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TITLE The archaeobotanical remains of hay: a comparison of results from seven DoE sites and various others with data obtained from species-rich 'Ancient Meadows'.

The archaeobotanical remains of hay: a comparison of results from 7 DoE sites and various others with data obtained from species-rich 'Ancient Meadows'.

J.R.A. Greig

ABSTRACT: The pollen and seed content of some hay from British species-rich 'ancient meadows' has been studied and compared with archaeological records of grassland plants, using data from the National Vegetation Classification for the definition of the meadow types. The evidence suggests that some of these meadow types may have existed in the Iron Age, although there is a great shortage of archaeological sites with large grassland floras and very detailed identification of pollen and seeds. It may now be possible to re-interpret some environments thought to represent grassland more exactly as hay.

1 INTRODUCTION

Hay was probably an important product in Europe in the past. It would have permitted more livestock to live, work and produce during the winter than from winter grazing alone. It might have been the ancient equivalent of diesel fuel, providing the power to plough the fields and provide transport, as well as the production of hide, milk and meat. Knörzer (1973, 1975, 1979) has already studied archaeological evidence for grassland in the Rhineland, based on macrofossil evidence. In the present work macrofossils and pollen from various kinds of hay are compared with results from archaeological sites. This kind of approach using the surviving traditional farming practices today has proved very valuable in the study of cultivated crops and their weeds (Hillman, Jones, this volume).

A great difference between cultivated crops like cereals and semi-natural crops like hay is that the first often consists of a single crop plant and its weed community, while the second involves a complex plant community with many variants which has developed over a number of years.

British botanists have not used phytosociology much for defining plant communities, other than rather broad descriptions of vegetation (Tansley 1939) and detailed studies have tried and rejected this approach (Rackham 1980). Although continental botanists have long used phytosociological works like Oberdorfer (1977, 1978) or Ellenberg (1982) such data on British vegetation is not yet published. The author has been fortunate in being able to consult the script of the National Vegetation Classification chapter on grassland and use the data from it in this article.

2 PRESENT DAY GRASSLANDS

Modern hay meadows are generally poor in species because of artificial seeding, application of chemical fertiliser and herbicides, and grazing at particular times of the year. However, there are some surviving hay meadows which are very species rich and spectacular in summer, and a number of these are protected as nature reserves. In some cases the meadows are managed traditionally, such as the 'Lammas Lands' that are still subject to legal clauses that allow grazing to take place only between 12th August and 12th February (Sheail & Wells 1969). It is possible that some of these meadows have existed for a very long time, and that they are survivors of an ancient hay meadow type that was formerly more common.

Grasslands can be difficult to study because there are many kinds, not all widely different, and mainly because they can only be fully seen and studied for about a month in the year.

The National Vegetation Classification (NVC) distinguishes 17 main types of mesotrophic grassland, of which 5 have been

used for haymaking. It gives a key and descriptions for recognising the various grasslands, based upon abundance and cover of grasses and broadleaved plants. The communities are generally similar to those of the continent, and all fall under the heading of Arrhenatherum elatior grasslands (Molinio Arrhenatheretea, Tüxen 1970). The hay meadows are generally distinguished from pasture grasslands by the presence of Arrhenatherum elatior and tall broad leaved plants with unprotected apical buds, often relying on seed set for propagation, like Heracleum sphondylium and Centaurea nigra.

The grassland types are given a number with 'MG' for Mesotrophic grassland, and also a phytosociological name. Like plant species, some are more easily defined than others.

The hay meadow grasslands are briefly as follows:

MG1 Arrhenatherum elatius (Arrhenatheretum elatioris Br. Bl. 1919) is a coarse grassland with umbellifers which are especially noticeable when they flower in early summer, now often found as a roadside community and rarely used for hay in Britain. The total species list for MG1 is very large and overlaps with those of many of the other grasslands. It is dominated by Arrhenatherum elatius, Dactylis glomerata and Holcus lanatus, and the commoner broad leaved plants include Anthriscus sylvestris, Heracleum sphondylium, Chaerophyllum temulentum, Cirsium arvense, Centaurea nigra and Urtica dioica. Other broadleaved plants are generally infrequent although some may achieve local dominance. This kind of grassland does not survive grazing.

MG3 Anthoxanthum odoratum Geranium sylvaticum grassland is found in meadow uplands in northern Britain where is is called 'herbie meadow'. It has not been included in this study so far.

MG4 Alopecurus pratensis Sanguisorba officinalis flood meadow is a very spectacular sight before haymaking, with dark red burnet, white daisies and yellow composites. It is found in a few places in the midlands and south of Britain (Fig 1) including the Lammas meadows. The constant species are Ranunculus acris, Trifolium pratense, Filipendula ulmaria, Sanguisorba officinalis, Rumex acetosa, Plantago lanceolata, Taraxacum officinale and Cynosurus cristatus. This grassland is found on brown calcareous earths and brown calcareous alluvial soils, often flooded in winter. Protection from grazing is important and the meadows need to be 'shut up' with no animals allowed in between February and the haymaking, which takes place in July.

MG5 Centaurea nigra Cynosurus cristatus meadow (Centaureo cynosuretum cristati)

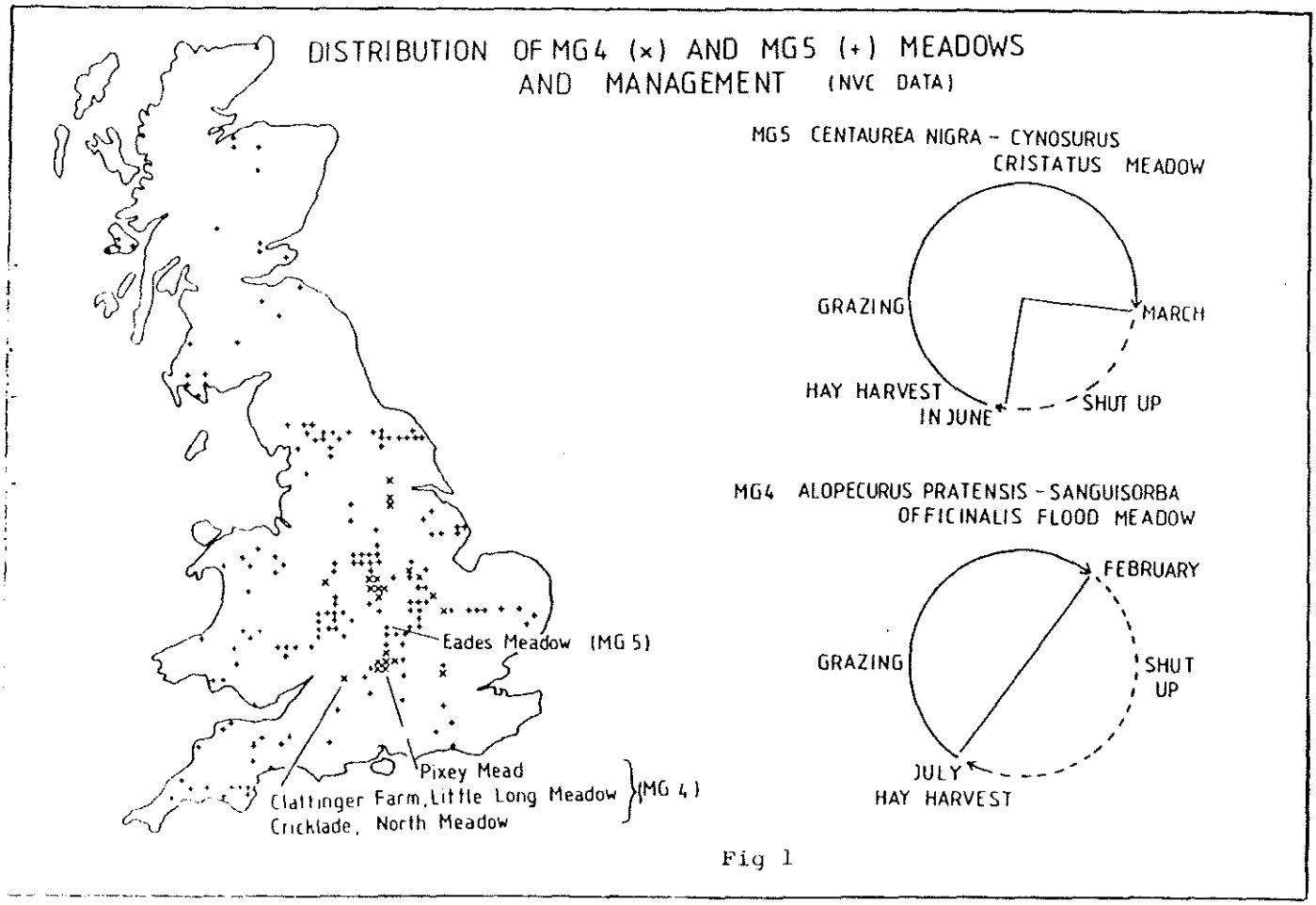


Fig 1

ridge and furrow old meadow) is scattered through much of the British Isles, but more concentrated in the midlands (Fig 1), often on clay soils. The constant species are Lotus corniculatus, Plantago lanceolata, Festuca rubra, Cynosurus cristatus and Holcus lanatus. Also very abundant are Trifolium repensand T. pratense, Centaurea nigra, Dactylis glomerata, Agrostis tenuis and Anthoxanthum odoratum.

The study of MG5 is complicated by the fact that there are three sub-communities which are not discussed in this article, and because this community overlaps with MG6 Lolio-Cynosuretum.

MG8 Cynosurus cristatus Caltha palustris flood pasture has occasionally been known to have been cut for hay. The constant species are Caltha palustris, Ranunculus acris, Trifolium pratense, Festuca species, Cynosurus cristatus and Holcus lanatus. The hay from this meadow type has not yet been studied.

3 EXPERIMENTAL WORK

The aim of working with samples of modern hay is to find out which plants can produce mature seed by harvest time, what the losses are from dehiscence and what is the representation of plants in terms of seed production. The aims of the pollen studies are similar, to find which plants are in flower or retain pollen and in what amounts. It is also important to find what variation there is between results from meadows of the same vegetational type.

It has not yet been possible to sample hay meadows of all the types of interest, so these results are preliminary, from four meadows so far, and some samples of commercial hay and some dung.

The sampling strategy is shown in Fig 2. Hay was cut at normal haymaking time in early July, in some cases just as the farmer was going to cut the hay himself. In order to obtain as representative a sample as possible of the whole meadow, small patches of grass at intervals of 15m were cut in a line across the middle of the field (vegetation near the edge tends to contain hedgerow plants). Random selection was used to avoid unconscious selection of species-rich patches of grass. Some meadows, such as Eades Meadow, were very noticeably patchy, with various plants dominant in particular spots, while others like Pixey Mead were more uniform. The

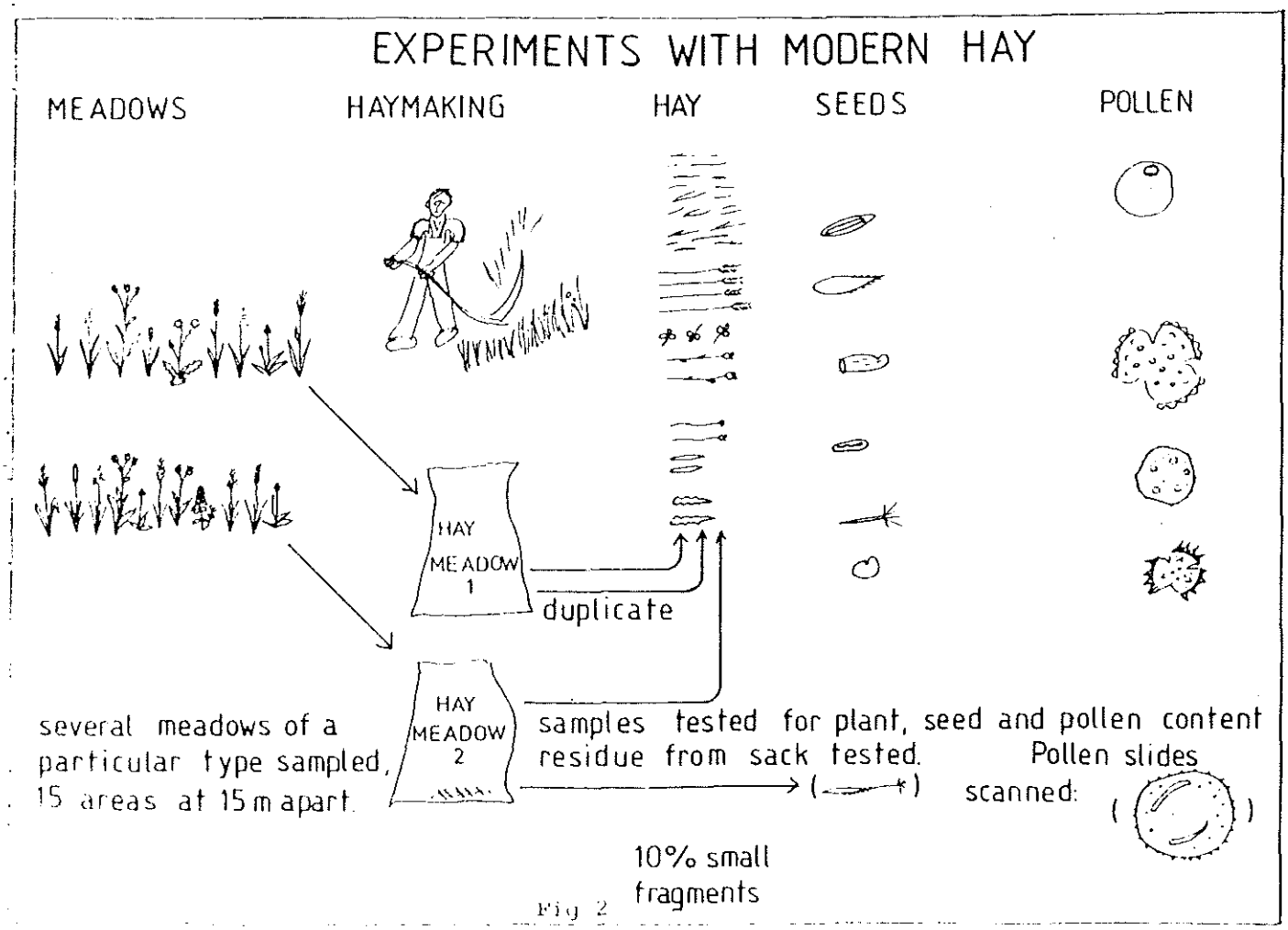


Fig 2

sack full of grass from each meadow was dried and mixed before study.

In the laboratory sub-samples of hay were taken for study, usually about 30 gm. Pollen was extracted by washing with 1-2 litres of very dilute alkali and detergent, then centrifuging the pollen down from the liquid, acetolysing it and mounting it in slides with glycerine jelly for counting. About 1000 grains were counted for the percentages, and then the whole slide was scanned to find any rare grains not seen before, which are recorded as (+).

The whole plant content of the hay samples was found by separating the hay sample, after re-drying, into its component parts which were then weighed, species by species. About 10% by weight was in the form of very small pieces which were not identified. Some plants were hard to identify from fragments after drying, but characters like leaf hairs were useful.

The seeds from the samples were counted and identified when they had separated from the flower head (although sometimes still enclosed in floral parts, like Trifolium). Immature seeds were noted, but the seed counts refer only to more or less mature ones. The rarer seeds in the hay were found by searching through the residue in the bottom of each sack. The result expressed in % grassland taxa, but in c case the amount of non-grassland represe such as tree pollen was only a few % of total.

4 RESULTS FROM MODERN HAY

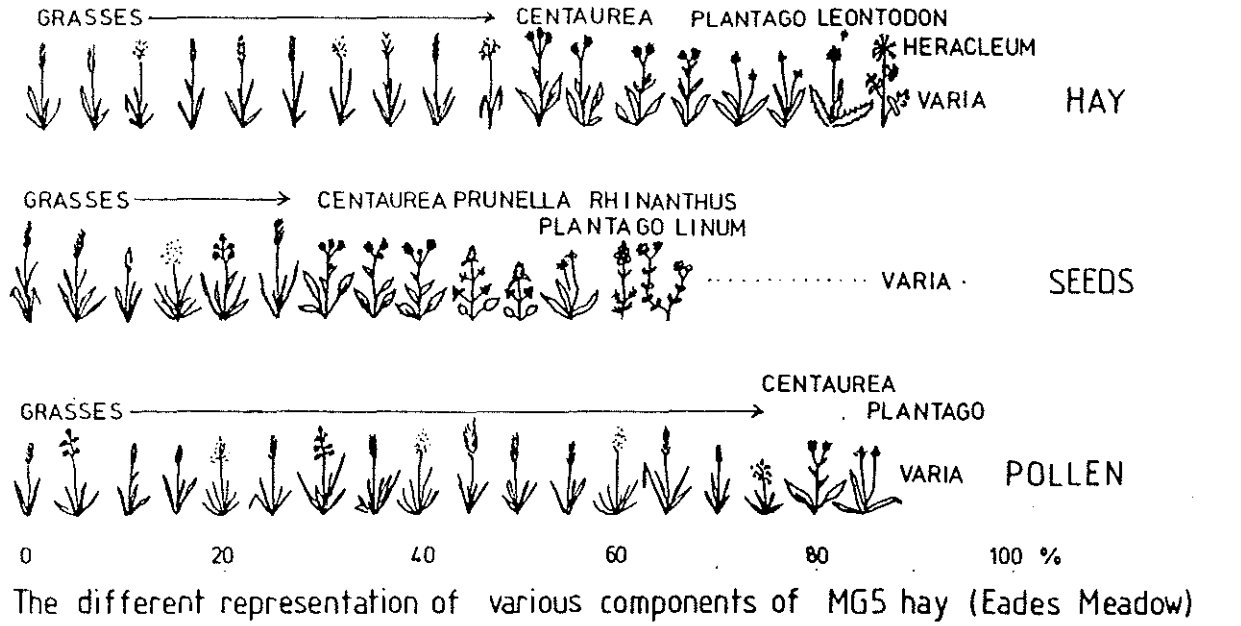
Fig 3 shows the broad outlines of the results. The hay consists of a mixture grass and broad leaved plants, not mainl grass like modern commercial hay. The mc common herbs are Centaurea nigra, Plant lanceolata, Leontodon and Heracleum.

The seed counts give a rather differe picture, with less grass, and Prunella, Rhinanthus and Linum catharticum well represented by their seeds as well as Centaurea and Plantago as before.

The pollen spectrum is dominated by Gramineae, with Centaurea and Plantago a common, but other broadleaved plants ra

The possible archaeological seed spec from such hay can be seen if only the t seeds are considered, which increases t representation of Centaurea and Leontod compared with seeds of grasses and plan This is discussed in more detail later.

The more detailed data from the hay i given in Figs 4 and 5. Here species lis for the vegetational types have been gi in taxonomic order (Clapham et al 1981)



The different representation of various components of MG5 hay (Eades Meadow)

possible representation in archaeological deposit

Fig 3

MG 4 LIST (SHORTENED)	IN FIELD PM	IN FIELD CNM	% HAY PM	% HAY CNM	% SEEDS PM	SEEDS CNM	SEEDS CLL	% POLLEN PM	% POLLEN CNM	
Ranunculus a/r/b V	+	+	5	3	6	4	11	6	4	
Cardamine pratensis II	-	-	-	-	-	-	-	-	-	
Cerastium fontanum IV	-	-	+	+	(+)	-	1	(+)	-C	
Trifolium dubium II	-	-	-	-	-	-	-	-	-	
Trifolium repens IV	-	+	-	+	-	-	-	-	+	
Trifolium pratense V	+	+	+	1	-	1	+	-	-	
Lotus corniculatus III	+	+	-	-	-	-	-	-	-	
Vicia cracca II	+	-	+	-	-	-	-	(+)	-	
Lathyrus pratensis IV	-	+	-	2	-	-	-	-	+	
Filipendula ulmaria V	-	+	-	-	-	-	-	-	1	
Sanguisorba officinalis V	+	+	10	+	5	-	+	5	2	
Silaum silaus III	+	+	+	3	(+)	5	-	+	1	U
Heracleum sphondylium I*	-	+	-	1	-	+	-			
Rumex acetosa V	+	+	+	1	-	+	-	+	1	
Primula veris II	-	-	-	-	-	-	+	-	-	
Rhinanthus minor III	-	+	3	1	18	+	-	+	- Rh	
Prunella vulgaris II	-	+	-	-	(+)	-	-	-	-	
Plantago lanceolata V	-	+	2	8	(+)	8	2	1	15	
Succisa pratensis II	+	-	1	-	4	-	-	+	-	
Bellis perennis III	-	+	-	-	-	-	-	-	-	
Leucanthemum vulgare II	+	+	-	1	(+)	8	-	+	1 A	
Centaurea nigra III	+	+	7	2	13	2	+	2	1	
Leontodon autumnalis IV	+	+	1	1	2	11	1	1	3	L
Taraxacum officinale V	+	+	+	+	-	-	-			
Fritillaria meleagris III	-	-	-	-	-	-	-	-	-	
Juncus articulatus II	-	-	1	-	-	-	+	-	-	
Luzula campestris II	-	-	+	-	+	-	+	-	-	
Carex acutiformis II	-	-	-	-	-	-	-	-	-	
Festuca rubra V	+	.	.	.	+	+	+	.	.	
Lolium perenne IV	.	+	.	.	2	9	+	.	.	
Dactylis glomerata III	+	+	.	.	(+)	13	+	.	.	
Cynosurus cristatus V	+	+	.	.	34	30	3	.	.	
Bromus hordaceus II	.	.	.	.	-	-	-	.	.	
Arrhenatherum elatius II	.	.	.	.	-	+	+	.	.	
Trisetum flavescens III	.	.	.	.	3	2	-	.	.	
Deschampsia cespitosa II	.	.	.	.	-	-	14	.	.	
Anthoxanthum odoratum III	+	+	.	.	8	+	10	.	.	
Holcus lanatus IV	+	.	.	.	7	2	+	.	.	
Agrostis capillaris II	+	+	.	.	+	-	55	.	.	
Alopecurus pratensis IV	.	.	.	.	-	-	-	.	.	
Total grasses		.	63	69	54	61	82	81	67	
sums			65·2g	60·4g		706	1456	1120	895	

PM = Pixey Mead CNM = Cricklade North Meadow
CLL = Clattinger Little Long Meadow

Fig 4

Eades Meadow, Worcestershire

MG 5 LIST	LIST FIELD	% HAY	% SEEDS	% TOUGH SEEDS % POLLEN	
Ranunculus a/b (III)		1	(+)	+	1
Cerastium fontanum (II)					
Linum catharticum (-) *		+	4	+	6
Trifolium dubium (II)					
Trifolium repens (IV)					
Trifolium pratense (IV)		1	1	+	
Lotus corniculatus (V)			(+)	+	
Lathyrus pratensis (II)					
Potentilla erecta (I+)					
Sanguisorba minor (I+)					
Conopodium majus (I+)					
Pimpinella saxifraga (I+)				+	
Heracleum sphondylium (II)		5	+		
Rumex acetosa (III)					
Primula veris (II)		+	1		
Veronica chamaedrys (II)					
Rhinanthus minor (II)		1	4		1
Prunella vulgaris (III)		1	8		12
Stachys officinalis (I+)					
Plantago lanceolata (V)		7	4	4	
Galium verum (II)				1 G	
Succisa pratensis (I+)		1	+	+	
Bellis perennis (I+)					
Leucanthemum vulgare (II)		1	(+)	1 A	1
Achillea millefolium (III)					
Cirsium arvense (II)					
Centaurea nigra (IV)		17	13	4	23
Hypochaeris radicata (III)			1		1
Leontodon aut., hispidus (III, II)		6	30		51
Crepis spp. (I) *			1	3 L	1
Taraxacum officinalis (III)		+			
Luzula campestris (III)					
Carex flacca, caryoph. (I+, I+)					
Festuca rubra, ov. prat. (V, I+, I+)		+	1		
Lolium perenne (IV)		+	1		
Poa pratensis, trivialis (II, II)					
Dactylis glomerata (IV)		+			
Cynosurus cristatus (V)		+	19		
Briza media (II)		+	+		
Arrhenatherum elatius (II)			1	83 Gramineae	
Koeleria micrantha (I+)					
Trisetum flavescens (III)					
Anthoxanthum odoratum (IV)		+	5		
Holcus lanatus (IV)		+	7		
Agrostis capillaris, stol. (IV, I+)					
Total Gramineae, sums		50 (Σ 27g)	32 (Σ 304)	(Σ 1046)	3

Fig 5

The constancy values have also been given (NVC data): I = plant present in 1-20% quadrats, II = present in 21-40%, III = present in 41-60%, IV = present in 61-80% and V = present in 81-100%. The species lists are shortened versions of the NVC ones for MG4 and the general MG5 list, not counting the sub-communities. Plants of constancy I have only been included if they were present in the results, like Heracleum, and Linum catharticum which is not on the MG5 list at all has been included because it features in the results from Eades Meadow.

The MG4 results (Fig 4) show that this flood meadow will only have about half the flora of the shortened list growing really abundantly, and the interesting rarities like Fritillaria and the orchids were not encountered, probably because they would be brown and shrivelled by this time of year even if they were abundant enough.

The hay samples matches the field observations fairly closely in the species noted, with about 60% of the weight being from grasses, and the rest mainly from bulky broad leaved plants like Sanguisorba and Centaurea nigra. Small plants were less well represented, such as members of the Leguminosae, which had probably shrivelled up.

The seeds show that most of the plants common in the field and present in hay could produce some mature seeds by harvest time in an average summer, although many immature seeds of Trifolium, Sanguisorba and Succisa were seen. A large proportion of sterile florets was noted in many grasses: all the Festuca, 1/3 of the Lolium, all the Arrhenatherum and 1/4 of the Trisetum florets were barren in the material from Cricklade, North Meadow. Of the most constant species, Ranunculus, Cerastium, Trifolium pratense, Sanguisorba, Plantago, Centaurea and Leontodon are the broad leaved plants best represented by their seeds, and Lolium, Cynosurus and Holcus the grasses. Some abundant plants are poorly represented, such as Filipendula, Rumex acetosa, Festuca and Alopecurus. Taraxacum, which is the most obvious feature of these meadows when it first flowers in early May, seems to have dispersed most of its seeds by July, and is poorly represented.

A few plants not on the MG4 list were found (but not included in the results), such as Medicago lupulina at Clattinger and Hordeum secalinum at Cricklade, both in small amounts.

Although pollen cannot always be very exactly identified, there were 15 pollen types found in the MG4 hay. Ranunculus, Sanguisorba, Plantago, Centaurea and the Gramineae were well represented, while the Leguminosae, Filipendula and Rumex are less evident from the pollen that might be expected from their abundance in the field. The hay pollen spectrum seems to be a fairly consistent one and may be distinct from pollen from grassland deposited in other ways.

The three meadows investigated for their seeds seem to give fairly consistent results, so that this vegetational type should be recognised from the seed assemblage.

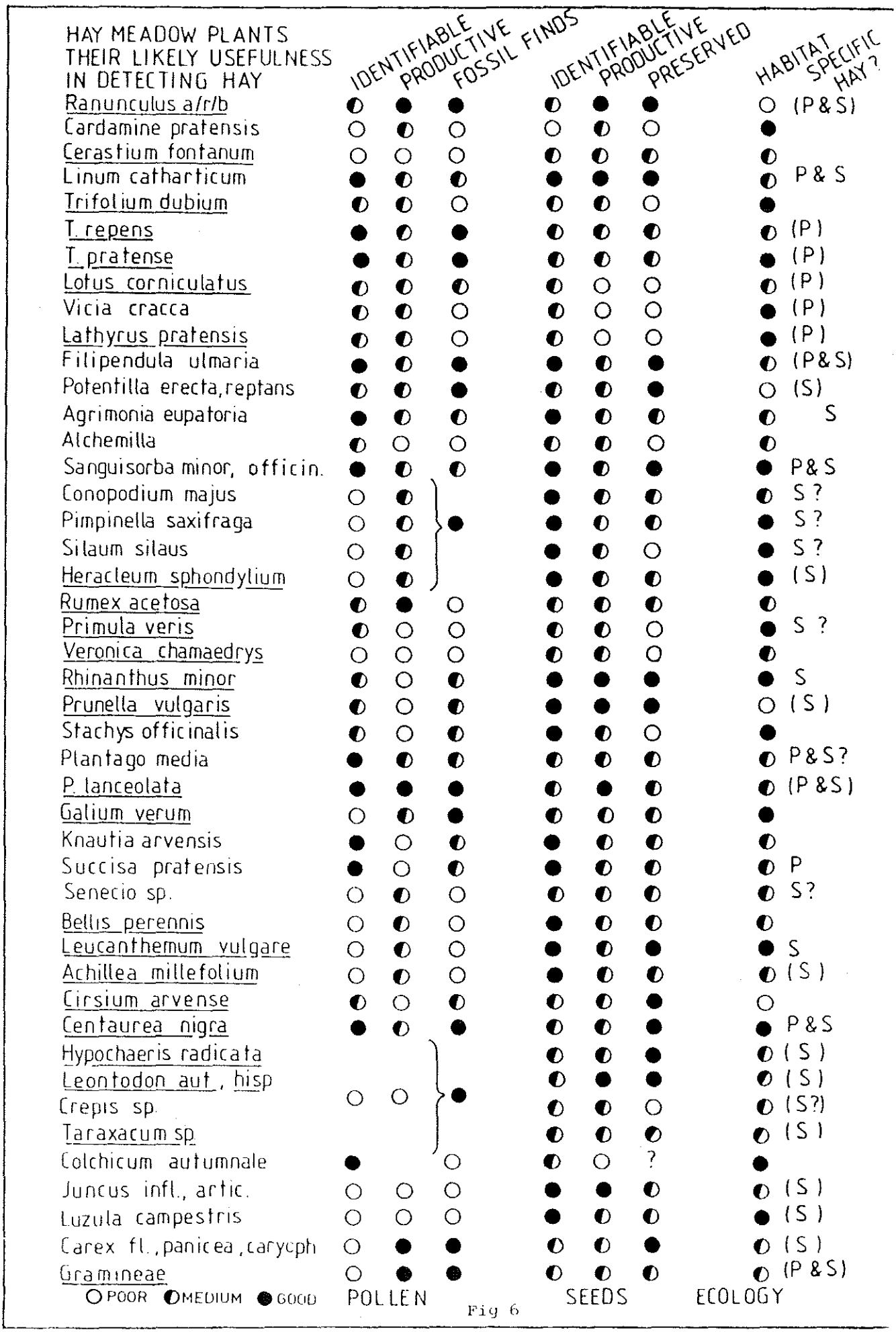
MG5 is a harder community to study because it has 3 sub-communities, and also grades into MG6. Only one example of MG5, Eades Meadow (Worcestershire) has been studied so far, and these results are shown in Fig 5. As in the case of MG4, only a proportion of the rich flora was abundant enough to be seen in the field (31 out of 39 on the shortened NVC list), and 21 species were found in the hay, 22 as seeds and there were 13 grassland pollen taxa.

Most of the plants whose seeds or pollen were found in the hay are common to both MG4 and MG5, and also to MG1 (not listed). The main differences between the different grasslands is in the varying abundance of the plants. MG1 is generally much poorer in species than the other two. A difference between MG4 and MG5 is that Sanguisorba officinalis is present in the former.

5 LIKELY REPRESENTATION IN ARCHAEOLOGICAL DEPOSITS

The different kinds of hay may seem to have fairly distinctive seed and pollen spectra when modern examples are studied, but the identification of hay remains from archaeological remains is likely to be more difficult. The main problems are the degree of preservation of the seeds, the level of identification possible, and the amount of mixing of hay remains with other vegetation which cannot always clearly be distinguished from it, for not all the hay meadow flora is habitat specific.

Fig 6 gives a generalised grassland plant list with some data on the likely usefulness of these plants for indicating the presence of hay remains. The pollen identification data is taken from the writer's own experience and from published seed lists which show how many archaeobotanists make unqualified determinations to species, or group or pollen type. 12 of the grassland taxa can be identified to species from their pollen. Seeds can more often be identified to species, although many archaeobotanists make qualified determinations of certain genera like Ranunculus, Cerastium, Potentilla and


HAY MEADOW PLANTS
THEIR LIKELY USEFULNESS
IN DETECTING HAY
IDENTIFIABLE
PRODUCTIVE
FOSSIL FINDS
IDENTIFIABLE
PRODUCTIVE
PRESERVED
HABITAT
SPECIFIC
HAY?
Ranunculus a/r/b
Cardamine pratensis
Cerastium fontanum
Linum catharticum
Trifolium dubium
T. repens
T. pratense
Lotus corniculatus
Vicia cracca
Lathyrus pratensis
Filipendula ulmaria
Potentilla erecta, reptans
Agrimonia eupatoria
Alchemilla
Sanguisorba minor, officin.
Conopodium majus
Pimpinella saxifraga
Silaum silaus
Heracleum sphondylium
Rumex acetosa
Primula veris
Veronica chamaedrys
Rhinanthus minor
Prunella vulgaris
Stachys officinalis
Plantago media
P. lanceolata
Galium verum
Knautia arvensis
Succisa pratensis
Senecio sp.
Bellis perennis
Leucanthemum vulgare
Achillea millefolium
Cirsium arvense
Centaurea nigra
Hypochaeris radicata
Leontodon aut., hisp
Crepis sp.
Taraxacum sp.
Colchicum autumnale
Juncus infl., artic.
Luzula campestris
Carex fl., panicea, carycph
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POLLEN
SEEDS
ECOLOGY

Fig 6

Carex, while grasses are often simply noted as 'Gramineae, gen. et sp. indet'.

The productivity of pollen and seeds of grassland plants has already been discussed in terms of the results from the modern hay. The approximate productivity of pollen and seeds of other grassland plants not found in the hay is usually known by the relative ease with which these can be obtained for the reference collection; some flowers seem to contain very little pollen.

The representation of pollen and seeds is directly affected by productivity, and it appears that grassland plants generally produce far fewer seeds than their weedy counterparts, perhaps the result of a crowded environment in grassland, or because large seed production is more important for opportunist weeds of open ground than for grassland plants. This difference of productivity means that seeds of grassland plants are under-represented compared with the weeds, just as the pollen of wetland plants tends to dominate pollen diagrams from natural boggy deposits. This under-representation of grassland plants is probably a reason why less attention has been paid to grass than to cultivated crops and their weeds. A very large seed flora is needed from a site in order to show up the grassland plants.

The 'preservability' of seeds is a very important question. Experience shows that seeds of Plantago lanceolata and of Gramineae, for example, are not often found in the amounts that would be expected from the pollen results from the same material. The modern hay experiment shows that both plants produce abundant seed in fresh vegetation, so it appears that seeds like these may not tend to be preserved as readily as others like Ranunculus. Other seeds which may not preserve well include some Cruciferae, probably all the Leguminosae and perhaps Rhinanthus. If certain seeds like these tend to decay away unless preservation conditions are exceptionally good, they will seem rarer than they were, while tougher seeds like those of Ranunculus and Leontodon will seem more abundant. The results from Eades Meadow (Fig 5) have been given as % tough seeds (on an arbitrary basis) to show the change in proportion of seeds that results (right-hand column).

Only in the rare finds of charred hay remains can the truer proportions of seeds be noted, (although distorted by relative combustibility this time) as at Dormagen (Knörzer 1979). The under-representation of the seeds of some plants makes it important to study the pollen as well, to obtain a more balanced picture of the presence of the Leguminosae Plantago species and Gramineae.

Finally, the habitat specificity of many of the plants found in hay meadows is low, and in mixed archaeological deposits the presence of plants like clovers can be interpreted as the result of short pasture, or meadow, while Ranunculus could have come from arable land as well.

The potential difficulty of identifying the remains of hay in archaeological remains is therefore increased by a number of factors, some of them like 'preservability' poorly understood and in need of further experimentation.

6 ARCHAEOLOGICAL RECORDS OF GRASSLAND PLANTS: HAY?

Remains of grassy material such as hay survives by waterlogging usually by chance in a well, pit or ditch. Charred hay remains are very rare (Knörzer 1979).

The grassy material is often of mixed or uncertain origin, especially when hay appears to have been fed to animals with other food like grain, the resulting dung has been mixed with bedding such as straw and bracken, and the mixture has grown a rich weed flora on a dung heap before being dumped in a pit. Notable finds of such material are the horse dung from a Roman well at Lancaster, which was still in recogniseable lumps (Wilson 1979). A more mixed deposit was the contents of a 6m deep pit in a medieval castle which contained organic material and some horse shoe nails (Greig, Girling & Skidmore 1982), and the organic layers found at Bristol, some of which appeared like dung (Shackleton, pers. comm.).

The mixed nature of such deposits means that it is important to know what are the characteristics of animal dung resulting from grazing pasture, as well as from hay.

More often, archaeological sites yield floras which are less obviously grassy in nature, and consist of a fairly small grassland component in a flora dominated by weeds of open land, or sometimes wet-land plants. Such sites give less certain evidence of hay itself, but they may show the presence of some of the characteristic hay meadow plants at particular times.

The records of grassland plants have been extracted from a number of floras with the best evidence (such as it is) of these plants. The earliest sites with extensive floras are Bronze Age in date and two are considered. Three Iron Age sites, three Roman, two Saxon and three medieval ones are also included, although this is not meant to be a comprehensive

survey.

Table 1. List of archaeological sites with good grassland floras

Berinsfield, Oxfordshire. Robinson, unpublished (pollen: Greig) A27 Bronze Age pond.

Runneymede, Surrey. Greig, unpublished. 35 Bronze Age riverside occupation.

Farmoor, Oxfordshire. Lambrick & Robinson 1979. 1100 Iron Age gulley, 1159 ditch.

Tattershall Thorpe, Lincolnshire. Girling & Greig, unpublished. Iron Age ring ditch.

Lancaster. Wilson 1979. Roman well LCT/12/9, ca. 180 A.D.

Denton, Lincolnshire. Conolly 1979. Roman well, ca. 300 A.D.

Rudston, E. Yorkshire. Greig 1979. Roman well, ca. 300 A.D.

Abingdon, Berkshire. Robinson, unpublished (pollen: Greig) Saxon well .

Berinsfield, Oxfordshire. Robinson, unpublished (pollen: Greig) pagan Saxon well.

York (Lloyds Bank). Hall et al 1983. 18 seeds, 20 pollen, Viking occupation layers.

Hen Domen, Montgomery. Girling, Greig & Skidmore 1982. 12e,pit fill, ca. 1200 A.D.

Bristol (Bridge Street). Greig, unpublished. sample AEV, urban occupation, ca. 1200 A.D.

The evidence for hay meadow plants from the samples indicated from these sites is set out in Fig 7 as the % total grassland plants listed, which excludes Urtica as it grows in so many weedy habitats. In only a few cases is the hay meadow component an important part of the whole flora from that sample, and both of those are where hay or dung was already suspected, Lancester and Hen Domen, when the seeds are considered. The pollen counts show more evidence of grassland, but these signs have to be carefully considered before they can be thought of as signs of hay rather than natural pollen rain from grass or dung from pasturing animals.

The seeds from Lancaster include many signs of grain and of weeds, but the list of hay meadow plants is long and appears similar to that obtained from MG5 at Eades Meadow. Ranunculus, Linum catharticum, Rhinanthus, Plantago lanceolata, Centaurea nigra and Leontodon were abundant in both, and the seed results have many other similarities. The richness of the flora is suggestive of MG5 although MG1 cannot be ruled out, and of course the plant communities were not necessarily exactly the same then as they are now: It is interesting to note a record of Peucedanum officinale from Lancaster, an extremely rare plant in Britain now and parallel to Knörzer's Roman records of it from the Rhineland where it has now also disappeared (Knörzer 1975). It appears then that hay meadow of a similar type to the 'ancient meadows' today existed in Roman times.

The pre-Roman sites have rather small hay meadow components in their floras which are not as convincing as the find from Lancaster, but which still allow it to be said that some of the characteristic hay plants that can be recognised from their surviving remains were present in the prehistoric period. The evidence from the two Bronze Age sites includes a hay meadow flora, it is true, but most of the plants in it could be argued as pasture plants as well, like Trifolium species and Taraxacum.

The Iron Age results have Rhinanthus, Leucanthemum, Centaurea nigra and Leontodon in addition to the Bronze Age flora, and it is possible that some dung could have arrived in the ditches and pits either from drinking animals or with general rubbish, for dung beetles are certainly present.

The Iron Age sample 1159 from Farmoor and two others from there of similar age provide the only records of Sanguisorba officinalis known to the author that could represent MG4 flood meadow (or possibly MG8 flood pasture), which is of great interest.

There are several Roman finds of the hay meadow flora in addition to the very good evidence from Lancaster, such as Rudston and Denton, and as Roman wells have been known to contain a very surprising assortment of rubbish which was probably put in after they had ceased to be used for water supply, the presence of hay meadow plants is not unusual. Further possible evidence of Roman hay making comes from finds of scythe blades from a number of Roman sites including Farmoor.

Some archaeological records of hay meadow plants

% grassland seeds: S
% grassland pollen: P
present in another sample: (+)

GENERAL GRASSLAND LIST	BERINSFIELD A27		RUNNEYMEDE 35		FARMOOR 1100		FARMOOR 1159		TATTERSHALL 135		LANCASTER		DENTON		RUDSTON		ABINGDON 832/4,5		BERINSFIELD 82/21		YORK LBII 18, 20		HEN DOMEN 12		BRISTOL AEV	
	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P
Caltha palustris							1											1			+					
Ranunculus a/r/b	22	3	+	+	10	4	27		1	1	2		15		30	–	5	3	5	3	47	1	20	10	43	3
Linum catharticum	3	–	–	–	14		19		–	–	16		41		–	–	12	–	–	–	3	–	–	–	4	–
Trifolium repens	–	8	–	1	–	–	–		–	(+)	+		–		–		–	–	–	–	–	7	–		–	1
Trifolium pratense	–	2	–	(+)	–	–	–		–	(+)			+		–		–	–	–	1	–	2	–		–	1
Lotus corniculatus	–	–	–	(+)	–	–	–		–	(+)			–		–	4	–	–	–	–	–	1	–	+	–	1
Vicia cracca	–	–	–	–	–	–	–		–	–	9		–		–		–	–	–	–	–	–	–		–	–
Lathyrus pratensis	–	–	–	–	–	–	–		–	–			–		–		–	–	–	–	–	–	–		–	–
Filipendula ulmaria	–	1	–	+	6	–	7		–	(+)	3		2?		–	–	2	2	–	1	2	6	+	+	–	1
Potentilla erecta	–		–		–		–		–		1		–		–		–		–		7		1?		–	
Agrimonia eupatoria	–	–	–	–	–	–	2		–	–	–		–		–	–	–	–	–	–	–	–	–	–	–	–
Sanguisorba officinalis	–	–	–	–	–	–	3		–	–	–		–		–	–	–	–	–	–	–	–	–	–	–	–
Sanguisorba minor	–	+	–	1	–	–	–		–	–	–		–		4	1	–	3	–	–	–	–	–	+	–	–
Torilis japonica *	–		–		–		–		1		–		–		7		–		–		–		–		5	
Conopodium majus	–		–		–		–		–		–		6?		–		–		–		–		–		–	
Pimpinella saxifraga	–		–		–		–		–		–		–		–		2?		–		–		–		–	
Silaum silaus	–		–		–		–		–		–		–		–		–		–		–		–		–	
Peucedanum officinale	–		–		–		–		–		1		–		–		–		–		–		–		–	
Pastinaca sativa	–		–		–		–		–		–		–		–		–		–		–		–		–	
Heracleum sphondylium	–		–		–		–		–		–		2		–		–		–		–		–		–	
Daucus carota	1		–		–		+		4		–		–		–		–		–		–		–		–	
Rumex acetosa	–		–		–		–		–		+		–		–		–		–		–		–		–	
Rhinanthus minor	–	–	–	1?	4	–	–		–	(+)	6		+		4?	1	+	–	–	–	–	1?	–	–	4	–
Prunella vulgaris	6	–	–	–	4	–	21		–	–	1		11		–	–	6	–	3	–	28	–	66	–	5	–
Plantago media	–	–	–	(+)	–	–	–		–	–	+		–		–	–	–	–	–	–	–	–	–	–	–	–
Plantago lanceolata	–	28	–	17	–	8	–		–	24	5		–		–	5	–	16	–	19	–	9	–	4	–	7
Galium	–	–	–	2	–	–	–		–	(+)	1		–		–	–	–	–	–	–	–	–	–	–	–	–
Succisa pratensis	–	+	–	?(+)	2	–	–		–	–	–		–		–	–	–	1?	–	–	–	1?	–	–	–	–
Knautia arvensis	–	–	–	–	–	–	–		–	–	–		–		–	–	–	–	–	–	–	–	–	–	–	–
Bellis perennis	–		–		–		–		–		–		–		–		–		–		–		–		4	
Leucanthemum vulgare	–		–		26		2		–		–		–		–		3		–		–		–		4	
Achillea millefolium	–		–		–		–		–		+		4		–		+		–		–		–		–	
Centaurea nigra	–	–	–	(+)	10	–	2		–	(+)	2		9		–	4?	3	2	–	(+)	–	–	8	5	11	5
Hypochaeris sp.	–		–		–		–		6		1		–		–		–		–		–		–		–	
Leontodon sp.	–		–		10		7		34		7		–		26		10		–		3		1		33	
Taraxacum sp.	–		+		–		+		–		–		9		–		–		1		–		–		–	
Juncus infl. art.	–		–		–		–		–		–		+		–		–		–		–		–		–	
Luzula sp.	–		–		–		–		–		–		3		–		–		–		–		–		–	
Gramineae	69	58	–	77	10	89	14		56	74	42		+		–	86	44	70	90	73	+	65	–	75	+	84
grassland taxa % flora	4	65		62	4	52	5	–	15	43	57	–		–	3	22	15	47	17	36	10	44	42	49	11	78
seed and pollen sums	33	217	–	240	61	80	230	–	190	143	585	–	46	–	799	359	670	487	229	211	98	165	275	221	55	193

Fig 7

10 CM

THE ROMAN SCYTHE FROM FARMOOR (REDRAWN AFTER REES 1979) Fig 8

Fig 8 shows the Farmoor scythe blade, which seems more suited to haymaking than for harvesting grain. Long scythes like this appear to have gone out of use by the end of the 4th century A.D. (Rees 1979).

The Saxon sites offer only slight signs that the hay meadow plants were at least present. The medieval castle of Hen Domen did better, with a relatively large grassy component of the whole flora, although not very rich in species. Horse shoe nails and a beetle flora of the 'compost heap' kind rich in dung beetles, together with the pupae of stable flies complete the picture of stable sweepings.

The dark organic layers found in most urban medieval deposits seem so mixed in origin that they are very hard to interpret. The grassland flora often seems obscured by large weed floras, and preservation is not as good as in well deposits, so delicate seeds are probably under-represented. The grassland component of these deposits such as at York, Bristol and Norwich (Murphy, pers. comm.) suggest that hay/dung was probably present. Detailed and certain interpretations of hay remains can only be expected from relatively pure and well-preserved material, however, not from mixed dung-heaps.

7;DISCUSSION: THE HISTORY OF HAYMAKING

The first animal fodder that was collected and stored came from trees rather than from herbs. At one neolithic lake village in Switzerland the occupation layers contained very abundant pollen from summer flowering trees like Tilia, Acer and Fraxinus, and Hedera pollen was also abundant; it was suggested that other leafy branches were also collected, but that winter flowerers like Ulmus would not have still had pollen when harvested in the summer. The complete absence of Plantago lanceolata pollen was taken as a sign that meadow hay was not used (Welten 1967). This tree pollen seems to be a clear sign of the remains of leaf hay which was collected until recently in parts of Europe (Ellenberg 1982). It has been suggested that meadow hay became important when deforestation had made leaf hay scarce, and that steppe plants came in and filled ecological niches created by persistant grazing (Knörzer 1975). Another factor whivh may have been important is that leaf hay can be torn off trees with little in the way of tools, but it would be rather hard to collect much grass this way. The technology to produce a metal sickle or scythe is similar to that needed for making a sword, so by the Bronze Age the grasslands which are so evident from some pollen diagrams could have been mown (it is assumed that flint implements would not be very good for scything). The evidence of Roman hay may then not represent the beginning of haymaking for the sheer abundance of Roman sites with preserving environments like wells tends to creat more Roman records of plants than earlier. This distorted impression changes when extensive work on good pre-Roman sites is done, as on the Iron Age part of the Farmoor site.

It would be very interesting to see if there is any change in agricultural practise indicated by the hay remains, but the evidence is not yet good enough. Presence of species depends more upon suitable work on good sites than on the date of the site, so any reliance on the dates of the earliest records of the hay meadow plants would be risky and likely to be changed by further results. Slight evidence of some kind of change is seen in presence of species now rare, like the Peucedanum already mentioned, and conversely some species that are common today like Anthriscus sylvestris seem to be rare in archaeological finds.

8. CONCLUSIONS

The main seeds which seem to be indicative of hay are Ranunculus acris/repens/bulbosus

Sanguisorba officinalis, Rhinanthus minor, Prunella vulgaris, Leucanthemum vulgrae, Centaurea nigra and Leontodon species.

If preservation conditions are good, some of the Leguminosae, Plantago lanceolata and Gramineae are found.

Less frequent finds of Caltha, Thalictrum, Agrimonia, Sanguisorba species, hay meadow umbellifers, Primula veris, Succisa, Bellis and hay meadow species of Juncus and Luzula occur.

Seeds of Cerastium and Rumex occur, but cannot often be identified to species, so these records are uncertain signs of hay.

The associated pollen spectra from hay are rich in Gramineae pollen, and there are small amounts of Leguminosae (ca. 1% total grassland pollen), moderate amounts of Plantago lanceolata (ca. 1-10%) and rather low Compositae Liguliflorae and Tubuliflorae (ca. 1-5%). Centaurea nigra would usually be present, and Sanguisorba officinalis if a pollen analysis were made of the remains of MG4 hay. A few other pollen types suggestive of hay like Succisa type might be present in traces.

Other signs of the past presence of hay come from insect remains such a rich dung beetle fauna or the puparia of stable flies like Stomoxys calcitrans, and finds like horse shoe nails.

Dung from pasture seems to differ in its pollen content from that of hay: one sample contained 19% Ranunculus (and this is an unpalateable plant!), 9% Trifolium pratense and 8% Plantago lanceolata, most of the rest being Gramineae. It therefore seems that grazing keeps the pasture plants flowering, and that this shows up in the dung.

Semi-natural deposits where the pollen and seeds have simply fallen in to the pit or well seem to differ from ones with hay. There is very often a pollen spectrum with large amounts of Gramineae pollen, abundant Compositae (L) but very few seeds of corresponding taxa, high Plantago, and high Leguminosae, much more than has been found in the modern hay samples. The insect fauna is usually diverse, reflecting the general fauna of the area and not a particular habitat like dung (Greig 1982).

Leaf hay is very different in nature, with its characteristic pollen spectrum mainly of summer flowering trees except Quercus (Welten 1967).

9. DIRECTIONS OF FURTHER WORK

The main conclusion of many pieces of research is that more work is needed, and this is certainly true of ancient hay studies. Some more kinds of meadow remain to be investigated to amplify the results obtained so far. Work is in hand to treat seeds with cellulose dissolving enzymes to try to obtain some objective data on the 'survivability' of seeds. Some more work on the survival of pollen and seeds in hay when it is eaten by animals of different kinds would be useful. The most important thing, however, is to obtain large enough seed floras with exact identifications made, especially in the case of the Gramineae, to have more evidence of grassy remains.

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