve as many as possible. They urge that the actual and possible conjunction of interests with ecologists be developed in practical ways to further this end as well as in the cause of research.

SESSION 2 PAPER 3

ARCHAEOLOGICAL FIELDWORK ON SETTLEMENTS AND LAND-USE IN THE LATER PREHISTORIC AND ROMAN PERIOD

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This is to be a short discussion of archaeological fieldwork and its relevance to the study of old grassland in Lowland England. Fieldwork consists of the examination of superficial remains and is akin in a number of ways to the first processes of medical diagnosis. To be of any value it must be based upon a knowledge of the subject which is more than skin deep but it has to rely upon the apparent and declared symptoms. In particular subjects examined individual case-histories will be important. Fieldwork is therefore usually preceded by an investigation of geology and previous land treatment. Air photographs are examined for diagnostic marks. It is when the analogy with medicine breaks down that one sees a particular value of fieldwork as opposed to excavation. Excavation is usually limited by practical reasons to one monument or a small area, equivalent to the individual in medicine. Fieldwork gives scope for establishing connections over a much wider area. In the case of settlements this will usually involve a study of roads from the settlements and of the fields and pasture associated with them. Where burial places are concerned it allows for a consideration of associated ritual monuments and of topographical determinations. Two points must be stressed, however: fieldwork involves consideration of all ground remains and, secondly, excavation is only ever going to be applied to a tiny proportion of such remains. Analogy and classification is therefore of vital consequence and simply has to be relied upon for the vast majority of degraded and levelled sites. Since surviving earthworks, by definition supporting old grassland, are now themselves rare it is important to suggest that all reasonably preserved should be kept in that condition at least until excavation on an appropriate scale is possible.

The limitations of fieldwork need no stressing. The visible remains are coarse shapes and represent only the latest structures or a conflation of many. They do, however, often show relationships and a story of land use that may be difficult to obtain even by excavation on a flattened site. A recent analysis of earthworks on Minchinhampton Common, Gloucestershire (SO 8500, 8501 and 8601) provides an illustration of this. Here, on a flat-topped ridge capped by Great Oolite, is a remarkable series of earthworks, mercifully preserved by the National Trust (Fig.1.) (St. Joseph 1968). In the accompanying diagram (1) (2) (4) and (5) are ramparts of apparent Iron Age date. Enclosures (3) and (9) are later than these and also later than a series of old enclosures (7) and (8), only partially shown by broken lines and themselves possibly of the Iron Age. Subsequent activity is marked by 40 or so 'pillow mounds', of which (a) to (e) only are shown. They are probably connected with rabbit breeding, some being built on top of earlier earthworks e.g. (c) on (4). 700 or so small shallow pits with accompanying mounds can also be seen to be man-made and of relatively late date but are otherwise unexplained. Even in this area there are patches which have been ploughed for a short time, at some unknown but probably recent period. Back-filled wartime trenches and the earthworks of a modern golf course, some built over old quarries, round off the picture. The whole area is grazed and some of it mowed. The earthworks enumerated can be clearly seen. It would be of great interest to know how they are rated in terms of natural history. For the excavator and, one hopes the ecologist, they are a treasure-house whose richness is increased by the knowledge that large areas of the flat ground around have probably not be ploughed.

It is clear that the density of prehistoric and Romano-British settlement is much greater than has often been envisaged and there is increasing evidence to suggest that much of the downland was cleared at least by the Middle Bronze Age. On Shearplace Hill, Dorset (SY 540986), a settlement on old chalk grassland is clearly linked, on the evidence of surface examination, to a ridge track defined by two banks (Fig.2) (Rahtz 1962). This track is joined, some distance to the north, by a double lynchet track bounded by 'Celtic' fields. Excavations and C.14 dating have shown this settlement to have existed about 1200 B.C. and not to have survived as late as the Iron Age. In other areas the evidence of 'Celtic' fields before the cutting of certain large boundary ditches in the Bronze or Iron Ages, reinforces this impression of early high organisation (Fig. 3). Such remains are widespread over the downland between the River Stour in Dorset and the River Meon in Hampshire. Recent unpublished work has shown that in the remains illustrated, on Figheldean Down, Wiltshire (Applebaum 1954), mercifully preserved as a whole but being encroached upon by ploughing, the assumed enclosure (3), tentatively regarded as for winter crops, does not exist as such and is an illusory effect on air photographs. This could only have been checked by fieldwork on the unploughed remains. There was a great variety of

settlements in both the Iron Age and the Roman period. In particular, rural communities as well as single farms are noted in both periods. This result has been achieved by excavation in the earlier period and is now also illustrated by earthworks, as on Berwick Down in southwest Wiltshire (ST 942198) (Fig.4.) (Wainwright 1968). Here there is a spread of settlement extending into the Roman period. North of the circular earthwork, but now under threat, there is the only unploughed example of an extensive 'open' Iron Age settlement known to the writer. Much of it appears as slight circular depressions marking the position of storage pits. Experiment has recently shown that certain calculations of arable acreage and consequent population, based upon the capacity of such assumed corn storage pits, must be revised upwards by a factor of at least three (Bowen & Wood 1968). The evidence for Roman villages, abandoned for a short time when such pits (then taken to be native houses) were reinterpreted as for storage, has been re-instated in Wessex by the recognition of certain earthworks as assemblages of former buildings now reasonably regarded as large villages (Fig.5.) (Bowen & Fowler 1968). Such rarely preserved sites are of the first importance, their plans displaying streets and small open spaces possibly for communal use like the later 'greens'.

In Wessex despite the substantial number of earthworks the proportion is tiny compared with what formerly existed. Professor Cunliffe has recently shown that even in an area of abundant cropmarks, Chalton Down south of Petersfield, the number of occupation sites of all periods in 15 square miles was at least 95 as opposed to a known five or six when his investigation began a few years ago. We must therefore expect that old grassland will have much more to reveal even than surviving earthworks suggest. Ten years of excavation on Overton Down, to be described by Mr. Fowler, demonstrates this in detail. It may be noted that broad plough ridges of apparently medieval date blanketed most of the remains, but allowed so much of the main features of the prehistoric and Roman background to show through that the pattern on an air photograph of the adjacent Fyfield Down could be described by a notably good fieldworker as 'typical Celtic fields'. (The incidence of ridge and furrow as the final evidence for cultivation here introduces a point of considerable importance. Ploughing in such a technique, although much more destructive than the ploughing by prehistoric or Romano-British light ploughs, simply did not create havoc comparable with the modern plough, particularly the apparatus with digger share pulled by crawler tractor.)

By the end of the Roman period there is probably little of the downland that was not cleared for arable or pasture. 'Celtic' fields still cover more of the observable countryside in south England than any other form of earthwork, though because of destruction they are a tithe of what once existed. (Let us remember in passing that almost

the only good examples in the Chilterns are in a Nature Reserve selected for its old grassland.). A generally rectangular form, with sides to a proportion no greater than 1:3, can still not be closely dated, though more elongated forms are found in the Roman period. The bracket seems to be from the Early Bronze Age to the end of the Roman period, at least - say 1500 B.C. to 400 A.D.. There is growing evidence, though still slight, that there was an allocation of ground in blocks or long parcels before the more permanent allocation in small plots. In Dorset, for 3 miles north of Puddletown (from SY 745953) there is an area of 2,000 acres of 'Celtic' fields where it can be shown that apparent 'base-lines', on which 'Celtic' fields were laid, extend even over a stream whose tiny flood plain was preserved as pasture (R.C.H.M. forthcoming). Though superficial evidence is mostly Romano-British there is little doubt that this land was largely divided up in a much earlier phase.

A very high proportion of surviving 'Celtic' fields, have, regrettably, been overploughed. It would be interesting and useful to determine whether the dates at which ground was last ploughed can, in any circumstances, be reflected in the flora or other natural phenomena. Wylye Down, Wiltshire (SU 005364), is one of the few small areas known to the writer where there is a conjunction of well-preserved 'Celtic' fields and ridge-and-furrow, providing a difference in date for the last ploughing of perhaps 1,500 years. Although botanical investigation by Dr. John Hope-Simpson has so far been inconclusive, the diagrammatic plan presented here is intended to present the archaeological evidence to critical examination (Fig.6). It is surely worth making a joint archaeological/ecological search for good potential test areas so that they can be preserved if only for this reason.

There is still no evidence that strip-lynchets, terraces often about a furlong in length, originated in the Roman period. The latest evidence for a positive post-Roman date comes from Dorset in an area of grassland, partly broken up in the nineteenth century but unploughed since, where ground examination showed that strip-lynchets lay over 'Celtic' fields. Subsequent investigation exposed a Romano-British settlement whose remains had been protected when a high 'Celtic' field lynchet immediately behind it had been broken up and spread over the footings of the Roman structures so that strip ploughing could begin (Bowen 1967). This site was at Poxwell (SY 736840), close to the spring whose presence is indicated by the O.E. 'well' in the place name and which was a prime reason for the location of Iron Age, Roman, and later settlement.

The importance of ranges for stock in the prehistoric period is emphasised by the long boundary ditches of the type shown in Figure 3, occasionally putting 'Celtic' fields out of use but frequently bounding blocks of fields. In the later Iron Age a 'banjo'-shaped type of earth-

work with circular enclosure of some ½ acre and a 'funnel' entrance is seen frequently associated with boundary ditches (Perry 1968). There are also much larger enclosures subdivided as if for stock sorting.

Areas other than those occupied by ancient earthworks which appear never to have been cultivated are difficult to detect and important when noted. The occasional incidence of old ploughsoils under barrows emphasises the difficulty. In open country on a slope the absence of lynchet formation against peripheral earthworks is the best evidence that can be offered. One such area is Woolbury fields near Stockbridge, Hampshire (SU 382350) (Crawford 1928). Here a long bank-and-ditch bounds 'Celtic' fields crossing a re-entrant valley to the east. There is no sign of ploughsoil accumulation against the west side of this boundary or against a round barrow skirted, as so often is the case, by the bank.

The complex association of ancient boundaries, burial mounds and ritual structures has to be relegated with no more than the mention just given. A further heading which cannot be developed is the bearing on the landscape of former water supplies and drainage. The only point that may be stressed is that the overriding need for bath water, inter alia, often involved the builders of Roman villas in major drainage works, some still functioning. When they are blocked and not remade the earthworks, not surprisingly, may be associated with waterlogged ground.

The advantages to the archaeologist of collaboration with the ecologist are innumerable and have been given scant justice. The writer would dearly like to see a joint archaeological and ecological assessment of surviving remains. It would seem that most earthworks interest the natural scientist even in their surface aspects. Mr. Fowler will stress the merits of dissection. There are at least two further points where collaboration might be, or is known to be, valuable: management and experiment. The former can only be mentioned. Only one aspect of the latter can be put forward and it is to do with old grassland. Grass rarely produces cropmarks except in conditions of drought (when, in extreme cases, the ditches of earthworks may dry out, as they did in 1959, more than the natural subsoil).

Hill-forts and their grassy interiors are frequently preserved. They are probably the best known of our Iron Age remains - though far less homogeneous than the often misleading type-name suggests. Their defences are the most investigated by excavation. Their interiors are much less well known and though not infrequently presenting the aspect of old grassland many have in fact been ploughed since the original occupation. Maiden Castle, near Dorchester, Dorset (SY 670885), is perhaps the best known. Its size is such that even the massive and illuminating excavations of 1934 to 1938 uncovered but a tiny area of its interior. It was assumed to be a defensible hill-town, its 47-acre interior covered by huts. Can this ever be determined? Inves-

tigation by geophysical means might produce a complex of anomalies to suggest an answer, but would scarcely provide the necessary clear pattern without impossibly elaborate excavation. Is this the sort of case where not-so-old grassland can be legitimately disturbed and an attempt made to carry out a carefully controlled ploughing experiment to produce cropmarks? The hill-fort has been ploughed since 1610. It would be necessary to check that biological values were not disturbed, to label the whole thing as a cropmark experiment, to restrict any fresh ploughing to a shallow depth and to think very carefully about the crop most likely to react to old ditch fills even though buried under the ploughsoil of historic cultivation. It may be that this same ploughing has totally eroded many remains and it would clearly be irresponsible to experiment initially on such an important site. The recent discovery of what appears to be a very large Romano-British settlement 600 yeds. north of the hill-fort between it and Roman Dorchester - reasonably taken to be its successor - was made when lucerne was sown. Is it not worth considering experiment to see what particularly sensitive crops could beused suitable to given circumstances? The preferably flat interior of a lesser hill-fort with a history of ploughing before the modern, might then be made the subject of experiment. The potential rewards in terms of an increased understanding of the surviving earthwork defences can be appreciated by studying for instance, Major Allen's air photograph of 'Dyke Hills', near Dorchester, Oxon., the interior under crop. And this is where selective excavation could begin.

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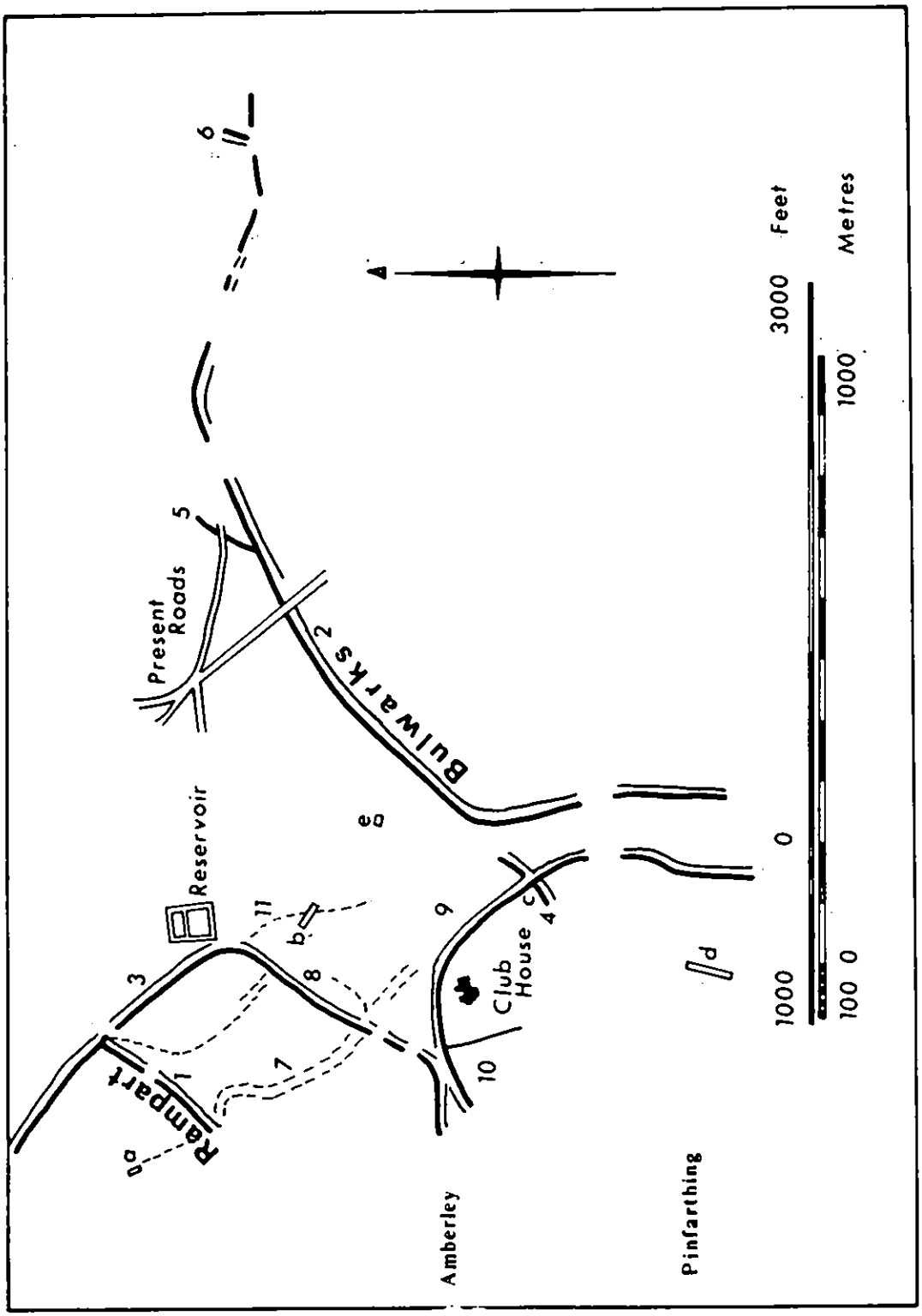

Figure 1 Earthworks on Minchinhampton Common
(based on plan by R.C.H.M. England)

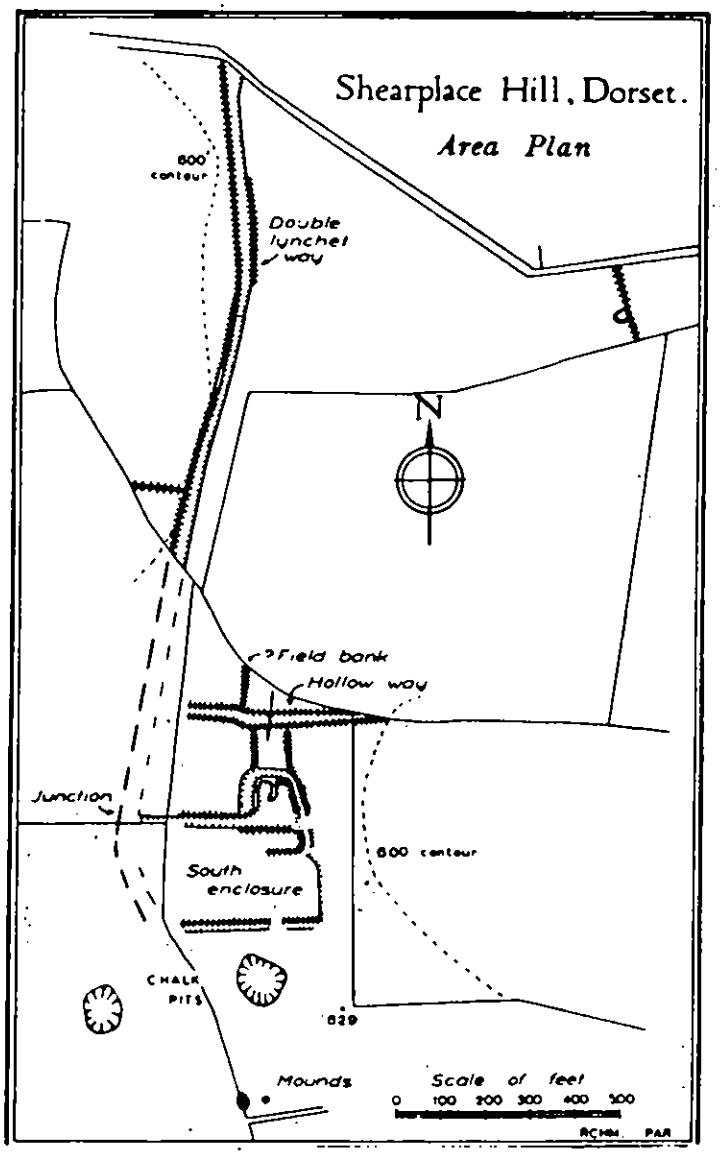
Shearplace Hill, Dorset.
Area Plan
600 contour
Double lynchet way
N
?Field bank
Hollow way
Junction
South enclosure
600 contour
CHALK PITS
629
Mounds
Scale of feet
0 100 200 300 400 500
RCHM PAR

Figure 2

Figure 3 (after S. Applebaum)

SETTLEMENTS ON BERWICK DOWN, TOLLARD ROYAL, WILTS

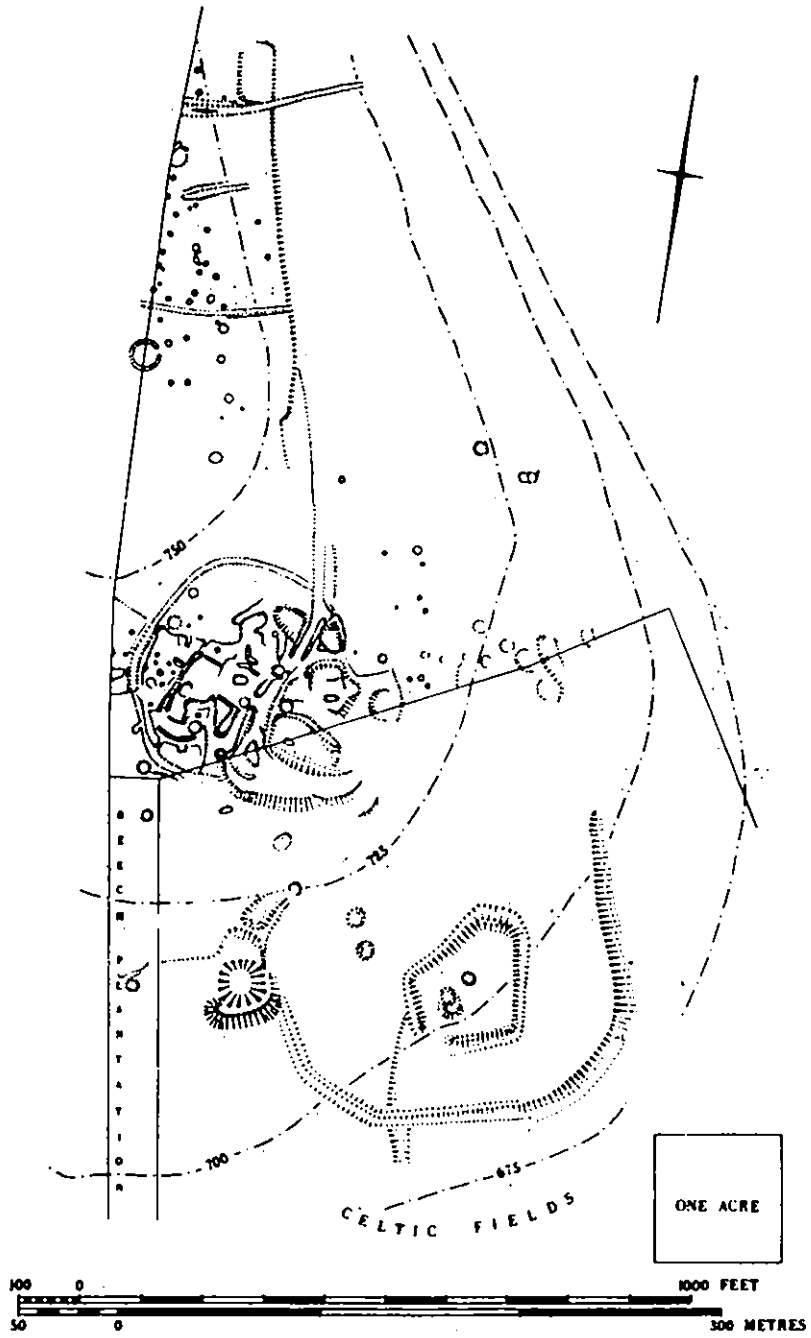

Figure 4 (after R.C.H.M. England)

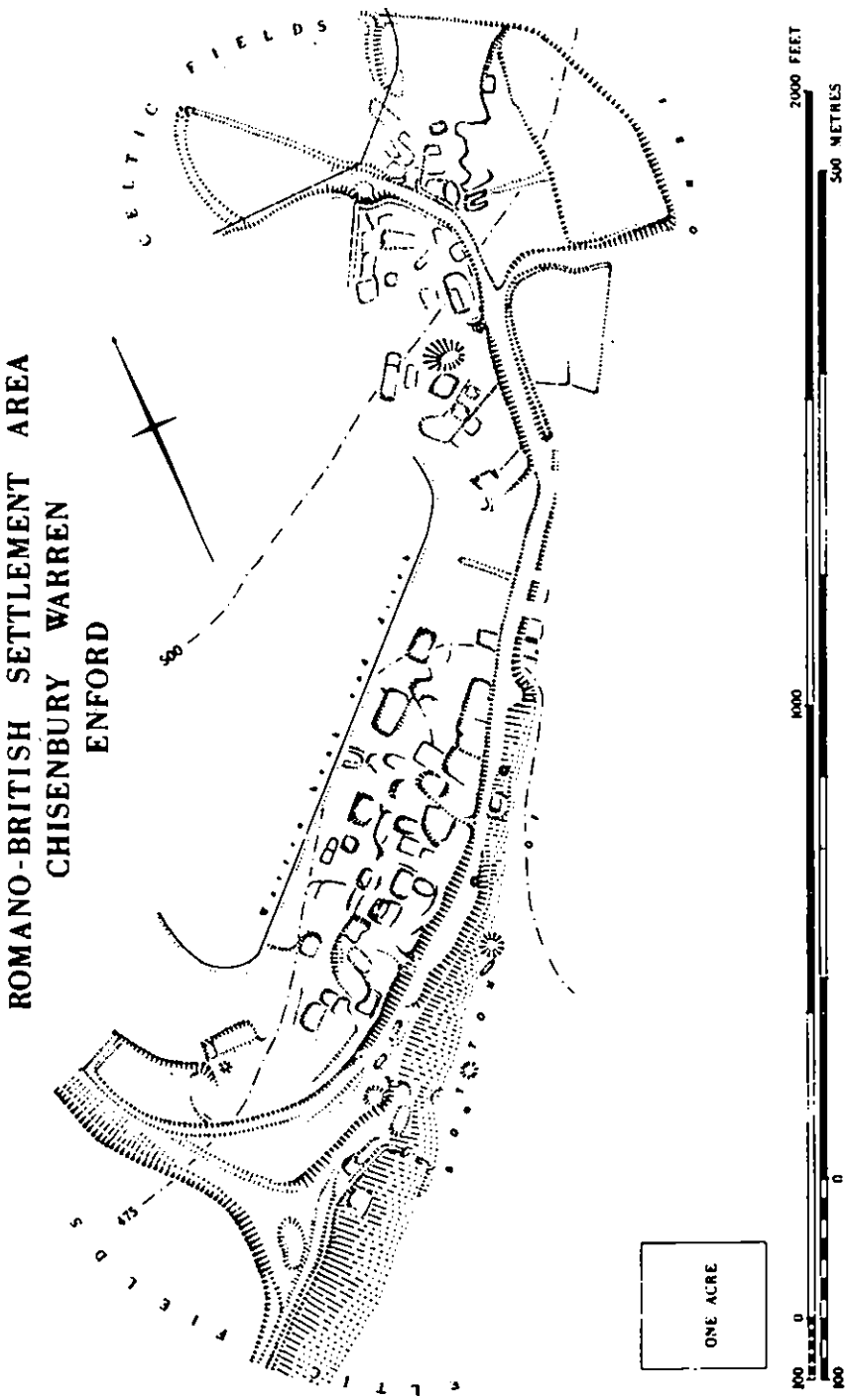

Figure 5

(after R.C.H.M. England)
- at Grid Reference SU 177537

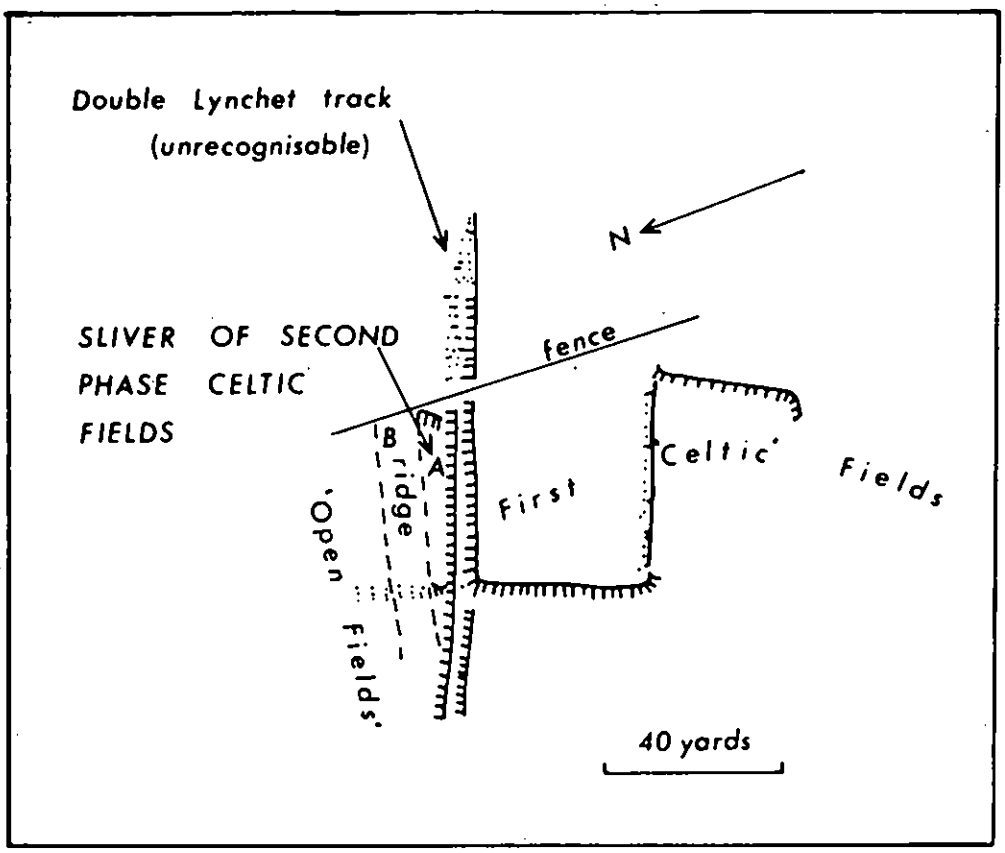

Figure 6

Wylye Down, Wiltshire
(after plan by R.C.H.M. England)

Note: ground falls N. and W., dropping 30 feet between 'fence' and 'furrow.

Botanical samples were taken from 'A' and 'B'.

PAPER 4

ARCHAEOLOGICAL EXCAVATION INVOLVING SETTLEMENTS AND LAND-USE IN THE LATER PREHISTORIC AND ROMANO-BRITISH PERIODS

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Any piece of archaeological evidence, be it flint arrowhead, prehistoric burial mound, Romano-British pottery kiln, medieval ridge-and-furrow or a modern motorway, is evidence of land-use at some time, and as such tells us something directly about a locality and indirectly about the people who worked or died there. A settlement, i.e. a place where people lived, is of course a type of land-use at a particular place. Such use can produce an archaeologically recognisable form of surface structure consisting, for example, of banks and ditches, as with a hill-fort, or of masonry remains as with a castle. But even well-preserved hill-forts and castles bear little resemblance today to their appearance when last in genuine use, and by that time they may well have been altered drastically from their original form. Consequently one of the archaeological excavator's main tasks is to show the development of his site from its beginnings to the present day in terms of its structural variation; but also he must show the development in terms of its land-use history and therefore of human activity within a topographical setting and an interacting environment (Evans 1968 a and b). Any site which happens to be excavated never has existed in isolation nor has it been static in use or abandonment.

Pre-medieval sites available for excavation on grassland in Lowland England only come in three forms: as 'earthworks', whether these be earthen banks and ditches or collapsed stone walls; as flat or flattened sites where either there were no original upstanding structures, where such structures were only of perishable materials, or where subsequent activity like ploughing has reduced any relief to an even surface; and a combination of the first two e.g. it is all too common for a hill-fort to be regarded as 'preserved' because its ramparts survive impressively while the area they enclose has been cultivated or quarried.

When earthwork sites are excavated, results tend to follow certain trends:

(i) structures associated with the earthworks do not necessarily conform with them, i.e. a plan of the excavated structures will be different from that of the surface relief before excavating;

(ii) the settlement may be multi-phase, so that the earthworks are then seen as representing only the last phase of activity or, more probably, as being the product of many changes over a long period (e.g. Rahtz and ApSimon 1962);

(iii) the settlement will be structurally complex within any one of its phases with many features such as pits, ovens, and traces of timber structures not represented by surface relief (Fig. 1);

(iv) land-use of that particular place may also be varied and not confined to habitation alone, e.g. a flint-working site or a flat cemetry may be covered by a developed soil profile which was then cultivated and subsequently abandoned to scrub or pasture before the first phase of the settlement ultimately responsible for the earthworks which were the original reason for the excavation (cf. Fowler & Evans 1967);

(v) subsequent examination of the non-artefactual material especially bones, soils, snail shells, charcoals, rocks, - as well as the artefacts - pottery, metalwork, glass and worked or utilised rock, - will, inter alia, throw light on the local ecology and perhaps suggest previously unsuspected lines of enquiry for the natural scientist (Ashbee 1963; Dimbleby 1967; Evans 1968a).

With sites which always were flat or have subsequently been flattened (i.e. destroyed above ground), there is of course an obvious need to excavate. In a sense it makes for easier excavation if there are no upstanding earthworks to complicate the process of dissection. Although excavation in such cases will be very much concerned with features cut down into the subsoil, and therefore with only a fraction of the original evidence, at least parts of features originally standing proud of the subsoil surface often remain e.g. hearths, patches of floor, and occupation spreads. Furthermore, a smooth modern surface may conceal buried relief, such as the rise and fall of a truncated bank and the old land surface beneath it, or the depression over the top of an undamaged pit or ditch. But a site that is flat now and perhaps known only from cropmarks on an air photograph cannot be assumed to have been originally an upstanding structure; conversely its flatness need not be the result of modern or even medieval cultivation, even though one of the interesting facets of land-use study in early landscapes is to pick out the evidence for the treatment of 'ancient monuments' in pre-medieval times. On Avebury Down, Wiltshire, for example, a soil-mark of a round barrow occurs inside a small rectangular field of a 'Celtic' field system, the cultivation of which in the pre-Roman or Roman Iron Age must have flattened it, while on Pentridge Hill, Dorset, a round barrow is sited near the

lynchetted corner of a 'Celtic' field in such a way that it can only have been built after the field had been in use for a long time (R.C.H.M. forthcoming).

Barrows, that is mounds erected for funerary purposes, may not seem immediately to be directly germane to our subject, yet it is their excavation in recent years which has produced a great deal of our evidence for later prehistoric land-use, and not only in the sense that a particular spot was used for disposal of the dead for a particular period of time (Ashbee 1960). One of the chief assets of such mounds from our point of view is that almost invariably they have accidently sealed and preserved a former land surface, frequently already cultivated, occasionally inhabited. Furthermore, the mounds are often structurally complex, representing later additions which can in their turn seal newly-developed humic layers over the original mound. And furthermore, as it becomes clearer that, in the very first place, various timber structures were often erected (Ashbee 1960 and 1966) and pits dug on the site before the long or round mounds were ever erected over them, so we increasingly appreciate what treasure-houses of environmental raw material for the 4th, 3rd and 2nd millenia B.C. barrows are. Birds, for example, sit on the timber posts and drop droppings, (Jewell 1964), frogs hop and small mammals fall into the pits (Smith & Simpson 1966), snails crawl into the loose filling of graves or cinerary urns, organic material is compressed and sometimes 'refrigerated' under the bulk of the mound (Atkinson 1968), and the stratification of the ditches reflects local weathering (Jewell 1963; Jewell & Dimbleby, 1966) and adjacent activity in its layers, one of the highest of which will as likely as not be a Romano-British ploughsoil. All such evidence clearly bears on environment and therefore on land-use history.

So much for synopsis: now let a few specific examples of recent excavations illustrate the points in more detail. It must be emphasised, however, that most recent excavations in chalk country have been carried out because of threats of, or actual, destruction, usually by ploughing, and only a few sites were at the time of excavation and still are now in areas of surviving old grassland.

Excavation has, therefore, to a large extent been influenced by non-academic factors rather than by coherent research policy. A few barrows can be mentioned first in as far as they bear on our subject. Long barrows of the earlier 3rd millennium B.C. at Waylands Smithy, Berkshire (Atkinson 1965), and South Street, Avebury, Wilts (Evans 1968a) both lay on old land surfaces which had previously been cultivated. The latter site is of particular interest because of the land-use sequence (Evans 1968a and b), including at an early, pre-barrow phase, the possibly deliberate scoring of the Coombe Rock subsoil surface by a cultivating implement within an area which may have been demarcated as

a field (Fig. 2; Fowler & Evans 1967). Similar evidence - non-marine mollusca, ard-marks and ploughsoil - also demonstrated post-barrow phase of land-clearance and cultivation about a millennium later; and, incidentally, potsherds also suggested agricultural activity early in the second millennium A.D.. The main point here of course is that what began as a typical rescue excavation of an already much-damaged long barrow produced as a bonus extremely valuable data on land-use history which could not be obtained by any other means (Fig. 3). This one example alone clearly points to the co-operation which is necessary between archaeologist and natural scientist in deciding what questions to tackle and in assessing the evidence from systematic excavation. A site like South Street, almost completely excavated under controlled conditions, is surely of more value to the scientist than single-handed borings or little inspection pits. Certainly excavation in the hands of the modern archaeologist has long past the peep-hole stage.

A few barrows can represent the 100-plus excavated on chalkland in recent years. On Arreton Down, Isle of Wight, one barrow accidentally covered, indicated a late-Neolithic habitation site (Ozanne 1960), and similar evidence plus stake-holes for slight timber structures was noted during excavation of the great barrow cemetry on Snail Down, Wiltshire (Thomas 1958). Near Amesbury in the same county, ard-marks occurred in the surface of the chalk subsoil beneath a structurally complex burial mound (Christie 1967); in north Wiltshire, a Neolithic occupation site was found beneath a round barrow at Bishop Cannings (Robertson-Mackay 1966), while another pre-barrow occupation of several phases was demonstrated on West Overton Hill (Smith & Simpson 1966). This last is one of the examples where a flat cemetery developed for some time before it was covered by the barrow mound, a phase during which frogs had fallen into the primary grave, and where worms, frogs and snails had enjoyed a zoological jamboree in a cinerary urn primarily intended to contain the cremated remains of an adolescent. The point that these and many other barrow excavations make is that, time and again, excavation shows even a simple-looking mound to be complex and produces evidence of non-funerary character directly relevant to understanding the development of landscape. Indeed, in seeking our settlements of the 3rd and 2nd millennia B.C. on the chalk downs, the burial mounds provide the best hope of increasing our currently deficient knowledge if only because beneath such mounds are virtually the only preserved contemporary land surfaces. I would have thought that this fact is of considerable importance to natural scientists and that it indicates an obvious area for management co-operation.

The same is true of those areas where settlements and early fields still visibly survive as grass-covered earthworks (Bowen 1961, 1969). We can take the National Nature Reserve on Fyfield Down, Wiltshire, as an example, for here is not just an area of geological interest, despite

the original reason for the Nature Conservancy taking it into custody, but also a marvellous palimpsest of various landscapes from the whole period under review, and indeed with post-Roman accretions too (Fig. 4). Furthermore, the excavation allied with fieldwork here over the last decade makes it relevant to present purposes (Bowen & Fowler 1962, 1966; Fowler 1963, 1967, 1969, 1970; Fowler & Evans 1967). A dozen or so settlements have been identified on the ground; five have been excavated completely or in part. One, somewhere between c. 500-200 B.C., was laid out on Overton Down, accidentally on top of a small flat cemetery of a thousand years earlier. The settlement was enclosed by a bank and ditch and contained several timber buildings, and other structures, as well as pits of varied form and purpose. It was surrounded by contemporary arable fields but, within the pre-Roman Iron Age, it was abandoned, probably deliberately. Its 4 acres were then incorporated into the existing field system, presumably now farmed from elsewhere. Some of the fields were bounded by a fence (OD XI/B on Fig. 6), and within them were found the ard-marks produced by cultivation, the first example in Britain of these phenomena actually inside a 'Celtic' field on chalk. The whole system was then apparently abandoned within the prehistoric period. The existing fields, already outlined by lynchets over the original boundaries, were recultivated and partly remodelled early in the Romano-British period for a short time, and the absence of archaeological evidence thereafter suggests desertion again or perhaps pastoral use. A settlement only ½ mile from the first was excavated precisely because it appeared to lie on top of part of the disused field system: satisfactorily it proved to be exclusively of late 3rd - early 5th century A.D. date and overlay or was cut into ploughsoil containing only earlier artefacts.

The pre-medieval sequence for the whole area was also borne out by sections cut across the lynchets of numerous fields. One such major section through a 9 ft. high lynchet on Fyfield Down produced structural evidence in the form of a low drystone wall which had originally marked out the field (Fig. 5), chronological evidence in the form of stratified potsherds spanning, though not continuously, the last centuries B.C. and the late 1st - early 2nd centuries A.D., and faunal evidence in the form of stratified snail shells indicating the gradual change from scrub to grassland in the local flora as a result of human activity in the same period (Fig. 6).

Here indeed is a good example of archaeological and environmental evidence dovetailing to the benefit of both, and of our understanding of how a typical area of old grassland, which now happens to be a National Nature Reserve, has come by its present appearance. While the archaeological importance of Fyfield Down cannot be overstated, surely the Reserve now has an even greater value and significance for environmental studies generally, and long-term research work, includinge field experi-

ments, in particular. Here is a classic case where our various interests focus on and overlap in a single area. Any informed management plan must take account of these several approaches converging from different academic starting-points; and clearly any basic decisions about the future of such an area must not be taken solely within the conventional frontiers of botany, ornithology or archaeology alone.

'Celtic' fields, where well-preserved, provide a sort of blanket datum representing a phase of land-use over hundreds of acres to which earlier and later phases can be related. My final examples concern a type of earthwork which provides a linear datum across the countryside; the 'travelling' banks and ditches which, in various forms, occur especially on the chalk downs, sometimes as short lengths across a spur, sometimes as miles of inter-related and often intermittent bank and ditch stretching across a rolling landscape of modern arable and old grassland (summarised with references in Grinsell 1958, 123-5). In the main, such features appear to have been boundaries, occasionally used as trackways or for defence, and of course, whatever their use, they closely relate to land-use and a settlement pattern at certain times in the past, particularly in the 1st millennium B.C.. Two excavated examples also demonstrate their use now as storehouses of information about local land-use.

A 'cross-ridge dyke' cutting off the spur of Buxbury Hill, one of a number of dykes forming a coherent pattern along the Ebble-Nadder ridge in south Wiltshire, was in part ploughed almost completely flat (Fowler 1964a, 1965). An excavated section across its presumed course not only proved its continuation but provided the soil samples and pottery from the ditch filling - no bank remained to sample - to reconstruct the local flora and suggest that the dyke itself belonged to the pre-Roman Iron Age while the cultivation which crossed it was of Romano-British date and not, as might be thought by just looking at this very attractive piece of old grassland, medieval or later.

Combs Ditch in Dorset (Fowler 1964b; R.C.H.M. forthcoming) is archaeologically rather different in appearance: 4 miles of relatively large bank and ditch, superficially defensive, facing northeast, and documented as a boundary from late-Saxon times onwards. But excavation showed how the earthwork had grown over the previous millennium from a very small bank through five reconstructions, each one related to a changing landscape as reflected in the snail shell conveniently sealed in the original land surface, and in each of the soil profiles which had time to develop on top of each new bank. Excavation was actually undertaken largely to answer the question whether the Ditch was built before or after the adjacent 'Celtic' field systems, and the snails from the original ground surface alone emphatically gave the answer. Consisting of shade-loving species, they indicated a wood - or scrub-

covered landscape, and other snails from the later levels indicate its gradual conversion to the open, arable landscape of Romano-British and indeed modern times.

In my mind, there is no doubt of the convergence of interest of archaeologist and ecologist on the same areas, and I hope these few examples demonstrate both this and the need for co-operation in both research and management of our limited old grassland resources. If an area is of ecological interest, then it is almost bound to be of archaeological interest too; and we archaeologists on our part must be alive to the opportunities of ecological research when we dig up the past, for we are doing more than exhuming human history. Furthermore, since naturalists are better organised than us, and are more successful in arousing public interest in, and sympathy for, our furry, feathered and floral heritage than we are for our man-made evidence, it makes good practical sense for us to support them in conservation policy - and to help them broaden their understanding in the process.

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CAPTIONS FOR THE FIGURES

Fig. 1. (a) Plan of the earthworks (black out) of the Bronze Age settlement on Itford Hill, Sussex, before excavation;
(b) plan of part of the settlement as excavated showing post-holes of timber structures and other features (after Burstow and Holleyman, 1957, fig. 3 and Pl. XVI).

Fig. 2. South Street Long Barrow, Avebury, Wilts. Plan of the subsoil surface after removal of the buried soil beneath the long barrow mound showing the Neolithic ard-marks and other features. The five stones are sarsens, placed in position during erection of the barrow (from Fowler and Evans, 1967).

Fig. 3. South Street Long Barrow, Avebury, Wilts. Histograms showing molluscan analysis from (A) the barrow ditch, and (B) the barrow mound (from Evans, 1968a).

Fig. 4. Fyfield Down National Nature Reserve, Wilts., in relation to previous and present land-use and recent archaeological fieldwork. The Reserve forms a grassland island in which earthworks are remarkably preserved. All around, except to the east where, ironically, few earthworks ever existed, modern arable is continuously destroying archaeological evidence, a process already begun to the

south in medieval times.

Fig. 5. Simplified section through a 'Celtic' field lynchet on Fyfield Down, Wilts. (cf. Fyfield Down I on fig. 6). Layer 9 is chalk subsoil, 8B a buried land surface, 8A disturbed (cultivated?) land surface, 7-3 accumulation of ploughsoils in the pre-Roman Iron Age, including 5A, a possible remnant of buried surface, and 2-1 Romano-British ploughsoil and topsoil, much-sorted by worms.

Fig. 6. Histograms showing molluscan analysis from 'Celtic' field lynchet sections on Overton and Fyfield Down, Wilts. In the lower, 'modern turf' equates with layers 1-2 of fig. 5, 'lynchet deposits' with layers 3-7, and 'pre-lynchet soil' with layer 8A. 'Root-hole fill' was beneath 8A, intruding into 9 (from Fowler and Evans, 1967).

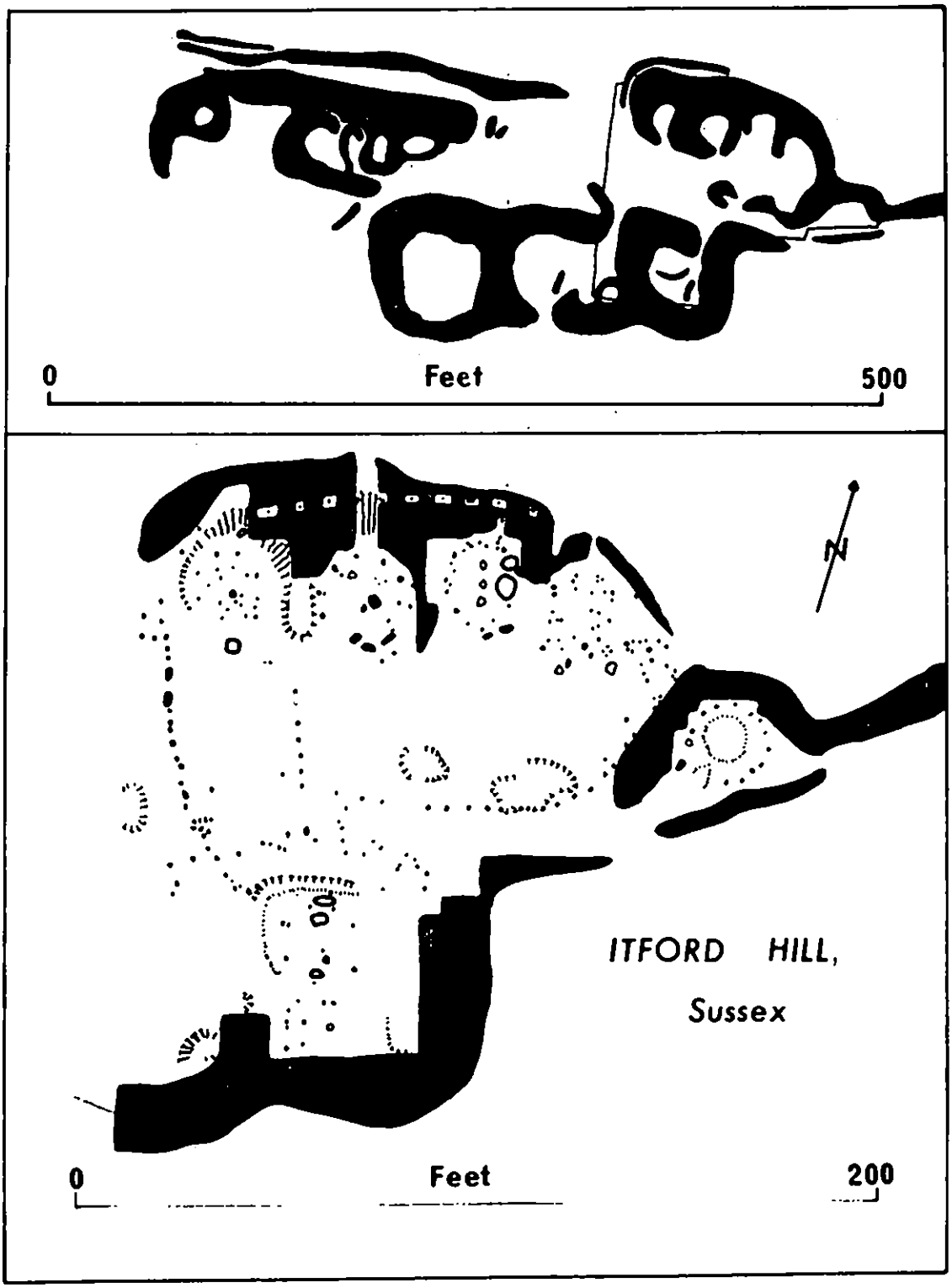

Figure 1

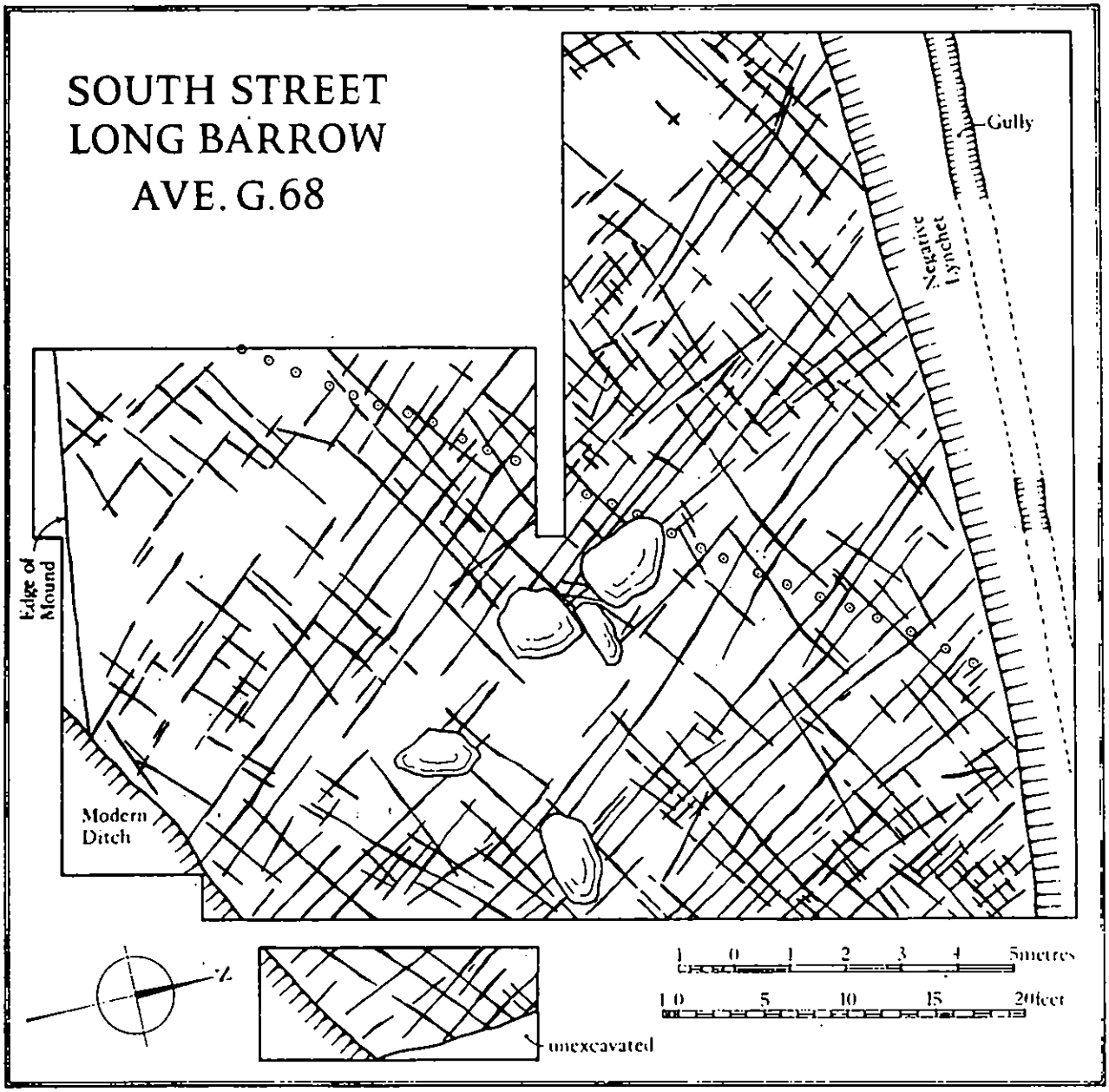
SOUTH STREET
LONG BARROW
AVE. G.68
Gully
Negative Lynchet
Edge of Mound
Modern Ditch
unexcavated
1 0 1 2 3 4 5metres
10 5 10 15 20feet

Figure 2

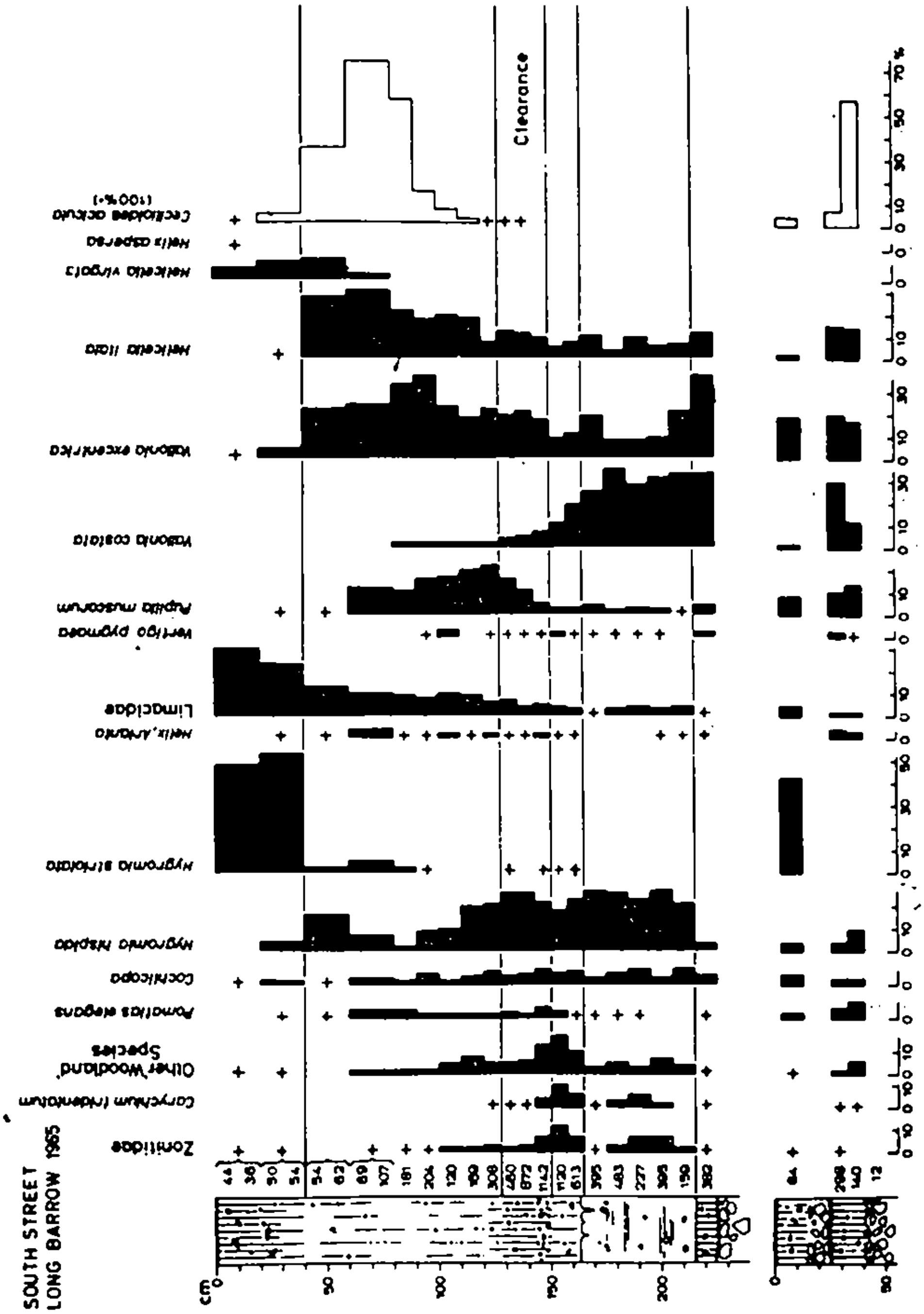
SOUTH STREET
LONG BARROW 1965
Clearance
Cecilioides acicula (100%+)
Helix aspersa
Helicella virgata
Helicella itala
Vallonia excentrica
Vallonia costata
Pupilla muscorum
Vertigo pygmaea
Limacidae
Helix/Arianta
Hygromia striolata
Hygromia hispida
Cochlicopa
Pomatias elegans
Other Woodland Species
Carychium tridentatum
Zonitidae
cm

Figure 3

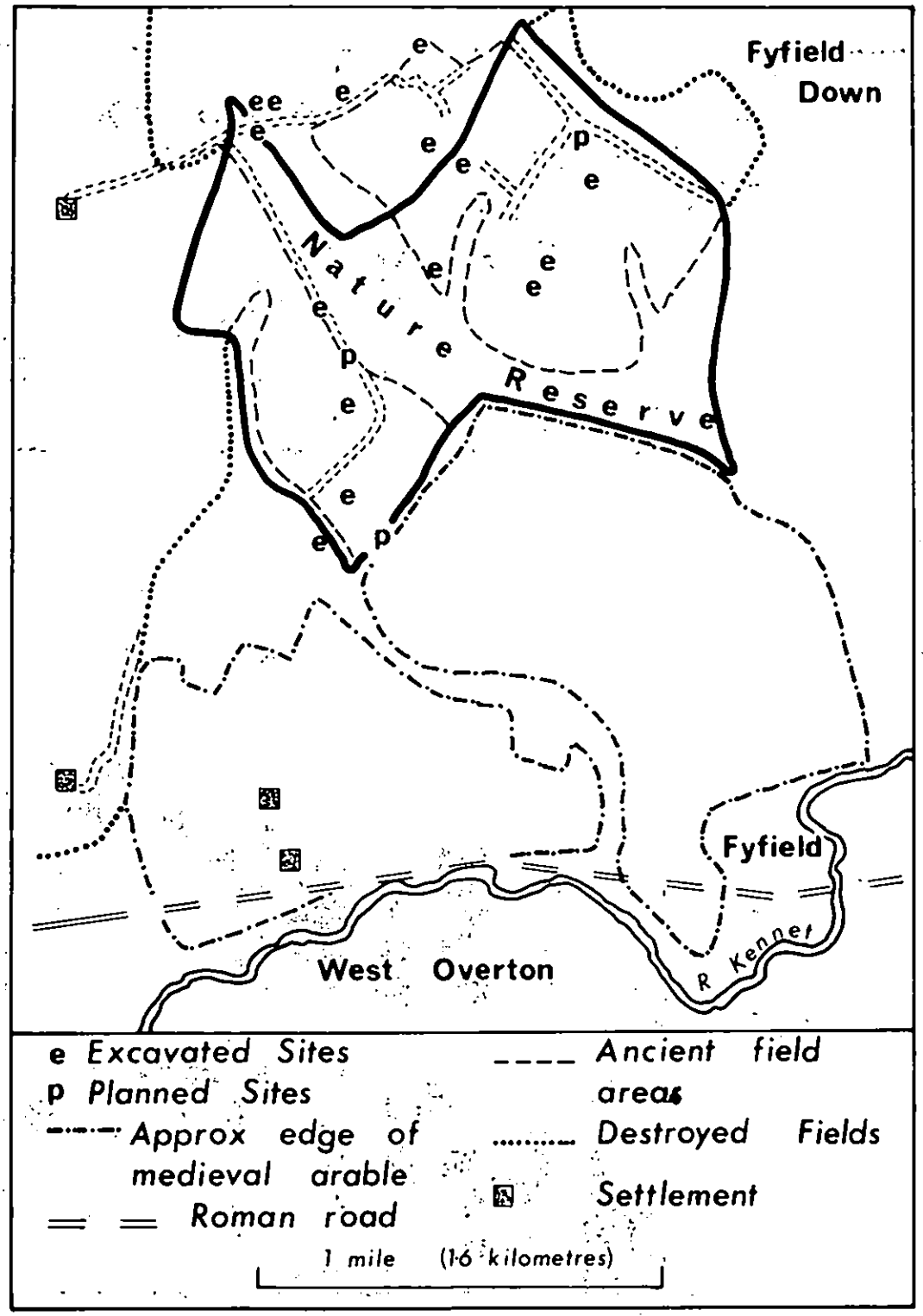
Fyfield Down
Nature Reserve
Fyfield
West Overton
R Kennet
e Excavated Sites
p Planned Sites
Approx edge of medieval arable
Roman road
Ancient field areas
Destroyed Fields
Settlement
1 mile (1·6 kilometres)

Figure 4

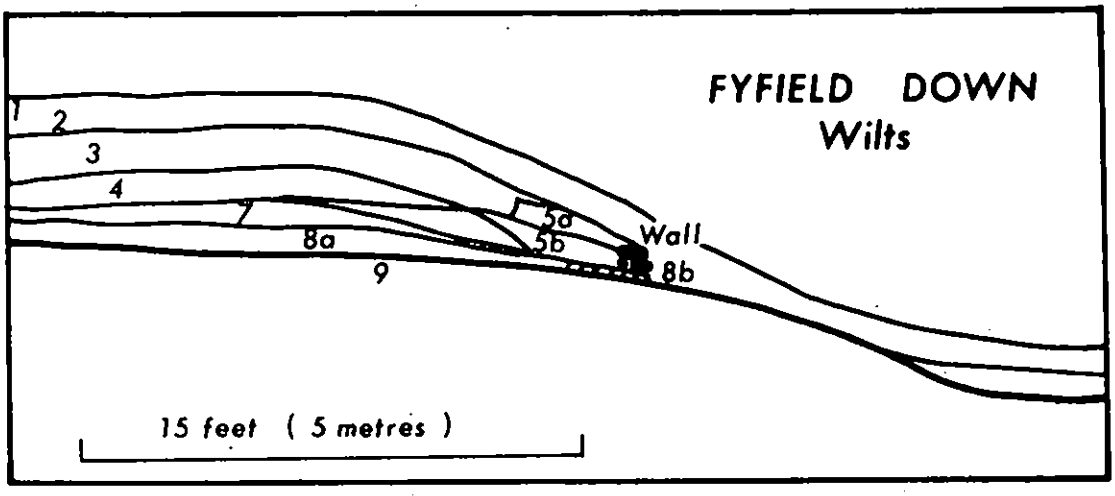

Figure 5

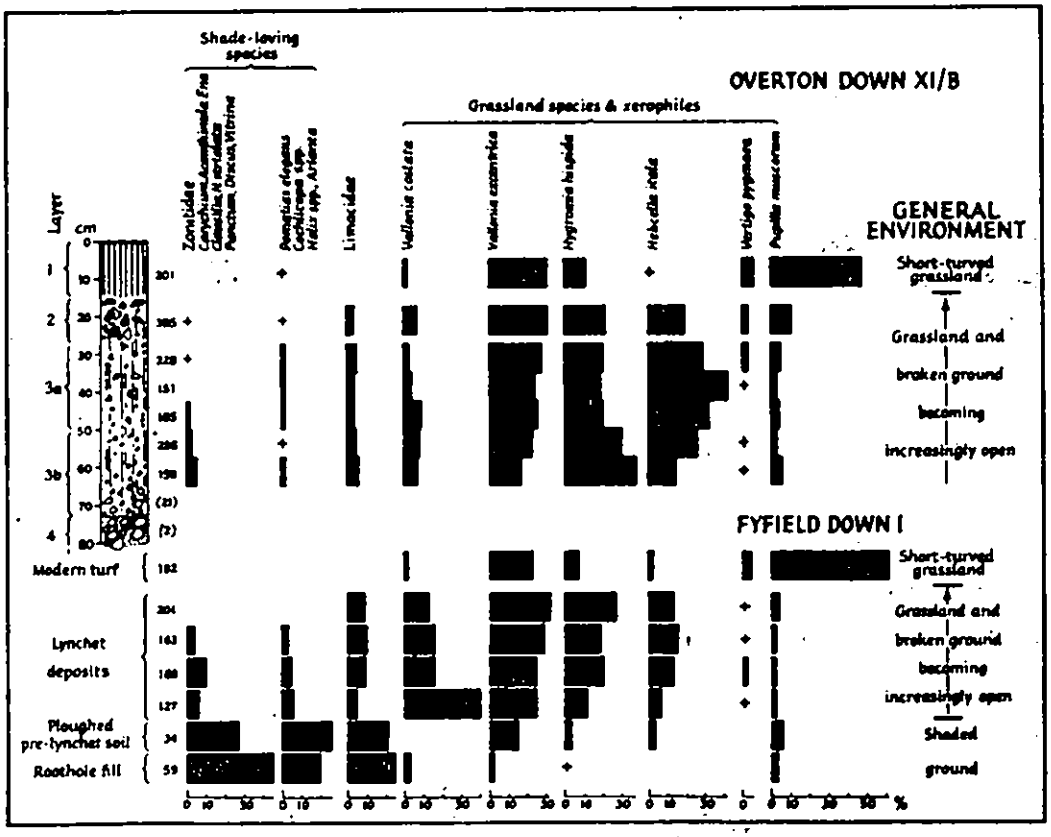

Figure 6

SUMMARY OF DISCUSSION

In answer to questions, Mr. Bowen and Mr. Fowler suggested that earthworks were best preserved under a thick cover of short grass. This protected the ridges and mounds from erosion and the short grass-cover allowed the layout of the earthworks to show up on the ground and in air photographs.

Earthworks were important because they contain evidence of former structures and human activity. The relationship of earthworks to one another suggested the chronology of activity and occupation, and for this reason as much grassland as possible should be preserved around the site.

Mr. Bowen felt that every earthwork site was likely to have some direct or incidental advantage to the ecologist. For example, there could be a correlation between the floristic composition of the old grassland and the length of time since the ground was last ploughed or occupied. In addition, Mr. Fowler pointed out that the archaeologist often excavated information on the natural environment of the past. The remains of invertebrates indicated the nature of their contemporaneous climate and vegetation.

PAPER 5

THE EXTENT AND CHARACTER OF BOTANICAL RESEARCH ON LOWLAND GRASSLAND

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In the first part of this paper I consider the question 'Who is doing what kind of research?' In the second part I review very briefly the current fields of research activity.

Who is doing what kind of research?

There are two main groups of professional botanists doing research on Lowland grasslands - those in Universities and Technical Colleges and those in Institutes that are primarily agricultural, most notably the Grassland Research Institute at Hurley near Reading, the Hill Farm Research Organization at Edinburgh and the Plant Breeding Stations at Aberystwyth and Pentlandfirth near Edinburgh

The botanists in Universities concerned with Lowland grassland are broadly classifiable as taxonomists (interested in the classification and distribution of plants) or ecologists (interested in plants in relation to each other and in relation to animals, soil and climate). The taxonomists concerned are partly occupied in writing modern local floras (as for Cambridgeshire, South Lancashire and Warwickshire) but are mostly interested in experimental taxonomy (biosystematics), which involves studies of variation within species and studies of the breeding systems and evolutionary mechanisms (see Briggs & Walters 1969).

The plant ecologists in Universities generally publish in the Journal of Ecology, Journal of Applied Ecology or New Phytologist and their interests are reflected in the distribution of papers in the Journal of Ecology between major topics in the year 1960-69 (Table 1). The greatest emphasis is on studies of single species (autecology). This emphasis is further shown by the publication of many 'Biological Floras' in the Journal of Ecology - accounts of 'all' aspects of the life-history and biology of particular species. Of 56 published in 1960-69, eleven were of typically grassland species and six of partly grassland species.

The botanists, in the agricultural institutes mentioned above, tend to work in teams and, at least in some cases, are associated with pedologists and zoologists so that an impressive all-round study of the ecosystem is made by a single super-unit. A great deal of work that might be included in experimental taxonomy is done at the plant breeding stations - not only on obvious species like rye-grass, cocksfoot or

white clover but also on species that are rarely or never sown for pasture, e.g. Red Fescue (Festuca rubra) and Tormentil (Portentilla erecta) (see Director's Reports, Scottish Plant Breeding Station, 1961-present).

Much of the other work of these institutes is on the classification of grazings, on the effects of grazing at different times and densities on the composition of the sward (see e.g. Kydd 1964), on the effects of fertilisers (see Thurston in Rorison 1969) and on the productivity of the sward or the cattle and sheep fed on it (see Ivins 1959 and the more recent Reports of the various Institutes). Some of the relevant fields are reviewed in the annual Advances in Agronomy. Brief accounts of research are published in the Journal of the British Grassland Society; most of these are 'purely agricultural' in intention but several have important implications for the general ecologist.

Besides the two main groups of professional botanists outlined above, there are those in the Nature Conservancy, who carry out two most valuable lines of research. First is the building up of an increasingly complete knowledge of interesting grassland sites left in Britain. Second is the accummulation of experience in practical management (cf. T.C.E. Wells Paper 9). In both these lines considerable assistance comes from the amateur botanists and the professionals in museums and schools, who are becoming more and more conscious of, and involved in, practical conservation and no longer primarily concerned with the 'stamp-collecting' approach. Despite this, valuable contributions are still being made in the cataloguing sphere (cf. Proceedings of the Botanical Society of the British Isles and the new county floras of Berkshire, Hertfordshire, Nottinghamshire & Wiltshire). The new county floras are mostly ecologically oriented and provide much valuable information besides bare distrubution data. What is needed now is a cataloguing of habitats and not just species. This is being done by a number of County Naturalists' Trusts, e.g. in the field-by-field survey of grassland in Leicestershire.

A review of current research activity

Description and classification of grasslands

Much current work on classification is statistically oriented, concerns small areas and is not very useful to conservationists. A few botanists are working over wider areas. Although little has been published recently, their efforts are important as part of the cataloguing process.

Factors of the soil and aerial environment affecting occurrence of species

There is no room here to review the considerable number of studies

being made of factors affecting the growth of individual species (cf. Table 1). Some idea of the present state of knowledge may be gained from reference to Ellenberg (1963), Hutchinson (1967) and Morison (1969). Many of the studies are exercises in 'pure biology' but some are designed to answer field problems (e.g. Grime 1963; Newman 1964, 1967).

Studies on the grassland community

a) Regeneration of grassland. Any sound understanding of the long-term control of species-balance must be based on a proper knowledge of the process of regeneration. This process seems to be basically different from that in woodland, where regeneration is by growth in clearings. In grassland there are no clearings formed by the fall of dead or over-mature plants because the living plants spread sideways and fill in any ground that becomes available relatively quickly. There is growing evidence that individual grass and herb plants may be quite as long-lived as trees (Tamm 1956; Harberd 1961) and that grassland seen over a long period appears as a kaleidoscopic pattern of plants 'wandering' amongst each other - some, of course, wandering further and faster than others (Leith 1962; Austin 1968). This process ensures that in tall grassland there are no persistent well-lit sites for seedling establishment - in the absence, that is, of animal activity such as breaking of the turf by trampling stock or building of soil-heaps by moles. The latter activity is very widespread and I have been following the effects in various sites. The provision of open ground in tall grassland is of importance for conservation since it allows the persistence of rare short-lived species, such as the annual Candytuft (Iberis amara) or the biennial Hairy Rock-Cress (Arabis hirsuta). Mole-heaps also have important effects on the balance of species among the perennials.

All these remarks on regeneration apply to relatively tall grassland not formed of an even-aged set of highly tussocky plants. The long-term pattern of regeneration in tall, highly tussocky grassland, e.g. that of Purple Moor Grass (Molinia coerulea) is not understood. We are also ignorant of the amount of regeneration by seed of perennials in closely grazed grassland: clearly many annuals thrive but that is not sound evidence that perennials can establish from seed.

b) Studies on competition and complementarity of species. Several studies have been published in recent years on competition between pasture grasses and between grasses and legumes. Several groups of research workers are interested in the basic physiological processes of competition (interference) through shading, root competion or production of toxic exudates (see reviews in Milthorpe 1961). These studies are important for building up an understanding of the control of the relative abundance of species in grassland. Other workers are interested in the issue of

competition - complementarity from an evolutionary point of view (see Harper 1967). In species-rich grassland how can so many species be complementary to each other when the basic needs for all of them are apparently the same - light, carbon dioxide, water and certain mineral nutrients? Why have not the few most efficient ousted all the others in the struggle for existence? The answer may lie partly in species being spring-growing or summer-growing, deep-rooted or shallow-rooted etc., but possibly more important are differences in requirements for establishment - larger or smaller gaps in the sward, hot summers, wet summers etc. We have almost no information on the precise conditions necessary for the establishment of even major grassland species and little work is being done in this sphere (cf. Cavers & Harper 1967).

c) Downgrade processes in grassland. The breakdown of dead leaves, stems and roots in grassland is very poorly understood. The general features of the fungal successions on the various organs are becomming clearer (Hudson 1968) but the part played by animals is only just beginning to be understood (see Overgaard Nielsen in Elton 1966).

d) Studies on the effects of biotic factors including man. The direct effects of the most obvious biotic factor - grazing and release from it - are now pretty well understood (see e.g. Watt 1957; Elton 1966; Grubb et al. 1969) and belatedly the effects of anthropogenic fire are being studied (Grant et al. 1963; Lloyd 1968). However the effects of trampling, defaecation and urination are poorly understood. In this context studies of soil properties, of productivity and of nutrient cycling in the ecosystem, such as those carried out by the Hill Farm Research Organisation in southern Scotland and for the International Biological Programme at Aston Rowant National Nature Reserve in the Chilterns, are particularly valuable.

Probably the single most important change of outlook shown by ecologists in the last decade has concerned the biotic factor. This change has been the long overdue recognition of the overwhelming impact of man on the landscape, brought to our attention by the evident need to manage in a positive fashion the growing number of nature reserves. Putting a fence round them did not suffice. Along with this realisation has grown an appreciation of the need to interpret site differences, e.g. over the presence or absence of some interesting rare species, as much in terms of the histories of the sites as in terms of, say, soil nitrogen or water status. This change of emphasis is reflected in three of the papers to be given on the second day of this Symposium. A great deal of co-operation from local historians and from archaeologists will be needed in the next few years. Experimental and observational work, e.g. on developments on land once ploughed or sown for pasture and then abandoned will also be important (see Lloyd & Pigott 1967; Wells 1967).

SUMMARY

Much plant ecological work in Universities is concentrated on single species and is physiological in approach; much of it is not very useful to conservationists. Some 'useful' work is done on communities, e.g. on effects of grazing or fire.

Much work done in agricultural institutes is useful to conservationists: experiments on competition and complementarity of species, on control of sward composition by different grazing and fertilising regimes and on productivity and nutrient cycling in the ecosystem.

Extremely little work is being done on the features of grassland ecology most central to sound conservation: rates and patterns of change in the sward, control of sward composition by regeneration processes and causes of rarity.

It is high time that Conservancy and University botanists got together to remedy this position.

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TABLE 1

Papers relating more or less directly to old grassland in lowland Britain, published in the Journal of Ecology 1960-69.

Studies of single species, including physiological studies.	39
Studies of plant communities: descriptions, successions, history, microclimate, relations with soil.	
Effects of man (including fire) and other animals.	
Population studies: long-term records from nature, ecotypes, experiments with simplified crops.	
Productivity studies and nutrient cycling.	
Statistical analyses of vegetation.	9
Total	79

THE EXTENT AND CHARACTER OF ZOOLOGICAL RESEARCH ON LOWLAND GRASSLAND

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In recent years a new and original aspect of zoological research on grassland, conservation research, has been added to the existing long-standing interests of zoologists in pasture/grazing animal relationships, grassland pests, and grassland as a 'background' to more fundamental zoological studies. A considerable amount of work has been done on various facets of the grazing animal/pasture relationship which is relevant to the management of grazing animals for conservation, but not to the conservation interest of grassland in general. Much applied research has been done on the grazing of domestic animals such as sheep and cattle and work on wild mammals such as rabbits and voles is not inconsiderable. We do not wish to discuss this work in detail, but hope that Dr. Jewell and others will contribute to the discussions where appropriate. As far as the importance of old grassland to grazing mammals is concerned it is perhaps time to say that other kinds of grassland such as leys are often more productive of herbage and that minerals, known to be abundant in the forage of old grassland, can be fed to stock as additional items of diet. On the other hand some natural grasslands may be equally productive as sown ones under certain conditions, and are frequently better adapted to withstand natural phenomena such as flooding. Moreover in many cases old grassland is not worth 'improving' agriculturally on a cost/benefit basis.

In the last decade a considerable amount of work on quaternary fossil invertebrate faunas has been done in Britain. Some of this is relevant to grassland studies, for instance the work on two faunas at Shustoke, Warwickshire (Kelly & Osborne 1964) which shows the effects of forest clearance on the representation of different types of Coleoptera (beetles) in the two faunas. A recent development of this type of work relates directly to archaeology, and we hope that Dr. Speight and Mr. Evans will tell us something about their studies during the discussion.

For the remainder of our paper we wish to consider the research which has been undertaken on grassland which is relevant to its conservation interest and management. Such research has been concerned chiefly with invertebrate animals. It is important to realise the order of magnitude of the numbers of invertebrate animals which occur in grassland. In a classic paper Salt et al. (1948) recorded 264,000 arthropods to the square metre of pasture turf and soil (in the top 12 inches), of which 94,000 were insects and 164,000 mites; about 70%

of the total occurred in the top 6 inches of turf/soil. Although most members of the fauna were minute, 142 spiders and 4,000 beetles were included, for example. About 24,000 species of insect occur in Britain, more than 1,600 species of mite and about 600 spiders. Although many of these do not occur in grassland the numbers which do are formidable. About half the 1,600 or so British flowering plants occur on calcareous soils; at a very conservative guess ten times as many invertebrate animals do so.

Most of our primary information as to what species of animals occur in lowland grassland comes from the work of amateur naturalists during the last 100 years or so. The ecpertise developed by such workers was very largely taxonomic and morphological, so that this type of information has tended to outstrip that on ecology, behavious and distribution. As a result we have often a good idea of the taxonomic range of species occurring in grassland, but a very poor knowledge of the composition and functioning of communities and ecosystems, except in the most general terms. Most of the early naturalists were collectors, but examination of old collections tends to be disappointing because the importance of recording adequate data, particularly of an ecological nature, was not realised. Moreover, although the presence of a species in a particular locality may have been recorded, absences are very sledom noted and neither are numbers of individuals nor the association of one species with another. The occasional early paper may be of relevance in grassland ecology, e.g. that of Boycott (1934) on Mollusca, but such papers are few. Perhaps we are too familiar with the generally satisfactory state of invertebrate animal taxonomy in Britain to appreciate how fortunate we are; workers in other countries, especially the tropics, have a very different state of affairs to contend with.

Two important features of the ecology of grassland invertebrate animals must be stressed before considering in any detail the research which has been done; these are the specificity of many plant/animal relationships and the importance of structure in the ecosystem. Many animals, especially insects, are restricted to one or a few species of foodplant. Some examples were given by Duffey and Morris (1966). In general, it is only common and widely distributed species of plant which support many kinds of monophagous insects (those restricted to a single foodplant). Bastard toadflax (Thesium humifusum) is a relatively uncommon plant which supports two such species, the caterpillar of a small moth, and a heteropterous bug, but plants which are rarer than this usually have no specific associated fauna. To the extent that old grassland supports a rich association of plant species, compared with other grassland types, it may be regarded as potentially richer in animal species too, but this general trend is often obscured by the over-riding influence of structure. In fact there is no good published information which shows that old grassland is richer in animals, although clearly we believe this to be the case.

Structure is important even in the case of single species of plants, because different insects feed on different parts of the plant. Roots, stems, leaves, buds, flowers and fruits all have different invertebrate animals feeding on them (see Morris 1967, 1969); and where one or more of these structures is absent, or reduced in number or quality (e.g. in an intensively grazed sward) the specific insect feeders and their parasites may be similarly absent or reduced. Morris (1967) showed that differences of the order of X100 occurred in populations of weevils specifically associated with fruits of Birdsfoot Trefoil (Lotus corniculatus) and Harebell (Campanula rotundifolia) on grazed and ungrazed chalk grassland plots. The most diverse structure is seen in trees and shrubs, such as Juniper, with which one of us (L.K. Ward) has recorded the following approximate numbers of associated invertebrates in Southern England:

feeding on needles, buds and shoots	18
" " flowers and berries	14
" " bark, lichens and algae	15
predators	45
parasites (incompletely studied)	12
overwintering	10
Casual visitors	70

But structure is also important in herbs; for instance, at the Barton Hills, Bedfordshire, Hardheads (Centaurea nigra) supports a leaf-mining weevil, a leaf-feeding beetle, a stem-boring weevil and several different flies (and their parasites) in the seedheads, while the flowers are an important source of pollen and nectar for several species of bee.

The overall structure of grassland is of over-riding significance to a very large proportion of the fauna, even where it is not primarily associated with individual plant species. Although in studies of grassland spiders Duffey (1962a) could assign 63% of 141 species recorded to the ground zone, he was able (1962b) to distinguish four different groups of species recorded in the field layer: permanent inhabitants, species using field-layer plants for constructing egg-cocoons, hunters in the field-layer and aeronautic species. The importance of gross vegetation structure is not invariably associated with food supply, as Dr. Duffey's work shows; another example is the need of many bird species to have scrub in which to nest.

It is a matter of common observation that old, unbroken grassland often supports interesting species of invertebrate animals which cannot be found in grassland of similar gross structure but of more recent origins. The factor of physical disturbance seems to be of importance for some species, which may only occur in areas in which management has

been minimal. The draining, ploughing and reseeding of leys and other grasslands not only destroys structure in the grassland, such as animal scrapes, burrows and tussocks, but creates a general disturbance which is not generally to the benefit of the more interesting invertebrate animals. We cannot here list all the possible ways in which leys tend to differ from old grasslands as animal habitats, but hope that this point will be raised in discussion.

In the field of conservation research, recent work has determined some of the differences between grazed and ungrazed grassland. Ungrazed grassland generally supports more invertebrate animals than grazed (3.7 times as many in one study on Chalk by Morris, 1968). For some species ungrazed grassland ceases to be an optimum habitat after three season's absence of grazing, e.g. in the case of the small lacebug Agramma laeta (Morris, in press), while for others ungrazed grassland of this age appears to be only beginning to be a favourable habitat (e.g. the mirid bug Mecomma dispar). There seems to be some evidence that cut grasslands may be richer than grazed or ungrazed grassland of similar type. Thus Southwood & van Emden (1967) record more invertebrate animals from cut acid-to-neutral grassland in Berkshire than from uncut, and Southwood & Jepson (1962) have recorded greater productivity of Frit fly (Oscinella frit) on the same cut grassland as compared with the uncut. It is necessary, however, to confirm these results, as much depends on the height of cutting and other factors.

Ungrazed grassland is rarely uniform in structure because of the phenomenon of tussock formation. Luff (1965, 1966) studied the morphology of Dactylis tussocks in relation to the beetle fauna, which is known to overwinter in grassland very largely in tussocks. He also considered the diversity of the coleopterous inhabitants of grass tussocks. In general, ungrazed grassland is richer in species than grazed, and measurements of diversity of the faunas have recently been made in other cases. The formation of a 'litter layer' in ungrazed grassland is important for many animals and future work in the Grasslands Division is planned to investigate the effects of trampling upon litter and its fauna.

The relevance of much recent zoological work to grassland ecology is considerable, but as the zoological aspect is the primary one very frequently the type of grassland studied is of secondary importance. Thus much work on grassland leafhoppers (Auchenorhyncha) is at present being done at Silwood Park (Imperial College, London), but essentially this work only uses grassland, it does not study it. Similarly, grassland is an essential background to many types of population study, such as those of Pontin (1961, 1963) on ants. For many studies of this type old, or natural, grassland is not essential because animal populations occur in most types of grassland. On the other hand conservationists regard work done on old grasslands as essential because of the rapid disappearance of such grassland.

The work of Salt et al. (1948) already mentioned was done in relation to a survey of wireworms in Britain, while work on Frit fly by Southwood & Jepson (1962) has been mentioned. Although the ecology of pasture pests is not as well-studied as that of pests of other crops there is a considerable literature on these animals. Recently Henderson has been studying the effects of pests on pasture productivity at Rothamsted. Again, such work is generally orientated towards grassland which is not usually of much value to the conservationist.

To sum up briefly: the volume of zoological work specifically done on old grassland issmall but increasing. There is a large and important amount of highly relevant work, but this can generally be applied to old grassland only by extrapolation and analogy and not by direct methods.

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SUMMARY OF DISCUSSION

Dr. Grubb thought that more botanical research on various aspects of the grassland community would be valuable to conservation. Studies on how long a plant would live would be useful, and he pointed out that some perennial grassland species seem to be able to persist as long as trees. Mr. Owen suggested that it may be many years before the vegetation completely adjusts to changes in grazing pressure; the longevity of some species being an important factor in this process. Mr. T.C.E. Wells was able to give examples of longevity in the Pasque Flower (Anemone pulsatilla) which had survived more than 10 years in scrub on Steps Hill, Bucks, and the Man orchid (Aceras anthropophorum) which had survived, presumably as a tuber, for a longer period of time in thicker scrub at

Tottenhoe Knolls, Beds. Both species had recovered and flowered after removal of the scrub and long grasses. Dr. Smith thought that the plant breeder and agricultural botanist would like to sample the old grassland on archaeological sites as this would assist studies of the longevity of agriculturally-important species.

The speaker thought that the establishment of species from seed was important in the grassland community, and in answer to a question from Dr. Poore about the reserves of dormant seeds in old grasslands said that these appeared to vary from place to place. He remarked on the value of mole activity in turning up earth on which seeds could germinate. Another speaker noted the importance of cattle feed in introducing seeds.

Dr. Grubb considered that the reasons for mortality of seeds should be studied and pointed out that many seeds germinated but few survived to establishment.

Colonel Floyd said he had observed how the floristic composition of the sward reflected period and intensity of grazing and cutting and said he had noticed that this could sometimes be seen by comparing swards of fields at different distances from the farm. He suggested that the abundance of Sweet Vernal Grass (Anthoxanthum odoratum) in hay fields on the periphery of certain farms in Wiltshire was a result of late cutting.

Dr. Morris said that much botanical and zoological research was not directly related to conservation and so information had to be inferred from work in other fields. There was relatively more botanical research that could be used in conservation than zoological, and he gave a total figure of 14 papers that included some relevant work on grassland ecology of animals appearing in the Journal of Animal Ecology in the period 1960-69. Taking into account the larger outlet of journals for zoological research, this still compared unfavourably with Dr. Grubb's figure of 79 papers on Botany (Table 1). One field of research in which zoologists had a greater experience than botanists was population dynamics.

The speaker was asked if rare plants had a specific fauna. Dr. Morris said that although it was generally true that rare plants did not have a well-marked fauna in this country; where these plants were common in Europe they often had a richer fauna.

Mr. Oxley pointed out that there was a conflict of interest between the short even turf wanted by the archaeologist and the taller grass cover favourable to many invertebrates. The speaker replied that the question of objectives had to be considered here; he thought that the value of rotational management was of importance to the zoological aspect of grassland.

Mr. Owen said that archaic forms of agricultural management must have had a considerable impact on the floristic composition of grassland. It was important to recognise that many insects had survived in spite of the management, rather than because of management.

Dr. Speight said that there had been few studies on the invertebrate remains found in field monuments, but what had been done suggested that certain groups, particularly the Coleoptera, were well preserved while other groups of soft-bodied insects were not. It was probable that evidence from insect remains could be used in reconstructing past habitats.

In answer to a question from Dr. Mellanby, Dr. Ward said that scrub was a habitat type that should be considered, it was useful educationally especially in demonstrating succession. It might have a place on some archaeological sites in the form of scrub hedge belts which would add to the sites by increasing the diversity of plants and animals, by improving shelter and scenery, and scrub could sometimes act as a barrier directing public pressure away from certain areas such as where orchids grew.

THE HISTORICAL APPROACH: PROBLEMS AND PITFALLS

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Some historians, no less than archaeologists and ecologists, are interested in the origins and past land use of old grasslands. And indeed there is a certain initial attraction in the historical approach of using apparently factual statements, referring to actual land use in the past, recorded in documents. Yet the historian has his problems, which need to be appreciated by non-historians if the historical approach and its techniques are not to be misused. The problems are serious, especially the further back one goes in time, and they are most serious at the very point at which the archaeologist and ecologist are usually most sure of themselves, i.e., at the level of detailed local studies, perhaps covering only a few acres of land. The historian can usually give a reasonably accurate account of the history of the land use of a given area of grassland, back to perhaps the 17th century. In the later medieval period he can often give a general idea of what has happened to a larger area of land, within either a group of parishes or perhaps a single parish. To be sure about the detailed history of a small piece of grassland at this time is usually beyond his capacity unless he is extremely lucky. In the early medieval period the historian can say little about the origins and land use of small areas of old grassland.

It is worth noting to begin with some of the more general historical difficulties before going on to look at more detailed problems associated with specific types of old grassland.

Availability of documents. Most agricultural activity, even in the recent past, was not carried out by great landowners, though one tends to forget this when wading through vast collections of estate documents in record offices. Much of it, and this is especially true of what is now old grassland in former forests, downlands and heathlands, was undertaken by small farmers who never recorded their work, and therefore there are no documents. In addition, the documents that do exist become fewer the further back into the past one goes, so that by the 12th century, there are virtually none that can help us with our particular problem.

Purpose of documents. Most available documents, especially those of the medieval period, of the detailed kind that we need for our work on grassland, were not of course written for historians or indeed farmers. Usually they were legal, semi-legal or accounting records, and not agricultural handbooks. They are therefore of very limited use when dealing with specific areas of grassland.

Interpretation of documents. This is the problem of how far we can accept an apparently factual statement at its face value. Many documents, because of their legal purpose, often repeat set-phrases and descriptions which may or may not be a true statement. An example of this may be seen in a small group of grassland fields in a south Wiltshire parish which, from their shape, appear as if they had been formed by the cutting down of the adjacent forest at a late date. They were called Burnt Grounds in 1842, but were recorded as New Burnt Grounds in 1704. The initial assumption that they were therefore of early 18th century date was shattered when it was noted that the same name was being given to these fields in 1618. All one can say is that these fields are pre-1618 in origin. The classic example of this problem, which, while not strictly concerned with grassland, illustrates it so well, is that quoted by R. Lennard (1964).

In the Account Rolls for Crawley for 1448-9 is a note indicating that land formerly leased has been taken into the demesne. But the same note concerning the same land is recorded in the Accounts for 1356-7, again in 1256-7 and is in fact listed in the earliest surviving Accounts for 1208-9. What is recorded in the mid 15th century as if it were a recent event had in fact occurred at least 240 years before.

All this is somewhat pessimistic. Some historians would perhaps disagree with this pessimism and quote examples of how documents can reveal the origins and land use of old grassland. But it is likely that most of their examples will be of post-medieval date, and concerned with areas of former open or common-fields whose date of enclosure is well recorded. Far too much agrarian history has been written about this type of land, to the detriment of others which were just as important in the past. We are still too concerned with late parliamentary and private enclosures of both former common-fields and wastes. But many of us who have lived and worked in areas far removed from the Midlands pattern of late enclosure know only too well the wide variety of other forms of agricultural activity which have produced various types of old grassland, and appreciate the difficulties involved in the historical approach to its dating and land use. It is now time to look at a few of these types and to see in more detail some of the problems.

Forest Edge Grasslands.

One of the most widespread types of old grassland field, which still exists to a remarkable degree, is that which lies in formerly forested areas, and which owes its origin to the "assarting" of the wastes over many centuries. On field evidence alone it is often easy to distinguish the irregular shapes and massive hedge banks of the medieval enclosures from the rectilinear forms and more "normal" hedge banks of

the later fields. From surviving documents, especially from the Forest Eyres, where the land was a Royal Forest, one can get a general view of how these fields originated. But accurate dating is usually impossible. Though the documents give the date and acreage of the new fields, they are rarely specific enough to identify the actual fields involved. In addition, the total acreages given for the newly enclosed land, which can sometimes be ascertained when there are complete runs of documents over a long period, always fall short of the actual area which appears to have been enclosed. This presumably means either that much assarting was never recorded, or, far more likely, that most of it was carried out at a time long before documents existed and thus the documents are recording only the last stages in a very long process of piecemeal enclosure. This particular problem was not brought out by the writer in his work on this type of grassland in south Wiltshire (Taylor 1967). There I confidently assigned the origin of large areas of grassland fields to the 13th-century. But this is by no means certain, and in retrospect it seems that much of this enclosure took place much earlier than this, long before there were documents to record it.

Water-Meadow Grasslands.

This type of permanent old grassland is also widespread, particularly in the valleys of the chalklands of Wessex. The method of "floating" water-meadows was introduced into these areas in the early 17th century, though most of the remaining meadows are of 18th or 19th century origin. Yet it is extremely difficult to date by purely historical methods any particular block of water-meadows. The construction of many of them was either never recorded, or the records have not survived. Even where detailed records have survived it is often impossible to identify individual blocks of meadow, and again it is clear from ground observation alone that the really complex arrangements of water-meadows were developed and extended gradually over a long period of time. In addition, there are also examples of "bastard" water-meadows, often of a curious and unusual form. The writer has examined some of these in Cambridgeshire, but no record of their date, method of construction or operation has apparently survived.

Heathland Grassland.

Much old grassland also survives in the heathland areas of this country, especially on the Tertiary rocks of southern England, in the form of small fields of both irregular and geometrical shapes, and associated with little farmsteads and cottages. Once again these fields are extremely difficult to date by purely historical techniques. In a few cases 13th century documents record the formation of some of these fields in certain areas, but the same difficulties noted above with regard to forest grassland are still present. Elsewhere there is virtually no

detailed documentation. The association of some of these fields with farmsteads which appear to have been in existence in the 11th century (i.e. recorded as villein farms in Domesday Book) suggests that the fields may also be of 11th century date or earlier. But this cannot be proved. Further, many of the more geometrically-shaped fields are clearly relatively modern, and yet again are completely undocumented in many cases.

Downlands.

The detailed land use of old grassland on chalk downland is again not easy to unravel, using only historical techniques. Very little documentation of the temporary medieval ploughing of these areas survives, if it ever existed. Only in the post-medieval period is there sufficient documentation in some places to recover an accurate picture of land use. This does go some way in showing us how much of what is apparently old grassland was taken into cultivation in the 18th- and 19th- centuries and has only recently reverted to grass.

Conclusion.

The writer has been concerned here to point out the problems and pitfalls of the purely historical approach to the study of old grassland, but it is possible to end on a more hopeful note. As pure historians our contribution is limited, but if we work in conjunction with archaeologists,geographers, ecologists and others we can achieve much. The archaeologist can provide, from field-work and excavation, many details of land use which are not recorded in documents; e.g. they can identify the slight traces of both medieval and 18th and 19th century ploughing on chalk downland. This has been done by the Royal Commission on Historical Monuments and others in Dorset and Wiltshire. The geographer can provide evidence from field shapes of the origins of enclosures in forest areas which are not documented or are ill-recorded. This has been done in Needwood Forest in Staffordshire where the early medieval fields are clearly distinguishable from those of the 15th century (Yates 1965). The ecologist can from botanical evidence in woodland, in hedges and along verges help to solve the problems of adjacent grassland fields whose history is undocumented. This has been started in S.E. Cambridgeshire where ecological studies are producing a detailed picture of the origins and land use of the forest grasslands there. Even architectural historians can help, for the dating of late grassland fields in the Dorset heathlands has been achieved by the examination of the contemporary adjacent cottages and farmsteads which are usually of the 18th and 19th centuries. The historian can provide the general background and occasional detail to all these studies.

Rarely can all these people individually hope to piece together the

complex history of old grassland. Collectively they can achieve a great deal. Perhaps this Symposium will go some way towards achieving the co-operation which is needed.

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PAPER 8

THE HISTORICAL APPROACH TO THE ECOLOGY OF ALLUVIAL GRASSLANDS

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Alluvial grasslands were noted in the past for their luxuriant plant cover and as refuges for birds, especially in winter when they were flooded. The farmer regarded them as the most valuable part of his holding, often paying twice as much rent for the meadows than for any other land. Today, they remain a distinctive habitat, but one which is threatened in many parts of Lowland England by changes in land use and land management.

Where are these grasslands found? They are located along stream and river valleys, on mineral soils with a high base content. Very often, there is a high humus content and, together with a high nutrient status, the alluvial grasslands are potentially very productive, but this is dependent on a reasonable water supply. There must be adequate water in spring and summer for maximum grass growth, and yet water-logging above and below the ground surface must be avoided.

The water regime imposed on a meadow, whether naturally or by man, will greatly influence the botanical composition of the sward, and indeed alluvial grasslands can be divided into three broad categories of (i) flood-meadows (ii) water-meadows and (iii) washlands. As these terms are indiscriminately used, it will be advantageous to define them here.

Flood-meadows are formed by the deposition of soil following natural, regular flooding in winter and very occasionally in summer by the associated river. Flooding is for short periods only, i.e. a matter of days and the drainage of surface water is rapid.

Water-meadows. These were created by man, mainly in the seventeenth and eighteenth centuries, in order to make the then low-lying and ill-drained land more productive. The basic idea was one of ridge-and-furrow, with an elaborate system of ditches for irrigation, via the ridges, and drainage, via the furrows. This type of alluvial meadow is mainly associated with the chalk streams of southern England. Flooding is by running water for 2 to 3 days at a time, throughout most of the year, and is controlled by man.

Washlands. These were created by man by embanking an area of land to accommodate winter floods in the lower reaches of a river flowing

through a very wide and potentially fertile plain, e.g. the rivers of the Fens. They are continuously flooded during winter and early spring, when the water is allowed to drain back into the river. In very exceptional years, very high summer flash-floods are taken into the washlands, but normally they remain dry from late spring until winter.

Because washlands and water-meadows were man-made, some attempt can be made at dating the present sward. For example, the Ouse washes were formed by the cutting and embanking of the Old Bedford river (1636) to the west and the New Bedford river (1651) to the east. The land between these man-made water-courses was used to contain flood waters from the river Ouse and before 1812, some marine tidal flooding occurred. In 1812, an Act was passed noting the construction of earthworks within the washes to prevent marine flooding. Therefore, since the beginning of the 19th century, the Ouse washes have been flooded only by fresh water brought down from the East Midlands by the river Ouse. This has led to a reduction in the frequency of maritime species, such as Aster tripolium and Scirpus maritimus. Indeed, the former species has not been recorded since the turn of this century and may now be extinct.

The dating of water-meadows is more difficult than for washlands but, on the Rivers Test and Itchen, Hampshire, we have been able to date the formation of many water-meadows, on the basis of evidence contained in documents related to leases, tenancy agreements and disputes. The age of the present-day sward can sometimes be deduced from this kind of documentary source material.

A great deal of ecological interest is centred on one form of flood-meadow, the Lammas Lands, where the pattern of land management in the past can be deduced with a reasonable measure of confidence. The Lammas Lands usually had a traditional method of management, prescribed by traditions which dated back to medieval times and beyond. At Cricklade, Wiltshire, there exists about 140 acres of Lammas Land, which are still subject to legal clauses which stipulate that grazing may take place between 12th August and 12th February. The grazing rights are granted in perpetuity to the people of Cricklade. After mid-February, the area is shut up for hay, sections of which are cut by any person prepared to buy the "hay doles". The hay doles are bought and sold from time to time in the same way as any normal land purchase. There is a variation on this system in the Acle marshes, Norfolk, and in the Somerset Levels, where the Church Commissioners and Parish Councils (but occasionally private individuals) lease the hay or grazing rights on an annual tenancy by auction.

These areas are of great interest because the grasslands have been used in the same way for a very long period of time, but very little research has been carried out on them in this country. Baker (1937) made

an interesting comparison between Port Meadow, Oxford, which has been continuously grazed and never cut, and Pixey and Yarnton Meads, which have been continuously cut for hay with grazing only in the late summer/autumn period. He found that certain plants, such as Sanguisorba officinalis, Thalictrum flavum and Filipendula ulmaria were present in the hay meadows, but not in the grazed meadows, and similarly Plantago media, Cirsium vulgare and Achillea millefolium were frequent in the grazed meadow but absent from the hay meadow.

There are very few detailed descriptions of alluvial meadows in the past. Except for Baker, the only other account of real value was by Fream (1888), who examined a group of water-meadows on the River Avon, Hampshire. He studied their appearance in the 1880's, and he noted that William Marshall (1798) had described the water-meadows over a wider area of the Avon valley in the late eighteenth century. We have recently discovered the exact location of the meadows studied by Fream: they are no longer irrigated, but a grass-cover has survived and it is possible to compare the composition of the meadows in the time of William Marshall, Fream and the present-day.

Marshall described the meadows in the following way (Latin names have been added to assist identification according to Clapham, Tutin and Warburg (1962).

> "The herbage of the watered beds is various in species; as ray grass (Lolium perenne), the meadow poe (Poa trivialis), the marsh and other bent grasses (Agrostis stolonifera and spp), and the meadow fescues; the loliacea (?Festulolium) and the pratensis, here putting on very different appearances. On the sides of the trenches, and ditches, the flote fescue (Glyceria fluitans), reed canary grass (Phalaris arundinacea), and the water poe (Glyceria maxima) are common; also the meadow rue (Thalictrum flavum) and the water dock (Rumex hyorolapathum)....One meadow I observed was almost shaded over with the common dock (Rumex obtusifolius); which appears to be a prevailing weed of the well-formed grounds; and almost the only one".

One interesting fact which emerges from this description was that Marshall recorded Thalictrum flavum as common, whilst Fream, about 100 years later and, of course, working in a much more restricted area, noted that Thalictrum was merely present, and not common. Today, the species is rare in water-meadows.

The condition and composition of alluvial grasslands today reflect the influence of man in forming and maintaining them. The ecologist has to study the grasslands in the past and today, if he is to understand their character. To what extent is there a common approach in the work

of the archaeologist and ecologist? This Paper will suggest two ways.

First, both the archaeologist and ecologist look for features which indicate the use and management of sites in the past. The use of indicators is fundamental; in archaeology, potsherds may indicate the period when a site was occupied and give some indication of the character of the occupants of the site. Potsherds, by their abundance, colour, design and texture, can be recognised and identified. In a similar way, the ecologist may use some species of plant on alluvial grasslands as indicators. Fritillaria meleagris is a member of the Liliaceae and is characteristic of certain alluvial meadows, particularly in the Thames Basin. The continuation of the species may be dependent on plants being produced from seed, as the life span of the bulb is reputed to be about 10 years. It is known that the bulb cannot survive for more than a year under arable conditions, and thus if the plant is to survive then seeds must be produced. The morphology of the seed of Fritillaria suggests that it cannot remain dormant in the soil for any considerable length of time, unlike such species as Viola stagnina and Luzula pallescens. If the above suppositions prove to be correct, then Fritillaria will be a useful indicator of the length of time a grassland has been left undisturbed. There are certain anomalies regarding past records of this species which must be resolved but, together with other indicators, the plant should help to throw light on the use and management of the grassland in the past.

Secondly, the archaeologist and ecologist both work in the context of what evidence is available, what has survived from the past. They work on the lynchets and washlands, which have survived modern ploughing, but how far are these relict features representative of the features which have been destroyed? How far are the Celtic Fields and Deserted Medieval Villages, which can be studied today, typical of all the fields and Deserted Villages which existed at one time? In the same way, the ecologist has to ask how far Lammas Lands, water-meadows and washes are representative of those which once existed in Lowland England.

Until relatively recently, archaeologists and ecologists were content to study whatever source material happened to survive in the field, but the limitations of this kind of material have become clearer. It is so easy to make false deductions, especially on sites which have been badly damaged by neglect or deep ploughing. Thus, both kinds of specialist have become increasingly interested in working-models, which reconstruct in some measure the environment of the past and actually test hypotheses. Thus, an experimental earthwork of the past has been erected on Overton Down, Wiltshire, in order to see how archaeological structures are denuded and buried. The ecologist is adopting a similar approach, grazing the alluvial grasslands and cutting the grass in the same way as the medieval farmer used the Lammas Lands. He would like to extend the

idea of a working-model to the water-meadow by re-creating an operational irrigation system, allowing the ecologist/farmer to water the land on the basis of descriptions found in old books and papers on farming. He could allow parts of the meadows to fall into disuse after a few years, and thereby study the changes in vegetation which take place once the water-courses are neglected, the grass is ungrazed and the hay unharvested.

Archaeologists and ecologists are studying parts of the same environment, and there is a great deal of common ground in their approach to research and conservation. It should be possible for them to help one another, by showing how the past has influenced the present, and by relating the contemporary distribution of plant species to conditions in the past.

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SUMMARY OF DISCUSSION

Mr. Taylor, in commenting on his paper and the discussions which had already taken place, stated that archaeologists and ecologists must know how land-use and land-management had affected their sites, but he felt that they did not always appreciate the difficulties of using historical material. It is extremely difficult to find documentation which relates to specific sites of perhaps only 20 acres. There is relatively little documentation on unenclosed areas of grassland and examples of temporary ploughing. The activites of small landowners and farmers often pass unrecorded, although they may have considerably influenced the environment.

Mr. Fowler noted that water-meadows covered many of the valleys in Lowland England, which made it difficult for the archaeologist to study early activity and occupation on those sites.

Dr. Sheail and Mr. Wells concentrated on alluvial grasslands in their paper but, in the discussion, they pointed out that areas of permanent pasture, such as ridge and furrow, were also ecologically important and were being destroyed at a rapid rate. Mr. Evans noted a survey was in progress to find the sites of old grassland in Leicestershire.

The value of an operational water-meadow was discussed. Mr. Green pointed out the value of such a site for experiments in hydrology, and he drew attention to the interest which had already been shown in the aquatic life of the carriers and drains of the meadows.

THE MANAGEMENT OF SITES OF ECOLOGICAL VALUE

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It is well-known that man's agricultural activities, both in the past and at the present time, have been responsible for the development and maintenance of all grassland in Lowland Britain. Grasslands occur on a great variety of soils, ranging from floristically depauperate grasslands developed on acid soils to the floristically rich grasslands found on calcareous soils which are derived principally from the Cretaceous, Jurassic and Carboniferous formations. Lying somewhere between these two extremes are the so-called "neutral grasslands", an important but much neglected type of grassland which includes many of the permanent pastures and meadows of the heavy clay-lands, the Washes of Cambridge and Huntingdonshire, the water-meadows of southern England and the alluvial grasslands associated with many lowland river systems. It is not surprising therefore, that the range of floristic and faunistic variation shown by Lowland grasslands is high, well-defined grassland types, such as chalk grassland or Agrostis setacea grassland being but part of this variation and it follows that the management of specific grassland types will vary according to the objectives of management. It is unlikely that one will ever be able to recommend management which can be applied indiscriminately to all Lowland grasslands.

Nevertheless, certain broad principles may be applied to the management of sites of ecological interest, which, provided they are applied wisely, act as guide lines along which management may proceed until the results of more detailed research produce more scientifically based management proposals.

1. Objects of Management.

These should be clearly defined before any management is begun. It has been standard practice in the Nature Conservancy for many years to produce a management plan for each National Nature Reserve in which the objects of management are defined and ways in which they can be implemented are discussed. It is suggested that management plans on similar lines could beneficially be made for sites of archaeological interest, public open-spaces and other areas of scientific interest.

The objects of management will almost certainly differ from site to site as well as varying in the complexity of the management that is proposed. A distinction must be drawn between primary and secondary objectives of management which will vary according to the ownership and use to which the area of land is put. Thus on a National Nature Reserve

the primary object of management will almost certainly be to enhance and maintain the scientific interest of the site. On a public open-space the primary objective will be to provide facilities whereby the public may enjoy the countryside with management for the ecological interest of the site being secondary. In only a few cases will the distinction between sites be as simple as that outlined above,but one should be wary of the management plan which appears to reconcile more than a few different interests,as this generally means that there is no primary objective of management and that the author of the plan is attempting to obtain the best of many worlds.

A fairly simple objective of management might be to maintain an area of grassland for its general floristic richness and an associated diversity of insects, without giving special attention to any one particular species. This form of management for "general biological richness" is as good a criterion to start with as any, in the absence of detailed knowledge of a site, and it allows the development of a more sophisticated management programme at a later stage. A more complex objective might be to limit the competitive ability of a particular species which was likely to cause an impoverishment of the flora while at the same time maintaining a population of a rare insect. For example, controlling Upright Brome Grass (Zerna erecta) at a site supporting a colony of the Adonis Blue Butterfly. This kind of management contrastsstrongly with the problems facing the archaeologist who is more interested in preventing the growth of scrub or coarse grasses on an earthwork which will destroy or hide physical features of the site, than in maintaining the biological interest of the site. Nevertheless, the basic question which all of those responsible for managing land must ask is, how best can the objective of management be achieved?

If we had available data on the biology of individual species of plants and insects in grassland, we might be able to predict the result of management practices, although one must be aware of interactions between species which cannot be predicted even from autecological studies. However, this kind of information is available for only a few species and is a goal which is unlikely to be achieved in the foreseeable future. We must rely, therefore, on observation of the effects of agricultural treatments and the small amount of information that has been obtained from grassland management experiments to make tentative suggestions for managing grassland of ecological value.

2. Grazing.

Although Arnold (1964) has shown that grazing is a complex activity with many variables of which only a few can be controlled at any one time, it is likely that three are of more importance to management than many others: these are, stocking density, time of year of grazing and type of

animal used for grazing.

At low stocking rates both sheep and cattle are selective grazers, sheep in particular avoiding coarse, tussocky grasses and other less palatable species. On chalk grassland, at Aston Rowant, Oxfordshire, Border Leicester X Cheviot sheep at 1 sheep per acre have produced a mosaic of closely nibbled grassland with clumps of coarser vegetation between, while some species, especially Brachypodium sylvaticum and Arrhenatherum elatius have been avoided completely. At higher stocking rates i.e. 3 or more sheep per acre, although selection was exercised at first, as the herbage on offer became less, the previously unpalatable species were eaten and a short evenly cropped turf was produced. In contrast, cattle which are generally less selective than sheep do not produce such a short turf although it may be evenly cropped. More usually areas which have been defaecated or urinated upon are generally avoided for up to 15 months and again a mosaic of closely cropped and taller vegetation is produced. The effect of grazing on chalk grassland in general terms has been discussed previously by Wells (1965) and more recently Wells (1969) has examined some botanical aspects of grazing on the chalk. Complementary work on the effects of grazing on the fauna of chalk grassland has been published recently (Morris 1967, 1968, 1969) but similar work has not been carried out on other grassland types although it is speculated that similar results would be obtained, at least in broad terms.

One of the important effects of grazing is trampling. Trampling by both sheep and cattle is important in breaking up the layer of litter which is formed at the base of ungrazed grasslands, and one of the effective ways of reclaiming grassland is by winter grazing using sheep or cattle. Cattle and sheep, grazing on steep scarp slopes produce well-marked paths on the slope and at even low stocking rates cattle may cause erosion on steep slopes, on linear earthworks and on similar field monuments. Sheep at stocking rates of more than 3 per acre may produce a similar effect. Trampling by livestock around feeding troughs and gateways which results in the destruction of the turf can be serious and these should be placed at sites where the scientific interest is least.

Grazing chalk grassland with sheep at 3 per acre during the winter and spring months has been shown to be effective in preventing litter accumulation, but after 5 years the grasses and perennial herbs which made up the bulk of the vegetation showed little change in frequency, although the structure of the grassland had altered. On the other hand, annuals particularly Crepis capillaris and Euphrasia nemorosa had increased considerably. Winter grazing on other grasslands, however, may produce deliterious effects on the sward, particularly on meadow grasslands where poaching will be a severe problem.

Certain grasses, particularly those which produce a great amount of leaf material and hence copious litter may become increasingly dominant in grassland to the general detriment of other species. In the field of conservation this is generally not desirable and ways of reducing the competitive ability of certain species are being sought. The work of Green at Hurley on the seasonal productivity of many strains and species of grass which demonstrates a seasonal pattern in growth which is apparently widely distributed through most grasses, provides a theoretical basis for management of particular species. Grazing in the period mid-May to late June, when most grasses are making their most rapid growth may effectively prevent the grass from producing sufficient leaf area to enable it to compete to the extent of causing the suppression of lower growing species. However, grazing in this period will also prevent the flowering of many other species which may be important food plants of numerous insects and it is clear that what may be the best form of management for one species may also be deliterious to other species. This is specially true of the zoological interest of grasslands in which the importance of having grazed, recently grazed and ungrazed grassland has been emphasized. This suggests that some form of rotational grazing may be the best way of managing grassland for "general biological richness".

3. Mowing.

Mowing of many meadow grasslands is one factor which is responsible for their floristic richness, and even where grazing has been the most common from of management in other grasslands, mowing is an attractive alternative. In addition to the obvious economic advantages of mowing, defoliation by mowing may be done at a precise time in relation to the growth cycle of important species in the sward. At the present time, mowing is only possible on relatively gentle slopes, but the recent development of machines which float on a cushion of air makes the feasibility of cutting on steep slopes a more likely proposition for the future.

Results from cutting experiments on chalk grassland in Bedfordshire suggest that cutting in the period from April - July is effective in reducing the competitive ability of Bromus erectus, the dominant grass, without adversely affecting other species. When cut vegetation is removed areas of bare ground are available for seedling germination and establishment and it has been shown in two experiments that this is important for the establishment of annuals. On chalk heath, Gay (1968) has demonstrated that leaving the cut material on the ground results in the establishment of many eutrophic weeds and that the establishment of chalk heath is more effective if cut material is removed. On the other hand, I have shown that in chalk grassland, returning the cut material in a finely divided form has no effect on either total dry matter production or species composition after 3 years of treatment and it is obvious that further research is needed before any clear cut answers

can be given to this problem of return or non-return of cut material.

Conclusions

1. Clearly defined objectives are essential for successful management.

2. Although grazing and mowing are the most likely forms of management to be used on grassland sites of ecological importance, other forms of management, particularly burning, rotovation, herbicide and fertilizer applications should not be overlooked.

3. Management practices should be related when possible to the biology of important species in the grassland, bearing in mind the complexity of the plant/animal relationship.

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PAPER 10

THE PROBLEMS OF RECREATION ON ARCHAEOLOGICAL AND ECOLOGICAL INTEREST

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Anyone managing a site of high historic or scientific value will know of the pressures and damage that can arise through recreational use of the area and will be in no doubt about the conflict with conservation. Thirty or forty years ago it might have been reasonable to segregate conservation on the grounds of self-defence. There must have been logic in saying that some values in life were discernible only to a limited number of people at a time when the interests of an exclusive club of, say, wild life addicts were far removed from the bread and circus approach of the football crowd.

At that time it may have been possible to keep these two basically incompatible elements apart. But things have changed and we find recreation and conservation being drawn together strongly on what looks like a collision course. There have been marked changes in people's habits over the last twenty years resulting from a wider spread of education, more time for leisure and more money to spend upon it. There is now a much greater demand for individual activities, such as climbing, sailing and gliding, with a corresponding reduction in mass spectator sports like football and greyhound racing. Television has had an enormous effect by bringing archaeology and wild life to millions of homes. These interests are no longer the prerogative of a few, Walt Disney, Peter Scott and Sir Mortimer Wheeler have seen to that.

The exclusive club approach no longer works. Remote sites are now within reach of the motoring public. Sanctuaries are no longer safe from demands of power stations. Historic avenues of oaks may have survived for hundreds of years, but now they can be threatened overnight by a new motorway proposal. The size of these threats has made many of the "clubs" realise the need for much greater membership in order to protect their interests. To influence decisions large funds are needed and to raise a public outcry it is necessary to get public support for one's ideals.

As segregation will no longer work, sites of special interest must be managed with greater care than ever before if they are to survive the rising tide of outdoor recreation. Vandalism is an increasing problem and there is an urgent need for fundamental research on this sickening subject, but from observation one can judge that the best form of protection is a visibly high standard of management, with well-designed and well-maintained fixtures. Broken signs, overflowing litter bins, and

badly cleaned lavatories give a down at heel appearance and encourages vandalism. If a sign is broken it must be removed at once and not left until a new one has been made to take its place. Try and avoid stencilled signs and see that they are attractively designed, made of strong materials firmly held in place. Special screws can now be obtained which can be done up with the conventional screw-driver, but can only be undone with a special tool.

"Group control" is another factor, by which I mean that casual vandalism is deterred by the presence of other visitors and a site where there is always someone coming and going is less likely to be damaged than a remote corner with little risk of detection. The presence of wardens offers the best protection of all - even a clearly labelled warden's van in the car park acts as a deterrent. For this reason some sites should always be wardened by uniformed personnel.

Most damage is caused by sheer weight of numbers and it is important to have a clear understanding of objectives for management of the site. In some places of outstanding value the site is definitely more important than the visitor. Here access should be under severely controlled conditions and no risks should be taken. The famous wall paintings in the Caves de Lascaux in France have had to be sealed off, perhaps forever, because of rapid deterioration and change of environmental conditions during the relatively few years they were open to the public. But this is an extreme case and public demand requires that our heritage should be accessible.

That is not to say that we should go to the other extreme and surrender our responsibilities to the general demands for outdoor recreation. I hope that country parks of the "honeypot" variety will tend to draw some of these pressures off our special value sites. Notwithstanding the awakening interest in archaeology or bird-watching, the vast majority of weekend motorists will be just as happy spending the afternoon picnicking by their car or sitting by the water's edge in sites which have been deliberately chosen for them, having good road access and being essentially robust and capable of withstanding extremely heavy use. We can no longer afford to have a National Nature Reserve mistaken for a convenient picnic spot. Not only will this secondary use damage the primary function as a nature reserve, but it also tends to detract from the general status of the area. I am all in favour of making the right sort of places available for the general public, but I am concerned how some sites of very special importance are subjected to excessive levels of use for quite unsuitable purposes. Those responsible for looking after such special areas must put the requirements of the site first, even though this may sometimes be unpopular.

Various methods can be used to limit direct physical pressures on a site and the first essential is to be able to control vehicular access. The size of car park and its distance from the vulnerable area determine the weight of use on any rural site. Sometimes charging will damp down excessive demand, but this can work in reverse unless supplemented by other sites in the locality which are available free of charge.

Protective works are sometimes needed to prevent excessive wear where use is heaviest and this calls for special skill and restraint lest the remedy be worse than the original trouble. It is extremely difficult on some sites to devise a hardwearing surface that is acceptable visually. If there is sufficient room, a system of alternative paths can be devised for use in rotation with a rest period to recover. But the reverse is usually the case and it becomes necessary to guide all feet on to one path which then has to be made up to withstand heavy use. How this is done depends on circumstances, but the surface finish must blend with its surroundings. In some situations the natural finish of a path can be restored; if it is a forest walk, fresh pine needles or bark chippings can be laid down to cover the bare patches. Similarly short lengths of grass paths can be re-surfaced by turfing at reasonable cost in order to avoid an artificial surface which might be out of keeping.

The way people use a site has a lot to do with its wear and nature trails can be used as a management tool to guide people on to a route where they will do no harm. Beware of <u>psychological</u> damage caused to a site by the use of too many signs put up to control and reduce <u>physical</u> damage. Signs are sometimes essential especially where danger is involved, but if possible they should be of a positive sort or containing interesting information. Many of the signs one sees could be done away with altogether or replaced with a small symbol which conveys information in a much more attractive and acceptable manner.

As the weight of use increases it becomes more important to get the visitor on your side. This is probably the most difficult of all management techniques and there is a sad lack of knowledge on this side of the Atlantic on how it should be done. Basically it is a question of communications and we must be able to convey information to the casual and disinterested person whose ignorance is a potential danger to your site. To preach to the converted is a waste of time and detracts from the message which should be aimed at the unconverted. It is often very difficult for a knowledgeable person to tell a story in simple terms, and for this reason many nature trails and guided walks fail to command the interest of those visitors who need to be influenced most. It is time we recognised that the art of "gentle persuasion" is a highly professional one, involving advertising techniques and means of communication which are far beyond us amateurs. There is an urgent need for specialists in this field who can be called upon to prepare and if necessary carry

out information projects that will really open a visitor's eyes to the attractions and values of our sites. Anyone who has seen the skill with which the American National Parks Service convey information to their visitors will know how powerful this influence can be. And we must reach the same standard.

The aim should be to unlock the visitor's interest and enthusiasm and to get him involved with your subject. Advertising techniques can transform the outlook and behaviour of visitors to your site in exactly the same way that they can be used to influence people's purchasing habits. The importance of the visitor's attitude can easily be seen when you compare the number of cigarette packets thrown down in a cathedral with the amount of litter that can be seen in a railway station.

A really effective information and interpretation programme can be expensive, but we must recognise that it is an essential protective investment and not just an optional extra. We have to stop thinking in terms of by-laws and try and capture people's minds. This is a fascinating subject and calls for far more time and skill than I possess to deal with it. But the first essential I would say is stage management. If you want the visitor to believe that the area is of very special value to him, you must set the stage to convey that impression. Stage management should separate the visitor from twentieth century noises and pressures so that his senses can become attuned to the experience you offer. Let me take Stonehenge as an example. The main road should be diverted so that diesel lorries do not thunder past, almost through, this internationally famous site. The visitor would approach along a private road flanked on either side by open downland grazed with sheep, which help to contribute an atmosphere of going back through time. He would turn into a carefully landscaped car park beyond which lay the visitor information centre. This building should be of striking design which in itself helps to reflect the story of Stonehenge. Inside a spacious foyer would be displays and illustrations showing how Stonehenge evolved through the ages and its significance in our history. More potent still would be a ten minute film show with all the impact that colour photography, wide screen, and multiple projection can give. Think of the sense of atmosphere that could be built up and the difference it would make to the visitor as he walks round the site after this powerful "briefing".

Stage management must be carried down to the smallest detail with a consistent theme running throughout. The signs, the views, the descriptions on the portable tape recorders or the guide's talk to his party as he takes them round, must all portray this theme so that the message is unmistakable. If possible, the theme should be related to the visitor's normal living conditions; otherwise it will be an experience in isolation

which could be switched off on leaving. The message of conservation must be identified with the visitor's everyday habits and needs. This is what the makers of soapflakes achieve and I believe this is how we shall be able to reconcile the conflict between recreation and conservation.

SUMMARY OF DISCUSSION

Professor Atkinson described the erosion caused by excessive trampling on the south aspect of Silbury Hill and the measures taken by the Ministry of Public Buildings and Works to combat this. The eroded area had been returfed with turves obtained from an alluvial meadow site with the result that this area now contained a different array of species from the surrounding grassland. Was this desirable? A more important problem on earthworks was the control of scrub and advice was sought on controlling scrub encroachment. Mr. Wells replied that a well-proven method of control was to cut the scrub to ground level with a saw and to treat the cut stump with an arboricide such as 2,4,5-T in a diesel oil mixture. This treatment gave an effective control of older scrub, but thin, young scrub needed a further application of arboricide if regrowth started. In reply to a question on the value of burning as a means of destroying scrub the speaker said that this was effective with seedlings of Hawthorn but doubted its efficiency with older scrub. Dr. Rackham suggested that Juniper was sensitive to burning and asked if information was available concerning the sensitivity of grassland species to burning. In reply, the speaker quoted the example of Rodborough Common, Gloucestershire, where burning was an annual practice, where Juniper was mainly restricted to old trackways with a shallow soil and was rare in the deeper grasslands, evidence which supported Dr. Rackham's view. The speaker had no data on the sensitivity of limestone grassland species to fire, but noted that annually burnt calcareous grasslands still had a rich flora which did not suggest undue damage to particular species by fire.

Mr. Chappell asked if the conclusions reached in the paper were compatible. Mr. Wells replied that clearly defined objectives were essential for successful management and while agreeing that it would almost certainly be impossible to relate management to the biology of all species in the grassland, it was possible to relate management to the more important species, and this should be borne in mind when stating the objectives of management. The corollary to this was that it was often advisable to be specific in defining objectives of management and not to try to placate too many interests. In reply to a question regarding the use of tethered animals in grassland management, the speaker said that this possibility had not been explored but thought that it might be useful on small reserves.

Mr. Bonsey emphasised the necessity of distinguishing between

habitat management and man management. In reply to a question asking about sources from which expert advice on management could be obtained, the speaker said that specialists should be called in at an early stage in management and that continuity in obtaining advice was important. In his view, this could best be met by having a consultancy service which would not only be the professional advisers to organisations such as county councils but would also monitor changes in knowledge and be responsible for keeping their clients 'up to date' with advances in techniques. Dr. Duffey informed the meeting that the Institute of Biology had a list of consultants in various fields and that the British Ecological Society was currently compiling a list of consultants in different fields of ecology.

SESSION 5

THE FUTURE OF OLD GRASSLAND IN LOWLAND ENGLAND

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(Edited transcript of tape-recording)

This Symposium has given us a very varied range of views from the archaeologist, ecologist and from those who are concerned with the public use of old grassland. I would now like to ask three questions. They are: Why do we want to look after old grassland? What kind of old grassland do we want to look after, and how do we preserve it?

"Why" takes us right to the heart of the problem. The conservationists want to preserve and maintain samples of plant and animal communities they want to preserve a sample of populations of particular species in order to provide for the perpetuation of the species. The archaeologist and conservationist share a belief that these sites offer particular opportunities for research and for the documentation of past land use and land management. We have heard talk of grassland as a preserver of sites, a skin which protects them from erosion and depradation, although occasionally the skin can conceal features beneath the ground surface so effectively that the archaeologist has not yet discovered them. Old grassland is also an educational and a recreational resource. All of these factors are perhaps among our objectives in management. I suggest that we are not considering old grassland as an agricultural resource in this Symposium. It may be used as an agricultural resource indirectly, but we are not concerned with this as a prime object. Now among these objectives, there is obviously room for conflict. These old grassland sites can be very often used in more than one way and, for this reason, we should be very careful in defining the primary purpose of management. We have to make sure that there is no conflict with the main reason for giving protection to a site.

I would like next to ask the question, "What kind of old grassland?" It has been pointed out quite validly that for some of the objectives outlined above we do not need old grassland. We can probably protect an archaeological site just as well with a sheet of polythene. Some of the conservationists' needs could be equally well met by creating new communities. And above all, recreation and education could very often be provided for in other ways: it has simply become customary for us to think of recreational areas as open country. It may then be possible to provide for many of our aims with other kinds of grassland, but it must be stressed that these sites would not have a continuity of history. Only old grassland can provide us with a basis for documentation and research.

Both archaeologists and ecologists are busy cataloging what kind of grasslands should be preserved. The scheduling of field monuments is a continuing process and the Nature Conservancy is conducting a Reserves Review. So far, we are both going our separate ways and there is little or no machinery to ensure that where our two interests coincide, this will be noticed by those people responsible for policy decisions.

Thirdly, I come to, "How should we manage old grassland?" It has become quite clear that the statutory provisions for protecting field monuments and nature conservation are very different from one another. I suggest that we should get together and see whether we can improve our operations by learning from the experience of the other. So far, the archaeologist seems to have made less use of voluntary help than the ecologist. In surveying sites and, perhaps, more significantly in actually conserving them, nature conservation has relied very heavily on voluntary organisations. Many of our sites of special interest are relics of a form of land use in the past and they have survived because of the goodwill shown by landowners and occupiers. However, many of these sites will be destroyed in the future unless compensation is given for the loss of agricultural output.

Let us now think about fields of co-operation. There is the possibility of co-operation in research. I have the impression that the archaeologist is hoping that the botanist will incidentally help him, and that the ecologist hopes the archaeologist will give him some aid, but there has not been a really co-ordinated approach.

It should be possible to co-operate in selecting and justifying protected sites, and it only remains to set up the machinery to carry this out. We should help one another in safeguarding sites of special importance, which may be more difficult because of the different legal and administrative frameworks within which we work.

We should co-operate in managing our sites. Both the Nature Conservancy and voluntary bodies should be able to offer a consultancy service to the archaeologist and local authorities, charged with maintaining areas of grassland. The Conservancy in the next few years hopes to produce a series of management manuals, setting out general principles underlying the management of various habitats. Finally, we need to combine in order to find the best tools for management. If the archaeologist, ecologist and such bodies as the National Trust and local authorities work in isolation, they will often fail to find satisfactory ways of managing their old grassland. If they combine and publicise their special needs, it is more likely that new machines and grazing techniques will be devised and introduced.