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Agricultural Land Use in Central, East and South-East England: Arable or Pasture?

Emily Forster and Michael Charles

Pollen data provide the best available large-scale, long-term evidence for vegetation and agricultural land use. In this paper we bring together data from numerous studies covering parts of central, east and south-east England spanning *c.* AD 300–1500, in order to understand how the landscape, and particularly the nature and scale of farming, changed over time.

This period encompasses the late Romano-British to post-Roman transition of the fourth to fifth centuries, a time when population declined and long-distance trade networks collapsed (Esmonde Cleary, 1991). These changes are often assumed to have resulted in the abandonment of farmland, as a significantly smaller population and the end of army provisioning and grain exports would have reduced demand for crops (e.g., see Lodwick, 2017a, and this volume). Arable land might have been left fallow, used for pasture or colonized by woodland/scrub plant communities in this case. Farming is generally thought to have been small-scale and mixed (arable and pasture) in the mid-fifth to early seventh centuries (Banham and Faith, 2014). As Hamerow (this volume) discusses, significant changes occurred in the so-called 'long eighth century' (*c.* AD 680–830), including the appearance of infrastructure for crop processing/storage and livestock management. Population increased considerably between the ninth and thirteenth centuries, and much of the landscape came to be characterized by large-scale, 'extensive' (i.e., low-input) arable production during this period (Bogaard et al., this volume).

We are very grateful to all who made pollen data available either directly or through the EPD, to Petra Dark for valuable email exchanges about Sidlings Copse, and to Michael Grant for searching BPOL for relevant sites.

However, the timing of changes in the nature and scale of farming in Anglo-Saxon and medieval England are much debated (e.g., Hamerow, 2012; Williamson, 2013; Banham and Faith, 2014; Hall, 2014; McKerracher, 2018). In this paper, we use pollen evidence to determine the scale and type of agricultural land use – namely arable, pasture or a combination of the two – and to test assumptions about land use in the post-Roman to medieval period, such as whether arable land was abandoned in the early post-Roman period or expanded at

Table 1 Pollen sites included in this study

Code	Site	County, cluster	Elevation (metres)	Bedrock geology	Local soils
OM	Oxey Mead	Oxfordshire, Central	60	mudstone, siltstone and sandstone	seasonally wet deep clay
SC	Sidlings Copse	Oxfordshire, Central	100	limestone, sandstone, siltstone and mudstone	loam
WB	Westbury-by-Shenley	Buckinghamshire, Central	100	sandstone, limestone and argillaceous rocks	shallow loam
BD	Biddlesden	Northamptonshire, Central	115	sandstone, limestone and argillaceous rocks	seasonally wet deep clay
WM	Willingham Mere	Cambridgeshire, East Anglia	2	mudstone, siltstone and sandstone	deep clay
WW	Welney Washes	Norfolk, East Anglia	2	mudstone, siltstone and sandstone	seasonally wet deep silt
RM	Redmere	Norfolk, East Anglia	0	mudstone, sandstone and limestone	peat
BR	Brandon	Suffolk, East Anglia	1	chalk	peat
HM	Hockham Mere	Norfolk, East Anglia	33	chalk	peat
BK	Beckton	London, Essex/London	4	clay, silt, sand and gravel	seasonally wet deep clay
EP	Epping Forest	Essex, Essex/London	117	clay, silt, sand and gravel	seasonally wet deep clay

the expense of pasture in the ninth to thirteenth centuries. There is considerable overlap between FeedSax and other large-scale landscape studies, including the *Fields of Britannia* project (Rippon et al., 2015), the *English Landscapes and Identities* project (Gosden et al., 2021) and, before that, Petra Dark's seminal book, *The Environment of Britain in the First Millennium AD* (Dark, 2000). Although we draw on datasets utilized in those important works, our approach to identifying agricultural land use is quite different, as detailed below.

Site type	**Relative catchment size**	**Dates used in model**	**Notes on chronology**	**References for data**
alluvial/ floodplain	small–medium	2	one date rejected – extrapolated (up) at constant rate	Greig, 2004
valley fen (stream-fed)	medium	4	one date rejected – extrapolated to surface	Day, 1991; 1993; EPD
sump/well within settlement	very small	2	dendrochronological dates on context	Hale, 1995
mire	medium	2	extrapolated (up) at constant rate for uppermost samples	Branch et al., 2005; Jones and Page, 2006; Jones et al., 2006
former lake	large	2	extrapolated to surface – radiocarbon dates all pre-date the FeedSax period	Waller, 1994; EPD
fen/washes – organic deposits under this	medium–large	8	well dated – extrapolated at constant rate for uppermost samples	Waller, 1994; EPD
fen – former lake	large	4	extrapolated to surface – radiocarbon dates all pre-date the FeedSax period	Waller, 1994; EPD
floodplain peat	small–medium	1	upper date is based on associated pottery	Wiltshire, 1990
former lake – large, *c.*1km diameter	large	6	well dated	Bennett, 1983; EPD
wetland	medium	6	one date rejected – extrapolated to surface – radiocarbon dates all pre-date the FeedSax period	Batchelor, 2009; EPD
mire/bog, edge of forest	medium	3	one date rejected; well dated	Grant and Dark, 2006

Code	Site	County, cluster	Elevation (metres)	Bedrock geology	Local soils
ST	Stansted	Essex, Essex/London	70	clay, silt, sand and gravel	seasonally wet deep clay
CF	Coleman's Farm	Essex, Essex/London	20	clay, silt, sand and gravel	deep loam
SH	Slough House Farm	Essex, Essex/London	10	clay, silt, sand and gravel	seasonally wet deep loam
PB	Pannel Bridge	East Sussex, South-East	4	sandstone and siltstone	seasonally wet deep clay
LC	Little Cheyne Court	Kent, South-East	-1	sandstone and siltstone	seasonally wet deep clay
LY	Lyminge	Kent, South-East	100	chalk	silty

Source: EPD, Institut Méditerranéen d'Écologie et de la Biodiversité (IMBE). www.europeanpollen database.net (accessed 20/07/21).

The study regions

Pollen data for England have been collated to create a national database as part of the FeedSax project. This paper focuses on a subset from four clusters of sites, referred to here as 'Central', 'East Anglia', 'Essex/London' and 'South-East' (Plate VIII; Table 1). When considering evidence for agricultural land use, important factors are the type and location of the pollen sites. Differences in geology, soils, altitude and hydrology/rainfall all have an impact on the vegetation types within an area and are likely to have influenced decisions about land use. None of the sites in this region is at very high altitude, but Epping Forest (Essex/Greater London) and Lyminge (Kent) are notably higher than other sites in their regional clusters, while in Oxfordshire, Sidlings Copse is significantly higher than Oxey Mead (Table 1). Many of the sites in East Anglia and the South-East are low-lying, and some are in coastal/fen areas, prone to seawater flooding and brackish conditions. This needs to be taken into consideration, as palynologically, coastal/saltmarsh vegetation is difficult

Site type	Relative catchment size	Dates used in model	Notes on chronology	References for data
floodplain peat	small–medium	2	extrapolated to surface for approximate accumulation rate – very short sequence	Murphy, 1988; Wiltshire, 1991
palaeo-channel/ alluvial	small–medium	3	possible truncation/break in accumulation between dates is problematic, tentative chronology	Murphy et al., 2002
well within settlement	very small	1	dendrochronological date on context	Murphy, 1991; Wiltshire, 1992; Murphy and Wiltshire, 1993
marsh	small–medium	8	extrapolated to surface – radiocarbon dates all pre-date the FeedSax period	Waller, 1993
marsh	medium	4	well dated – extrapolated at constant rate for uppermost samples	Waller et al., 1999
palaeo-channel/ alluvial	small–medium	4	dates are for contexts – pollen sample dates estimated according to context	Maslin, 2017

to distinguish from an arable weed assemblage (as discussed further below). Equally, Brandon, the only East Anglian site with substantial evidence for heathland, is on the edge of Breckland, an area of sandy heath.

An important consideration for understanding the strength and type of agricultural land use signals from different pollen sites is the extent of the site catchment or 'relevant source area for pollen' (RSAP), which Sugita (1994) defines as the radius beyond which the correlation between pollen and the surrounding vegetation ceases to improve. More simply, the catchment is the area around a pollen sampling site from which most of the pollen is derived. The proportion of pollen arriving from different distances is affected by numerous factors, including the density and type of local vegetation, the type and size of site sampled (e.g., lake, bog, alluvial sediment, archaeological feature), hydrology and topography (Jacobson and Bradshaw, 1981; Sugita, 1994; Bunting et al., 2004). Broadly speaking, the larger the diameter of a lake, mire or other sampled feature, the larger the pollen catchment area will be. A site surrounded by dense woodland or mountains will have a smaller catchment than one in an open, flat landscape. Inflowing streams also increase catchment size, as pollen is carried in from the wider landscape (Brown et al., 2007). For the pollen records discussed here, the most substantial difference is between very small catchment sites within, or close to, settlement areas, referred to as 'on-site', and larger catchment 'off-site' records, from mires and lakes. The former would be expected to have a much stronger representation of local vegetation, while the latter provides a picture of the wider landscape. In a hypothetical scenario where sites of both types were adjacent to arable fields within a landscape containing pasture and woodland (for example), the small catchment site would usually have a stronger arable farming signal than the large catchment site. Interpretation of pollen records from within or very near settlements may be further complicated by the input of pollen from crop processing or dumping of waste (e.g., Lyminge: Maslin, 2017). Both on-site and off-site records are included here, as they each provide valuable insights relating to arable and pastoral land use, but it is important to bear these differences in mind when interpreting the data.

Palaeoenvironmental records from a variety of sources, including north-west European peat bogs and lakes, indicate cooler/wetter conditions around the fifth to seventh centuries AD (e.g., Blackford and Chambers, 1991; Barber et al., 2003; Charman, 2010), which may have had an impact on both 'natural' vegetation and agriculture. In addition, low-lying coastal regions are likely to have been affected by higher/unstable sea levels in the Romano-British period and from around the tenth century AD (Long and Hughes, 1995; Waller et al., 1999). The potential impact of higher temperatures during the medieval climate anomaly (MCA) in the tenth to thirteenth centuries must also be considered; it is possible that changes in average temperature or rainfall patterns made parts of the landscape more or less hospitable to cultivation – and to specific crops – than in previous centuries.

Data collation and standardization

Pollen survives best in waterlogged, undisturbed, acidic conditions such as peat bogs and lake sediments. In much of central and south-east England, preservation is poor owing to a combination of long-term agricultural disturbance and good drainage (e.g., chalk and limestone bedrock). However, there are pockets of good preservation in small fens/mires, floodplain sediments, palaeochannels and archaeological features such as pits and wells. Any site with pollen data relating to any part of the period *c.* AD 300–1500, where a minimum of 300 land pollen grains[1] had been counted, and which had some form of radiocarbon, OSL or dendrochronological dating evidence, was included in the analysis. Data were downloaded from the European Pollen Database (EPD)[2] or digitized from published tables and diagrams (see Table 1).

Pollen types were standardized using the nomenclature of Bennett (1994). Wherever possible, radiocarbon dates were recalibrated using the IntCal20 calibration curve (Reimer et al., 2020) in OxCal 4.4 (Bronk Ramsey, 2008; 2009; Bronk Ramsey and Lee, 2013) and new age-depth models were created. An age-depth model establishes an approximate range of dates for each pollen sample (i.e., the age of the pollen at any given depth within the pollen core), based on extrapolation between radiocarbon (or otherwise) dated samples. The quality of site chronologies is highly variable; most records do not have dates covering the entire time period, so some dates are based on extrapolation and are therefore more tentative. Dendrochronological dates are usually precise, while older radiometric dates may have ranges of hundreds of years. The length of time covered by pollen data from different sites varies greatly, with some spanning the whole *c.*1,200-year period and others providing data for just 100–200 years. Some have multiple pollen samples per century, others have significant gaps in the record (see Plates X–XI).

Assessing agricultural land use

The approach to establishing arable or pastoral land use presented here builds on that used in Hamerow et al. (2020). To gauge the type and scale of land use it is necessary to consider the following factors:

1. the type of **vegetation**;
2. the **dominant** form of **agricultural land use** (i.e., arable, mixed farming, or pasture);
3. the **strength** of the signal for agricultural land use;
4. the **diversity** of key crops and weeds.

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[1] The TLP (total land pollen sum), which is the number of non-aquatic pollen grains an analyst records to complete a sample, is not always stated, but full analysis for publication usually requires a count of 300–500. Some sites have lower counts for certain periods, usually where preservation was poor. Counts of less than 150 have been excluded entirely.

[2] European Pollen Database, Institut Méditerranéen d'Écologie et de la Biodiversité (IMBE). www.europeanpollendatabase.net (accessed 20/07/21).

1 Vegetation

The first of these factors concerns the dominant types of vegetation in an area, and particularly the proportion of tree/shrub cover compared to heath and grassland, which can be used to gauge landscape openness. The total percentages of trees, shrubs, heaths and herbs in each century were determined for each site. Where necessary, the TLP was recalculated to exclude reeds, rushes, sedges and aquatics – this was necessary to standardize data between sites, but also because these types are likely to reflect very local conditions (e.g., surface wetness). Tree and shrub data were combined as 'total arboreal pollen'. The percentage of arboreal pollen is not a direct measure of tree/shrub cover within the landscape (e.g., Huntley and Birks, 1983; Bunting, 2002; Smith et al., 2010), although it is a good indicator of relative tree/shrub cover unless there are substantial differences in the species present. Species composition is important as some trees/shrubs produce much larger quantities of pollen than others owing to differences in dispersal mechanisms (e.g., wind-pollinated species produce more pollen than insect- or self-pollinated trees). As many trees and shrubs are wind-pollinated with widely dispersed pollen, it is also difficult (or impossible) to distinguish a small number of local trees/shrubs from a larger, more distant woodland. It is, however, possible to establish approximate arboreal cover – which may include woodland, scrub, hedges and individual trees – for a region by looking at data from multiple sites. This allows us to gauge how much open ground would have been available.

2 Emphasis of agricultural land use

The dominant type of farming in the pollen catchment was determined using Turner's (1964) arable/pastoral index (API), which is the ratio of cereals and likely arable weeds to plantain (*Plantago*, excluding *P. maritima*), a common pasture weed. The index has been shown to work well as a means of establishing the emphasis of agricultural land use in a region (Pratt, 1996). The API had to be adjusted in two cases where anomalously high percentages of taxa classed as 'arable weeds' were likely to have other origins. As mentioned previously, this is particularly problematic for coastal/saltmarsh areas: Chenopodiaceae/Amaranthaceae (fat hen family) and *Artemisia* type (wormwood/mugwort) pollen includes common arable weeds, but also plants which grow in brackish conditions. This affects sites in the East Anglian wash/fens and the South-East and is taken into account in interpretation of the API. For the eleventh-century assemblage at Little Cheyne Court (Kent), the API was not applied as all the indicators point to brackish/marine conditions (Waller et al., 1999), while pollen records from Wiggenhall St Germans (Norfolk) and Hope Farm (Kent) were excluded from the analysis entirely, as conditions were evidently brackish/marine through the late Roman period onwards (cf. Waller, 1994; Waller et al., 1999).

Sidlings Copse has remarkably high percentages of another 'arable' type, Brassicaceae (mustard family). Many Brassicaceae are 'archaeophytes' – non-native species introduced deliberately or accidentally that became naturalized before *c.* AD 1500 – including arable weeds, vegetable and oil crops. However, there are also wild native Brassicaceae that grow in damp areas, hedgerows and on riverbanks (Stace, 2010, 385–425). Based on the pollen it is not possible to determine which types – or even how many different types – are present, but there are strong indications that most, if not all, of the Brassicaceae pollen at Sidlings Copse originated from local aquatic plants (Day, 1991, 463). Brassicaceae were therefore excluded from the API for this site.

Cereals are also included in the API and are obviously a key component of arable farming, but their pollen is problematic for several reasons. First, most cereals are self-pollinating and produce small amounts of large, heavy pollen that does not travel far from the plant (Edwards et al., 1986; Edwards and McIntosh, 1988), meaning they are often underrepresented in pollen assemblages. Second, threshing and other processing activities release pollen, so high percentages of cereal might reflect proximity to crop processing rather than crop fields (e.g., for on-site records). Third, definitive identification of oat, wheat and barley is impossible by existing methods (Andersen, 1979; Tweddle et al., 2005). Rye (*Secale cereale*) is usually identifiable by eye, but other cereals require measurement to separate them into *Avena-Triticum* type (oat/wheat) and *Hordeum* type, which includes barley and large grasses that grow in arable fields, but also large wild grasses that grow in wetlands and coastal areas. *Avena-Triticum* type is less problematic, though it includes wild oat (Andersen, 1979). Unfortunately, cereals are often recorded as a single group, 'Cereal type' or 'Cerealia', with no criteria for identification stated. Where criteria are given, they do not often match Andersen's criteria closely enough to establish an identification. Measurements, if recorded, are rarely published. It is therefore assumed that the FeedSax 'cereals/large grasses' category encompasses oat/wheat and/or barley type pollen, including large wild grasses.[3]

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[3] It is possible that rye is also present in this group where it has not been identified separately, though unlikely as the pollen has a distinctive shape and can usually be recognized, if not by eye then by measurement.

Lyminge has remarkably high percentages of cereal/large grass pollen, resulting in a strongly arable API. However, as Maslin notes (2017, 7), seeds of wild oat (i.e., equivalent to *Avena-Triticum* type in the pollen record) were found at the site, and, as mentioned previously, cereal percentages at on-site sampling locations such as Lyminge are likely to be inflated by nearby crop processing (an early medieval threshing barn was identified at the site, for example: Thomas, 2013, 131) and potentially dumping of crop waste. For Lyminge, which is an extreme case, APIs were calculated with and without cereals/large grasses. This had a limited impact on the API (discussed below), so it is the former (with cereals) that is shown in the figures.

3 Agricultural land use signal strength (ALUSS)

The API is useful as a measure of the relative importance of cultivation and grazing but does not convey any sense of scale or intensity of farming, meaning the amount of land being farmed/grazed, or the number of crop plants growing within a given area. This is because the API is based on a ratio. To give an example, a pollen sample with an abundance of cereal and arable weed pollen and far fewer pasture weeds would register as strongly arable in the index, but so would a sample with just one cereal but no pasture weeds. To counteract this, the percentage of pollen contributing to the API was calculated as a measure of the agricultural land use signal strength (ALUSS). It is important to note that for arable land, ALUSS does not necessarily equate to the amount of land used for farming. For a pollen assemblage from a single site, there is currently no reliable way to distinguish 'extensive' and 'intensive' cultivation (see Bogaard et al., 2016; Bogaard et al., this volume; Hamerow et al., 2020): both processes may result in a higher quantity of cereal plants and potentially crop weeds within the pollen catchment. Weed species associated with intensive and extensive cultivation differ, depending on ploughing methods/frequency and fertility (soils, manuring). These differences can be seen in archaeobotanical assemblages (Bogaard et al., 2016; Bogaard et al., this volume), but since many pollen types cannot be identified to species, or even genus, these subtler changes are often impossible to detect other than in rare cases (e.g., cornflower; see below).

Scale may be determined by comparison of pollen records from different sites in a region: if multiple sites have strong ALUSS values and arable APIs, it is more likely that cultivation was occurring on a large scale. Some regions have much better coverage spatially and chronologically than others, which has an impact on the reliability of interpretations.

4 Diversity of key crops/weeds

The final component of the analysis was the presence/absence of key crops and arable weeds, namely cereals/large grasses, rye, hemp/hops (Cannabaceae: *Cannabis sativa* and *Humulus lupulus*), flax (*Linum bienne* type),[4] and cornflower (*Centaurea cyanus*), which is a rare example of a crop weed that can be identified to species by its pollen. The appearance of these taxa suggests changes in agriculture through the introduction of – or a new emphasis on – different crops or farming techniques. In terms of new crops, these changes are likely to result from decisions made by farmers or through changes in land ownership. For example, the arrival of hemp or flax at a site might reflect the beginning of (or an increase in) local cloth/rope production. The cereals grown in an area might change because of changing demand for a certain crop, intended usage (baking, brewing, fodder, etc.) or environmental factors (e.g., rye copes better than other cereals on poorer soils). By contrast, the arrival and spread of cornflower was probably incidental, reflecting a change in the way cereals were cultivated. Interestingly, this plant is typical of low-input cultivation (Amy Bogaard, pers. comm.), so would be favoured by more extensive arable farming.

Vegetation and agricultural land use in East Anglia, Essex/London, Central and South-East England

Major trends in vegetation and agricultural land use identified in this study are described below and shown in Plates IX–XI. It is important to be aware that, although data have been split into centuries, date ranges for individual pollen samples often extend into the preceding and/or succeeding centuries. Also, chronologies for the later periods tend to be more tentative owing to a lack of radiocarbon dates for the upper parts of pollen cores (see Table 1). It is encouraging to see that, although the pollen data themselves had no influence on the age-depth models, key shifts appear to have happened at similar times at multiple sites.

Plate IX shows the average percentages of broad pollen types in the four regional clusters from the fourth to fifteenth centuries. Data were averaged over 200-year periods because most of the sites had at least one sample every two centuries, reducing the 'noise' created by the intermittent presence of sites with very high or very low tree/shrub pollen. When 100-year blocks were used, this 'noise' created

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[4] The pollen of *Linum bienne* type includes both *L. usitatissimum* (flax) and *L. bienne* (pale flax) but is generally assumed to represent the former.

a false impression of repeated woodland clearance and regeneration, particularly in Essex/London (e.g., see tree/shrub pollen by site in Plate Xa). Sites with short-lived records were excluded, as were those expected to have very small catchments; almost all of the excluded sites were classed as on-site pollen records, reflecting local rather than wider regional vegetation.

As noted in previous large-scale analyses of pollen data from England, including *The Environment of Britain in the First Millennium AD* and *The Fields of Britannia*, the post-Roman to medieval period saw limited change in overall tree cover (Dark, 2000; Fyfe et al., 2013; Rippon et al., 2015; Rippon and Fyfe, 2019). Large-scale clearances occurred from the Bronze Age onwards, but by the late Romano-British period much of the landscape was already 'open'. The Central and East Anglian regions were largely open throughout the period analysed, showing low tree and shrub cover (Plate IX). Arboreal pollen percentages were higher on average in East Anglia, declining from the twelfth to thirteenth centuries onwards, a time at which there was an increase in trees in the Central region. The data from Essex/London and the South-East suggest noticeably higher tree and shrub cover in those areas, with a gradual decline over time in Essex/London.

In the South-East there was a substantial amount of heathland until the tenth to eleventh centuries, although this was mostly at one site in the Romney and Walland Marshes; the loss of heath after this date coincides with seawater flooding the area, curtailing the pollen record from Little Cheyne Court (Waller et al., 1999). It is possible that heath persisted further inland or on higher ground after this date, but it is not seen in the available pollen data. The only other site with substantial heathland vegetation was Brandon, Suffolk (Wiltshire, 1990) on the edge of Breckland (East Anglia), and then only in the sixth to seventh centuries; as mentioned previously, conditions are thought to have been cooler and wetter at this time (e.g., Blackford and Chambers, 1991), which might explain the localized spread of heathland.

Arable and pastoral types were included in Plate IX to give an impression of overall scale of agricultural land use; this is explored in more detail below in relation to ALUSS at individual sites (Plate XIb). Arable and, to a lesser extent, pastoral indicators are seen to increase over time in East Anglia and Essex/London, peaking in the fourteenth to fifteenth centuries. Both types are most common in the Central region in earlier periods, declining gradually after a peak in the eighth to ninth centuries, although this pattern is strongly influenced by the record from Oxey Mead and may not reflect changes in the wider region. By contrast, evidence for both types of land use is very rare in the records from the South-East, though higher in the tenth to eleventh and fourteenth to fifteenth centuries.

Plate X shows percentages of arboreal pollen at individual sites in 100-year blocks, with sites arranged west to east within each region. There is considerable variability between sites within the regions, and some sites have markedly higher tree/shrub pollen than average (e.g., Beckton (BK), Epping Forest (EP) and Pannel Bridge (PB)), but on the whole arboreal pollen percentages are low enough to suggest open landscapes. It is noticeable that, with few exceptions, more 'wooded' sites remain wooded throughout the period under study, while open sites remain open. The marked decline in tree cover at Little Cheyne Court (LC) in the tenth to eleventh centuries coincides with the aforementioned increase in heath and a shift to saltmarsh conditions, not long before the site was inundated (Waller et al., 1999). The on-site pollen records tend to reflect more open conditions than off-site records (Plate Xa). This indicates a lack of substantial tree cover close to settlements but may also reflect small catchment sizes of some sites, causing under-representation of trees/shrubs in the wider region.

Plate XI shows which types of agricultural land use dominate over time, arranged west to east within regional clusters as in Plate X. There is substantial variability, with no clear association between higher amounts of arable or grazing and different regions. In Plate XIa–c, showing agricultural land use type, ALUSS and presence of key crops and weeds, sites are rearranged according to whether farming appears to have been predominantly arable (left) or pastoral (right). Ordering the sites in this way (rather than by region) makes it easier to see correlations between land use type, ALUSS and crops/weeds, and to see broader trends through time. Key periods of change are discussed below.

Fourth to fifth centuries: abandonment of farmland?

As mentioned previously tree/shrub cover is already low by the fourth century, with much of the landscape 'open' (as opposed to wooded) (Plates IX and Xa). There is relatively little change in tree cover going into the fifth century (Plate Xa). Minor increases occur at Oxey Mead (OM) in the Central cluster and Brandon (BR) in East Anglia, and there is a more substantial expansion of trees and shrubs at Little Cheyne Court (LC) in the South-East. The latter might represent a period of woodland regeneration, perhaps indicating neglect of former farmland. However, it is also possible that the increase in tree cover at this site reflects local environmental conditions: heaths increase, and the taxa responsible for most of the rise in arboreal pollen are *Alnus glutinosa* (alder) and *Corylus avellana* type. The latter is usually presumed to represent hazel, but could be bog myrtle: alder carr and myrtle may well have grown on expanding heathland/wetland. Another factor to consider is the inundation of nearby coastal areas by seawater at this time (Waller et al., 1999), potentially changing the catchment area of the site or flooding grassland/pasture; the weak fourth century signal for pasture at Little Cheyne Court disappears entirely in the fifth century (Plate XIa). Owing to limited data for this early period in the South-East, it is not possible to say whether these changes coincide with a decrease in agricultural land use in the wider region.

Agricultural land use in the fourth century is predominantly mixed, with some sites more arable and others more pastoral in nature (Plate XIa). Beckton (BK) and Lyminge (LY)[5] are both strongly arable according to their APIs, though removing cereals from the index calculation for Lyminge gives a mixed/arable API: this seems more likely as pasture weeds such as plantain and sorrel/dock (*Plantago* and *Rumex*) are common. The ALUSS in most areas is relatively strong but usually lower at sites where pasture is dominant (Plate XIa–b); this might suggest that grazing occurred on a small scale near those sites (e.g., Little Cheyne Court (LC), Pannel Bridge (PB), Sidlings Copse (SC)), while the overall amount of agricultural land was generally higher around sites with mixed and arable APIs (e.g., Lyminge, Beckton, Brandon). Cereals/large grasses are found in all regions and at the majority of sites, but hemp/hops and rye are only present at some East Anglian sites at this time (Plate XIc). Rye is more common in the Breckland area archaeobotanically (Smith et al., 2016, 400), perhaps owing to the suitability of this crop for sandy and unproductive soils.

In the fifth century there is a noticeable shift towards pasture at five sites, three of which are in East Anglia (Plate XIa), which bears out Murphy's observation about a post-Roman reduction in arable farming in the region (Murphy, 1994). Unfortunately, there are no fifth-century data for the two sites that were strongly arable in the fourth century, although Beckton is more mixed (i.e., more pastoral) by the sixth century. Most other sites see no change in emphasis, but the exception is Oxey Mead, which becomes much more arable. Changes in ALUSS vary, with some sites seeing an increase in activity and others a decline (Plate XIb). There is no clear pattern relating strength to type of agricultural land use for this period. No new

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[5] The date for Lyminge is tentative, but is Roman to early Saxon (Maslin, 2017).

crops/weeds appear and their overall representation does not change, though there are losses and gains at individual sites (Plate XIc).

To summarize, the overall picture for the fourth century is of a mostly open landscape, with both arable and pastoral land use widespread and a substantial amount of the landscape being cultivated/grazed. There were areas with strongly arable or strongly pastoral land use, but the majority of sites appear to have had forms of mixed farming at this time. This does not quite fit the picture built up for these regions by the *Rural Settlement of Roman Britain* project, which stressed the importance of arable in some areas, citing, amongst other evidence, the large number of corn dryers and the presence of weed seeds consistent with a spread onto poorer soils (e.g., Lodwick, 2017a, 82). By contrast, the method of calculating the extent of pasture and arable in the *Fields of Britannia* project tends to indicate a much larger proportion of the landscape being devoted to grazing than to cultivation (e.g., 6 per cent arable and 45 per cent 'improved pasture' in the South-East region: Rippon et al., 2015, 124–25). Looking at the data as a whole, it seems likely that farming was more mixed, with some areas seeing an expansion of arable, balanced by a spread of pasture in others. Although pollen is more suited than archaeobotany to sensing broad patterns of land use, it is important to note that the areas with the best-preserved archaeobotanical and zooarchaeological evidence are often poor areas for pollen preservation, and vice versa, so it is often impossible to make a direct comparison (see Hamerow, this volume).

Very few sites show an increase in tree cover in the fifth century and there is no indication of widespread regeneration of woodland/scrub in any of the regions, such as might occur if farmland was abandoned entirely. There is, however, an increased emphasis on pasture compared to the fourth century; as suggested by Gerrard (2013) and Rippon et al. (2015), a widespread desertion of agricultural land is unlikely given the lack of evidence for expansion of woodland/scrub, yet conversion of former crop fields to pasture would still prevent woodland regeneration. Two of the three sites with increased tree/shrub cover, and several of those where there is a shift towards pasture, are in East Anglia. Mixed farming continued in this region with cereals/large grasses, rye and hemp/hops present, but there does appear to be a reduction in arable land use, which might indicate a reduced need for crops at this time, as would be expected if grain was no longer being exported (see Lodwick, this volume). Although this pattern is clearest in East Anglia, it is important to note that almost half of the sites with data for both the fourth and fifth centuries are in this region. Similar shifts are seen at some sites in other areas, and it is possible that if more data were available for other regions, East Anglia would no longer stand out.

Sixth to seventh centuries: small-scale mixed farming?

In East Anglia, tree/shrub pollen is reduced at Willingham Mere (WM) and Redmere (RM) from the sixth century – this is likely to represent clearance of woodland/scrub in the region (Plate Xa). There are no significant changes in overall arboreal cover elsewhere (Plates IX and Xa). Agricultural land use is variable for this period. Some sites become more arable, some more pastoral, while at others there is continuity, but the overall trend is towards an increase in arable. By the seventh century there is a further shift towards arable at some sites, including previously pastoral sites that become more mixed. Changes in ALUSS are variable but, overall, sites where arable increases also tend to see an increase in ALUSS, while sites that become more pastoral see a decrease (Plate XIa–b), suggesting that arable land use was becoming more important. There are minor changes in the presence of key crops and weeds, with cereals and hemp/hops remaining relatively common and rye appearing at two sites (Plate XIc). Westbury-by-Shenley (WB) and Slough House Farm (SH) have very strong agricultural land use signals, particularly by the seventh century. These are both small-catchment, on-site records and may represent local cultivation, though as Hale (1995) points out for the former, crop processing is also a likely source of crop/weed pollen.

At Willingham Mere (WM) there is a drop in agricultural land use and a shift to pasture in the sixth century, with key crops and weeds disappearing. This coincides with a marked increase in sedges/reeds and meadowsweet (*Filipendula*) and a rare find of burnet (*Sanguisorba*), likely to arise from damp ground or possibly wet meadows close to the mere. This might indicate cooler/wetter conditions owing to the sixth-century climatic shift but could also reflect a drop in the mere's water levels, allowing reeds/sedges to colonize the margins (cf. Waller, 1994). There are no other clear signs of Late Antique Little Ice Age (LALIA – e.g., see Büntgen et al., 2016) changes in vegetation for the regions discussed here, and no obvious impacts on agricultural land use. This agrees with Rippon and Fyfe's suggestion that lowland areas would have been less strongly affected by this change in climate than upland regions (Rippon and Fyfe, 2019, 138). Peat macrofossil and other proxy climate records from Britain and Ireland that show cooler/wetter conditions at this time are predominantly from northern regions, peat bogs and upland areas that might be more sensitive to this type of change[6] than southern lowlands (e.g., Blackford and Chambers, 1991; Barber et al., 2003; Charman, 2010).

In summary, the type of agricultural land use was variable in the sixth to seventh centuries. Some sites became more arable, others more pastoral, although a shift to arable in some areas is combined with an increased ALUSS, which suggests that crop farming became more important overall. The degree of variability fits with the idea of relatively small farms practising mixed farming (cf. Banham and Faith, 2014), with the emphasis on crops or livestock varying from place to place. There are no clear impacts of the LALIA on either tree/shrub cover or agricultural land use in the regions covered by this paper.

Eighth to ninth centuries

The eighth century sees the first major change in agricultural land use across all regions. Small decreases in tree cover at multiple sites indicate clearance and there is a marked shift towards arable, with almost all sites having an arable or arable/mixed emphasis at this time (Plates Xa–b and XIa). There is also a widespread increase in ALUSS and higher diversity of key crops and weeds, with the appearance of cornflower at four sites and flax at Brandon (Plate XIb–c). Although cornflower appears earlier in archaeobotanical assemblages (McKerracher et al., in prep.), the eighth century seems to be a key time for its appearance in pollen records. This might reflect the increasing scale of arable land use, making weeds more likely to reach pollen sampling sites, but it is also possible that a change in farming techniques allowed cornflower to flourish. As mentioned previously, the functional ecological traits of cornflower indicate that it would be favoured by low-input cultivation, suggesting a shift to more extensive arable farming at this time (see also Bogaard et al., this volume). There is a further increase in arable at Oxey Mead, Willingham Mere and Brandon in the ninth century, though this is less marked than the eighth-century change and is not universal (Plate XIa). ALUSS increases at some sites and decreases at others, with no clear link between ALUSS and either arable or pastoral land use at this time (Plate XIb). Although there are differences in the data used and the approach to interpretation, the eighth century was also identified as a time of 'greater discontinuity' by Rippon et al. (2015, 335), citing an increase in agricultural land use and nucleation of settlements. To

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[6] Conversely, southern lowland regions might be more sensitive to increases in temperature and reductions in rainfall, e.g., causing drought.

this we can add an increased emphasis on arable and – as explained above – perhaps a more extensive type of cultivation, with larger areas managed less intensively.

Tenth to eleventh centuries

The tenth century marks the start of another period of change, although its trajectory is less clear than the eighth-century shift. Most regions see no change in tree/shrub cover, but where they do, with the exception of East Anglia, there is a decline (Plate IX). However, there are notable increases in arboreal pollen at Redmere (RM), Sidlings Copse (SC) and Beckton (BK) (Plate Xa). Day identified oak woodland regeneration at Sidlings Copse, beginning around the tenth century and becoming more marked from the eleventh century (Day, 1991, 467). Although data for different arboreal taxa are not presented here, there are similar increases in oak at Beckton (Batchelor, 2009) and Redmere (Waller, 1994) from the ninth to tenth centuries onwards. In spite of a gradual decline in trees/shrubs at Redmere from the eleventh to thirteenth centuries, percentages of oak remain high, suggesting protection/management. Day suggests (1991, 467) that the increases at Sidlings Copse could have been caused by efforts to encourage this species, as oak was highly valued; it was protected nationally in later medieval and post-medieval periods because of its importance for shipbuilding (e.g., Kipling, 1974). By contrast, from the eleventh century onwards, overall tree cover at Epping Forest (EP) is reduced. This reduction might represent clearance within the catchment, but it is also likely to reflect woodland management, including use of the area as wood-pasture. As a royal forest, Epping was also subject to Forest Law, which may have led to an increase in deer grazing or browsing from the medieval period onwards (Grant and Dark, 2006, 10).

ALUSS increases at most sites in the tenth century, affecting both arable- and pasture-focused sites, which suggests an increase in both types of land use (Plate XIa–b). There is an overall shift towards pasture or mixed farming in comparison with the eighth to ninth centuries, though most of the strongly arable sites remain arable. Crops and weeds remain diverse, with flax appearing at Oxey Mead (OM) in the eleventh century (Plate XIc), though, as Greig notes (2004, 377), macrofossils of flax were found in earlier periods at Yarnton/Oxey Mead, so its arrival in the pollen record does not mark its introduction as a crop. Cereals/large grasses, hemp and cornflower remain widespread, although rye is less common by the tenth century and disappears by the eleventh century (Plate XIc). As mentioned previously, it is possible that rye was present at some of the sites where only 'cereal' is recorded but given its relatively distinctive shape this is assumed not to be the case. Significantly, rye is seen to vanish from sites where it was present in earlier periods (Plate XIc). This loss of rye might reflect a narrowing of the range of cereal crops grown at some sites. This is perhaps reinforced by the fact that rye is wind-pollinated and consequently might be expected to be better represented than oat, wheat or barley in the pollen record; wind-pollinated species tend to produce more pollen than self-pollinating plants and release it more readily.

The overall picture for the tenth to eleventh centuries is of an increase in agricultural land use, with both arable and pasture increasing. A minority of sites became more pastoral at this time, resulting in a slight shift to pasture overall, and rye appears to have become less common. Arboreal pollen declined, suggesting further clearances in some regions, while elsewhere woodland management may have been responsible for localized increases in oak.

Twelfth to fifteenth centuries

Data are patchy for this period and dates are generally tentative, as there are rarely direct dates for the later medieval/post-medieval sections of pollen cores. There is little or no change in tree/shrub cover at most sites, but a marked twelfth-century decline is apparent at Welney Washes (WW), followed by a gradual recovery (Plate Xa). This coincides with an arable/mixed farming signal and the most diverse phase for crops and weeds at the site, with cereals, hemp/hops and cornflower present (Plate XIa and c), suggesting clearance for cultivation. A substantial decline in arboreal pollen at Beckton (BK), and a slight increase in open ground at Pannel Bridge (PB), also indicate clearances by the fifteenth century. This coincides with a marked increase in ALUSS at both sites and the reappearance of cornflower at Beckton (Plate XIb and c); a rare example of cornflower occurs in the late Iron Age/early Romano-British period at the site, after which it disappears until the fifteenth century.

There is a drop in agricultural land use and arable diversity in the twelfth to thirteenth centuries. The decline is exaggerated by the low number of on-site records covering this period, which has an impact on the measure of arable land use in particular, yet the reduction in diversity is notable. Hemp/hops and cornflower are present at fewer sites and – as in the eleventh century – rye is not recorded in any of the studies (Plate XIa–c). Cereals/large grasses are still common, being present at all sites bar Epping Forest (EP). This might suggest

– albeit tentatively, given the data available – a reduction in arable or a shift from more to less diverse ranges of crops growing in some areas. This trend in the pollen data will be examined in more detail in publications examining the national picture, in comparison with archaeobotanical records which provide more direct evidence of crop types (Hamerow et al., in prep.).

For the pollen sites discussed here, there is no clear signal associated with the Great Famine or the Black Death in the fourteenth century. Expected impacts might be a decline in agricultural land use, particularly arable, as the population fell dramatically, and an increase in tree/shrub cover as abandoned farmland was recolonized. In the early fourteenth century, cattle and sheep were depleted by disease (Thomas et al., 2013), but by the later fourteenth century there was a renewed emphasis on pastoralism owing to livestock management being less labour intensive than crop farming, and as the lower demand for grain freed up arable land for grazing (Hopcraft, 1994; Thomas, 2005). It is important to note that this period is poorly represented by pollen data for the regions discussed here; only four sites have data covering both the thirteenth and fourteenth centuries, and none of those continues into the fifteenth century. Of the four sites with continuous data, two see a slight increase in tree/shrub pollen in the fourteenth century, at one site there is no change, and at the fourth trees/shrubs decrease (Plate Xa). Only one site sees a shift towards mixed, more pastoral farming (Coleman's Farm: CF), and – surprisingly – the ALUSS increases at three out of four sites (Plate XIa–b).

Coombes et al. (2009) also saw little evidence of a fourteenth-century decline in pollen and geochemical data from Hulleter Moss, Cumbria; they suggest that, although populations fell, most communities in the area were not destroyed completely, meaning that some arable farming continued. They also hypothesize that grazing pressure prevented significant woodland regeneration, which is likely given the increase in livestock farming. These factors may apply to some of the pollen sites discussed here, although if arable farming declined on a large scale, we should be able to see this when looking at pollen on a regional level; clearer patterns may emerge in the national dataset, within which there are a larger number of records spanning the thirteenth to fifteenth centuries (Hamerow et al., in prep.).

Summary

Although data for some regions and periods are limited, it has been possible to build up a picture of vegetation and agricultural land use through time, and to identify key periods of change from AD

300–1500. Plate XII summarizes the data for all sites combined. As seen in Plate XIa–c, there are marked differences between sites that had high and low tree/shrub cover, and between those dominated by arable, mixed and pastoral farming. In order to avoid conflating evidence from very different site types, in Plate XII data are grouped for open, semi-open and wooded sites under tree/shrub cover, and for arable, mixed and pastoral sites under agricultural land use. As discussed previously, the landscape was broadly open by the late Roman period and percentages of arboreal taxa were low at most sites. Agricultural land use was mixed, but varied across the regions, with Central sites more pastoral, and a mixed arable/pasture farming signal in East Anglia. Essex/London and the South-East have limited data for this period, but where evidence for agricultural land use (i.e., ALUSS) is strong, sites were focused on arable or mixed/arable farming. There was a slight increase in trees/shrubs at both open and wooded sites in the fifth century (Plate XII), though, as others have noted (e.g., Rippon et al., 2015), there is no evidence for widespread post-Roman woodland regeneration. Although there is variability, overall land use for farming was reduced in the fifth century and there was an increase in the importance of grazing (Plate XII). Site-level data indicate a shift to grazing in East Anglia in particular, suggesting that some arable land may have been converted to pasture in this area.

Agricultural land use trends during the sixth to seventh centuries were variable. A reduction in tree/shrub cover (Plate XII) was caused mainly by woodland/scrub clearance at two East Anglian sites, though this was not seen elsewhere. At some sites, mainly those classed as 'arable', there was a shift from mixed farming towards cultivation at this time, while at other site types there was continuity or a spread of pasture. ALUSS recovered to fourth-century levels following the drop in the fifth century (Plate XII), although again this varied from site to site (Plate XIb). Key crops and weeds became more widespread overall, with rye appearing at Oxey Mead and Brandon, perhaps suggesting an expansion of the types of cereal cultivated (cereal-type pollen was already present at both sites). At other sites, cereals disappeared entirely (Plate XIc). These differences might suggest a landscape divided between small farms doing different things, which is compatible with the view that farming was mixed arable/pastoral and relatively small-scale at this time. There is no clear evidence for a large-scale impact of cooler/wetter LALIA conditions on vegetation or land use in the regions discussed here. It is quite likely that this shift was more pronounced in the north and west of England, where average rainfall is higher and there are large areas of upland; this will be addressed in other FeedSax publications focusing on both those regions and the national picture (Hamerow et al., in prep.).

The eighth century was a period of significant change across all of the sub-regions considered here. Both arable and pastoral land use increased, but with a particular emphasis on cultivation, resulting in sites classed as 'arable' becoming strongly arable and 'mixed' sites becoming mixed/arable (Plate XII). Many sites saw an increase in cultivation and became more diverse, with cornflower appearing in three regions, suggesting more extensive, low-input cultivation, while flax appeared in East Anglia. The scale of agricultural land use also increased (Plate XII). These changes suggest a widespread increase in arable farming and potentially the adoption of new, low-input farming practices, corresponding with the appearance of crop processing and storage infrastructure in the 'long eighth century' (Hamerow, this volume).

Oak woodland began to recover at some sites from the ninth to tenth centuries onwards (Plate XIa), perhaps encouraged by forms of woodland management that favoured oak, and later by Royal Forest designations. At some sites there was a further increase in agricultural land use at this time, but this was countered by a reduction at others; as Plate XII shows, although ALUSS remained high in the tenth century, there was no increase overall, and the eleventh century actually saw a marked decline. At sites where there was an increase, this affected both arable and pasture – although, as Plate XII shows, there was a slight shift towards mixed arable/pastoral farming with an increase in pasture. Key crops and weeds remained widespread, though less so than in the eighth century. In terms of the impact on pollen assemblages, the tenth-century shift was less marked and less focused on arable than the eighth-century expansion. It is possible that the warmer conditions caused by the MCA played a role in this continuing growth of farming, but, as discussed by Hamerow, Holmes and others in this volume, this period also saw wider changes in farming techniques and landholding.

Pollen records for the twelfth to fifteenth centuries are patchy in the regions discussed in this paper, and chronologies are less reliable than for the fourth to eleventh centuries. This is problematic when interpreting data for all sites combined, requiring caution: for example, Plate XII shows a disappearance of heaths from the twelfth century onwards, yet as Plate XIa–c shows, this is caused by the termination of pollen records close to heathland (i.e., Brandon and Little Cheyne Court), rather than a genuine loss of this habitat type. Although the data are limited, it is possible to see further increases in agricultural land use in some areas, including examples of woodland clearance by *c*.1500. Other sites saw a drop in arable and a loss of crop/weed diversity in the pollen record, although the low number of on-site records for this period is an important factor here. The data available reveal no clear impacts associated with the fourteenth-century Great Famine or the Black Death, such as widespread woodland regeneration or a reduction in arable land, but this may be due to a lack of data rather than a lack of impact.

It is perhaps surprising that few clear regional differences have emerged. The timing of key shifts is furthermore similar in most places. Looking at the late Roman to medieval period as a whole, there was a general shift from more pastoral and mixed farming to more arable farming over time. Trends varied between sites and did not always continue in the same direction, but the sites with strongly arable pollen records in the earliest periods usually remained arable or mixed/arable throughout. Similarly, sites with more pastoral land use in the earliest phases tended to remain broadly pastoral. Overall agricultural land use also increased, although not in a continuous expansion; the spread was more noticeable in the off-site records than those from on-site locations, as the latter were predominantly arable, small-catchment sites with high levels of agricultural land use from the earliest periods onwards. Although off-site records usually come from wetlands/heath that were (presumably) more suited to rough grazing than cultivation, pollen of crop types and weeds from the surrounding landscape is often present. Off-site records may underestimate arable land use, particularly because of the problems of cereal pollen dispersal discussed earlier, but unlike on-site records they are unlikely to be affected by nearby crop processing; both types of pollen site are liable to be biased but considering them together we can build up a more coherent picture of the landscape.

Where arable expanded at the expense of pasture, it seems likely that livestock would have been moved further afield or grazed on land that was deemed unsuitable for cultivation, such as heaths and uplands. As seen in Plate IX, of the four regions covered here, only the South-East has significant heathland according to pollen data alone; Romney and Walland Marshes show little evidence of farming overall and are broadly pastoral, suggesting these areas may have been grazed as they are today. As mentioned previously, most of the pollen sites discussed here are relatively low-lying, and the regions they represent do not include significant uplands; most land within the study area is below 150 metres OD (Plate VIII). However, two of the higher-altitude sites, Sidlings Copse and Epping Forest, were markedly more pastoral than lower-lying sites nearby. This might indicate that higher ground was more commonly used for grazing in these regions. Hay meadows may also have been a source of grazing or fodder, although distinguishing these habitats from the natural vegetation in an alluvial area or wetland through pollen data is problematic.

Conclusions

For the sites and regions discussed in this paper, much of the late Romano-British landscape appears to have been open, with a mixture of arable and pastoral farming under way and a relatively strong land use signal. The early post-Roman period shows limited evidence for woodland/scrub regeneration, and – in agreement with previous studies (e.g., Rippon et al., 2015) – farmland does not appear to have been abandoned on a large scale. There are, however, signs of a reduction in overall agricultural land use and a shift towards pasture in some areas, suggesting that former arable land was grazed.

There is variability in the scale and type of agricultural land use across the regions discussed here through the post-Roman to medieval periods, yet there are clear shifts towards an increase in arable, and in the extent of agricultural land use as a whole, around the sixth century and – more noticeably – the eighth century. Although forms of mixed and pastoral farming continued, there was an increased emphasis on arable at this time; as the overall signal for agricultural land use also increased, it is difficult to gauge how much former pasture was cultivated, but it is likely some arable was converted to pasture. Beyond the eighth century the picture is less clear, but there was a further increase in agricultural land use – this time in both arable and pasture – around the tenth century, with a high diversity of crops/weeds continuing. The eleventh to thirteenth centuries saw an overall drop in agricultural land use and a reduction in the diversity of arable pollen types present. This pattern is partly influenced by the lack of data from on-site records; but even accounting for this factor, there is a decline, and the drop in diversity of crops/weeds appears to hold. Although limited and patchy, the data available for the fourteenth and fifteenth centuries suggest a resurgence of both types of agriculture, with sites more likely to be weighted towards arable or pasture than mixed farming in comparison with earlier periods.

This analysis has shown the value of bringing together pollen records from a wide variety of sites in order to gauge changes in agricultural land use. Within individual pollen records there is often considerable variability but looking at data from multiple sites and using the methods employed here, we have been able to highlight key changes across central, eastern and south-east England. On-site records played an important role in building up the overall picture of vegetation and land use for farming, particularly in those areas where preservation is poor and off-site records are lacking. However, they also provide a valuable insight in areas with better pollen coverage, where they provide a snapshot of activity closer to settlements. Well-dated, high-resolution pollen sequences are crucial for understanding past vegetation and land use, helping us to contextualize archaeobotanical data within the wider landscape, but also to test assumptions based on archaeological and textual evidence.