CHAPTER 4

AGRICULTURAL STRATEGIES IN ROMAN BRITAIN

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INTRODUCTION

Arable and pastoral farming was central to the economy of Roman Britain. Throughout the Roman world, the production of agricultural capital, alongside the availability and exploitation of land and labour, were key factors in the logistics of farming practices, while technological innovations were crucial for instigating changes in the scale of crop and livestock production (Erdkamp 2005, 12–54). However, in comparison with other Roman provinces, particularly around the Mediterranean (e.g. Bowman 2013), written evidence that provides details of land-ownership, agricultural strategies, and tax systems is almost completely absent from Britain (Fulford 2004). In contrast, British archaeology, particularly since the establishment of developer-funded archaeology, has produced a wealth of environmental evidence to draw upon. The *Rural Settlement of Roman Britain* project has assembled one of the largest zooarchaeological and archaeobotanical datasets available for the Roman period, drawing upon the project database. In the previous two chapters, these data were examined in isolation to reveal broad regional and chronological patterns of arable and pastoral farming. In this chapter, the two datasets are combined in order to consider technological innovation, diversification and scale in farming practice within five case study areas in England and Wales, before a detailed comparison of the various agricultural strategies is explored. The possible motivations for these patterns are then considered in light of social, economic and environmental factors, particularly with regards to the demands of the urban and military populations that became established after A.D. 43.

An important consideration for understanding the scale and functioning of the agrarian economy of Roman Britain is the evidence for the movement of animal and plant resources. It is clear, from the presence of specialist processing structures such as corndryers, mills and granaries, that agricultural surpluses were being produced in quantities that were beyond the basic needs of the rural population (Halstead 1989; Van der Veen and O'Connor 1998). Expanding rural and urban populations, alongside the establishment and maintenance of the Roman army, placed substantial demands on food supplies and probably resulted in the development of more complex economic systems, perhaps incorporating elements of free market exchange with the demands of the state. While a certain amount of agricultural surplus may have been traded through markets unrestricted, it is uncertain how much exchange was driven or stimulated by political concerns. Taxation would have been the principal means of the state for extracting a proportion of this surplus in order to supply the army, and support the *cursus publicus* and the provincial administration (Mattingly 2006, 494–6). Extensive written evidence for the supply of garrisons stationed at Vindolanda at the turn of the second century A.D. provides unique details of requisitions for a wide range of consumer products (Bowman 2003). Other potential evidence for an imperial command economy largely derives from literary records such as Diocletian's price edict, which brought about financial reforms at the beginning of the fourth century A.D. (Salway 1993, 243–5), though it is unclear how successful these reforms were in practice, particularly in provinces such as Britain. Nonetheless, it is abundantly evident that coinage circulated widely in the agricultural heartlands of Britain from the second century A.D. onwards, probably reflecting the growing use of coins for exchange and tax purposes (see Ch. 6).

Approaches to the study of Romano-British agriculture have advanced considerably since the development of environmental archaeology in the 1970s (Fulford and Brindle 2016). One of the first attempts at conceptualising an agrarian history of Roman Britain was made by Applebaum (1958; 1972), whose interpretation of the available evidence, made with little use of environmental remains, was largely conjectural. Several efforts since have focused on how individual farming settlements might have functioned, with Bignor villa, West Sussex (Applebaum 1958, 69–70; 1975; Frere 1987, 265) and Barton Court Farm, Oxfordshire (Miles 1986; 1989), forming two stand-out examples. By the early 1990s, however, soon after the implementation of PPG16, the potential contribution of animal bones and plant remains to knowledge of the Romano-British economy began to be highlighted. Overviews devoted to zooarchaeological (King 1991) and archaeobotanical (M. Jones 1991) evidence were

presented in chapters two and three respectively of the 1991 publication *Roman Britain: Recent Trends*, in front of more traditional themes such as coinage, pottery and architecture (see R.F.J. Jones 1991). The subsequent 2001 research agenda *Britons and Romans* included a chapter on zooarchaeology (Dobney 2001), but only a general discussion of plant evidence within the rural society chapter (Taylor 2001). Likewise, *A Companion to Roman Britain* contained a chapter dedicated to domestic animals (Grant 2004), but little mention of arable farming. Since then, the analysis of environmental remains has become a central tenet of developer-funded archaeology, though the degree to which the results have been drawn into overarching interpretations of Romano-British settlements has varied between sites. As seen in the previous two chapters, these data form our primary means for examining the agricultural economy of Roman Britain, though very little combined analyses of archaeobotanical and zooarchaeological data have been undertaken. Despite Van der Veen and O'Connor's (1998) call for greater integration nearly 20 years ago, discourse continues to focus on either one or the other of the two disciplines (e.g. Maltby 2016; Van der Veen 2016).

The purpose of this chapter is to build on what has been learnt in the preceding chapters by providing a clearer picture of the agricultural strategies that underpinned the provincial economy. Following the approach taken in Chapters 2 and 3, data from five case study areas are analysed here to examine the interplay between crop and livestock husbandry, concentrating on variations between different site types. The five case studies examined here comprise the Upper Thames Valley, the West Anglian Plain, Kent and the Thames Estuary, Wessex, and Gwynedd in north-west Wales. These case study areas (with the exception of Gwynedd) are based on Natural England's National Character Areas, and provide the opportunity to investigate the relationship between environmental and social factors in agricultural strategies. The first four have been chosen owing to the abundance of animal bone and plant data recorded from sites in these areas. The inclusion criteria for animal bone assemblages is 100 or more specimens identified to cattle, sheep/goat, pig and horse, and for botanical assemblages, samples with 20 or more standardised crop items. Distribution maps of the sites in each area are presented in the relevant sections below and the raw data are available on the project website (http://dx.doi.org/10.5284/1030449). Assemblages have been phased according to the parameters set out in Chapter 1, and conform to the late Iron Age, late Iron Age/early Roman, early Roman, middle Roman, and late Roman periods (see Ch. 1 for specific dating criteria). Numerous sites produce more than one phased assemblage, allowing for changes over time to be considered, while some are only broadly dated and have been categorised as 'Roman'. These assemblages have been utilised for the examination of different site types, but they are omitted from chronological analyses. Compared to the first four case study areas (as mentioned above), environmental assemblages are lacking from Gwynedd, though the region is fairly rich in terms of settlement, landscape and material culture evidence. Together, these case studies provide the opportunity to examine the diversity of farming practices in Britain, and evaluate the factors contributing to changes in agricultural production at various types of settlement in different regions. Following examination of the case studies the chapter turns to two themes through which the significance of the results can be discussed: 'strategies of agricultural expansion' and 'movement of resources'.

AGRICULTURAL EXPANSION IN LATE IRON AGE AND ROMAN BRITAIN

Before presenting the regional data it is worth expanding a little further on the context of agricultural production in late Iron Age and Roman Britain and summarising the current evidence for technological changes, specialisation, and farming practice in the archaeological record. Writing at the end of the first century B.C., Strabo remarked that Britain was exporting 'corn, cattle, gold, silver, iron, hides, slaves and hounds' (*Geography* IV.v 2–3). This extract suggests that British Iron Age elites were able to mobilise surplus agricultural, mineral and human resources, though it provides little information regarding the quantity and regularity of these exports (Fulford 2004, 309). The recovery of grain-rich samples from large storage pits at hillforts in the middle Iron Age, most notably Danebury in Hampshire, suggests that agricultural surpluses were being centralised in this period. Such evidence has been argued to reflect the role of communal feasting and the possible use of grain as a commodity for long-distance exchange (Van der Veen and Jones 2006, 226). While large storage pits are found on some sites, four-post and six-post granaries – a type of above-ground grain silo – were present on many sites, a form that probably allowed people easier or more readily available access to stored cereals. These, and the large storage pits, are known to occur frequently across south-eastern Britain and into the midlands (Cunliffe 2005, 411–12). Of course, agrarian regimes in Iron Age

Britain were far from homogeneous. A socially diverse range of communities were producing food in a landscape that was equally varied in geology and climate and, thus, most groups would have needed to employ flexible agricultural strategies.

Agricultural innovations in the later first millennium B.C. include areas of field drainage, the cultivation of clay soils, and the adoption of free-threshing wheat (M. Jones 1981; Millett 1990, 97), while mono-cropping and spring sowing of cereals have been recognised at late Iron Age settlements on the Hampshire Downs (Campbell 2008a; Taylor 2012). Developments in the cultivation of flax and hay meadow management have been identified at the late Iron Age *oppidum* at Silchester, though there is little evidence for large-scale cereal processing or storage (Lodwick 2016, 18–19). This possibly indicates that animal husbandry was a greater concern for late Iron Age elites, perhaps focused around the management of cattle and horses (Creighton 2000, 18). Of course, there was broad continuity from the late Iron Age in the types of crops and livestock exploited in Roman Britain. That these were produced in greater quantities in the first and second century A.D. is indicated by the increasing number of farming settlements during this period (Smith and Fulford 2016). The late Iron Age economy of lowland Britain was no doubt complex, and was probably able to absorb the initial demands of the invading military (Millett 1990, 56–7), although this issue is much debated (Sauer 2001, 345–8). Yet, its capacity for further growth and development was clearly exploited after the Roman conquest in A.D. 43. As Cunliffe (2008, 193) explains, 'the only drivers towards intensification [in the Iron Age] were the need to provide for an increasing population and the escalating expectations of the competitive elite. The Roman Conquest changed this'. New demands for tax revenues were now required to support the Roman infrastructure and a changed socio-political system.

While the basic model of agricultural continuity has been adhered to, regional and chronological variations have been clearly highlighted by the considerable archaeobotanical, zooarchaeological, and associated artefactual and architectural evidence reviewed in the two previous chapters. First, technological developments can have a major impact in increasing per capita production, though evidence for innovations in crop husbandry is limited to tillage practices, which do not appear to have altered much over time (Ch. 2, p. 41). It remains uncertain whether heavy mouldboard ploughs were used in Roman Britain. Archaeobotanical remains suggest that there were no major changes in the levels of soil disturbance during this period, while the majority of ploughing marks indicate the use of an ard and this is supported by the artefactual evidence, which primarily consists of iron ard share tips (Ch. 2, p. 42). Some developments in the later Roman period are suggested by the recovery of iron foreshares and plough coulters at villas and other high-status sites, though ards probably remained the primary cultivation tool at most farmsteads (Fowler 2002, 182–6; Rees 2011, 93–4). Changes in the size and, potentially, the shape of livestock were perhaps more significant (see below). Notably, larger cattle were exploited in the eastern part of southern England in the early Roman period (Ch. 3, p. 100), and this may be interpreted as evidence for an increase in the use of plough cattle on rural estates (cf. Erdkamp 2015). Other possible changes may include the instigation of crop rotation practices, such as shifts to a 'two-field' or 'three-field' system (M. Jones 1981, 113), though further detailed analyses are required to establish the occurrence of such a change (cf. Bogaard *et al.* 1999).

Major technological changes in cereal processing certainly occurred, as evidenced by the increasing use of corndryers and grain mills. Corndryers have long been one of the more readily identifiable features of Romano-British archaeology (Morris 1979, 5). These structures varied in size, form and construction, but were used during periods of the annual farming cycle to bulk-process cereal grains. As discussed in Chapter 2 (p. 59), their use increased considerably in some areas of the countryside from the second century A.D., clearly indicating an expansion in the scale of crop processing, but not necessarily in per capita production, since the quantity of cereals being cultivated were still limited by the availability of labour and land. However, the distribution and quantity of millstones now known from Roman Britain provide evidence for fairly widespread and large-scale cereal processing, particularly from the third century A.D. (Shaffrey 2015). These types of find are most common at villas and roadside settlements, indicating that flour production became centralised in some areas.

In addition to technological changes in agricultural production and processing, diversification of farming practices is indicated by the evidence for fruit, herb and vegetable cultivation (including some newly imported species), the production of alcoholic beverages (notably ale), and, potentially, the rearing of livestock for specialist meat and dairy products destined for urban and military populations (Chs 2 and 3). It must be noted that most of these developments were not widespread in the countryside, and were probably located quite close

to their intended markets. Vineyards first appeared in the later first century A.D., peaking in number during the second century, and were mostly distributed in the eastern Central Belt region. However, the rarity of vineyards suggests that these were opportunistic endeavours, undertaken by those with sufficient capital to purchase vines, knowledge of grape cultivation, and suitable access to consumer markets (Ch 2, p. 74). Similarly, sites where bedding trenches have been recorded, perhaps for vegetable or fruit cultivation, are primarily early and mid-Roman in date and, as with vineyards, are concentrated in the eastern Central Belt. Unfortunately, most sites with this type of land-use are not obviously associated with domestic settlements, though the most reliable evidence for fruit orchards comes from villas and complex farmsteads, such as Bancroft, Buckinghamshire, and Frocester Court, Gloucestershire. These were not specialised production sites, however, as cereal farming was the mainstay of their economies, while they also lack evidence for specialist architecture and material culture associated with production and processing. Fruits were perhaps grown for consumption at the site (or on the estate?), rather than being exported to urban or military markets (Van der Veen and O'Connor 1998, 19). Similarly, substantial evidence for brewing ale primarily derives from villas, complex farmsteads, roadside settlements and defended small towns, such as at Droitwich in Worcestershire or Springhead in Kent (de Moulins 2006; Stevens 2011b), where production appears to have been for local consumption.

At most rural sites, mixed livestock husbandry appears to have been the norm and there is minimal evidence for specialisation. Extensive dumps of butchered cattle bones have been recovered from the outskirts of several major towns and military sites, reflecting the presence of specialist butchers who were processing large numbers of carcasses (Maltby 2007). This evidence need not reflect specialist production of beef cattle at rural sites, as the victualling of livestock may have been supported by herds that were primarily exploited for traction or other secondary products. As discussed in Chapter 3, dairying does not appear to have been a large-scale enterprise in Roman Britain, though the dominance of bones from mature cows in urban deposits may suggest that dairy herds were being maintained on land around towns, with the females being sent to slaughter after their milk yields had started to decline (Maltby 1994a, 90–2; 2010, 146–52). Larger and hornless types of sheep have been recovered from some towns and rural settlements in southern England (cf. Maltby 1994a, 94), and these may reflect new varieties specifically exploited for their wool, perhaps to supply the growing textile industry with raw materials for products destined for towns and the army (see Ch. 3, p. 141, and Ch. 5, p. 221). More intensive pig production occurred at some rural settlements in the Roman period. There appears to have been a demand for pork products at villas, towns and military sites, where pig bones tend to be better represented. Also, chicken husbandry clearly transforms from being a rare, specialised activity in the first century A.D. to being fairly widespread across southern England by the fourth century, perhaps reflecting changed attitudes towards the consumption of poultry meat and eggs (Ch. 3, p. 136).

Specialisation is commonly seen as an economic strategy to produce commodities for market exchange (Van der Veen and O'Connor 1998, 129). However, there is no evidence of Romano-British agricultural settlements fully specialising in specific products. Instead, more farmsteads appear to have diversified their outputs, with additional plant and animal products being produced on a relatively small scale, and some investing in more opportunistic activities such as wine and ale production. Evidence for widespread specialisation is limited, and agricultural innovations were slowly embedded into regular farming patterns across the province. But while mixed-farming regimes appear to have been fairly customary, an expansion of arable and pastoral agriculture seems to have occurred in the second century A.D., enduring into the fourth century. Examining how this occurred, through different forms of farming practice, is crucial for understanding the agricultural economy of Roman Britain, especially given the difficulties mentioned above in identifying capital investment and the sketchy evidence for land-ownership, other than the land transaction of an acreage of woodland in Kent (Tomlin 1996).

Previously, three broad scenarios have been outlined that may explain the character of farming practices undertaken in Roman Britain, and which could result in increases in per capita production (Van der Veen and O'Connor 1998; Van der Veen 2005). First, an *intensification* of farming strategies involves an increase in the input of labour or manure to generate higher crop yields from the same area of land. Second, *extensification* involves an expansion of the existing area of land under cultivation but without an associated increase in input from new technology, manure, or labour per unit area. Both of these strategies can be considered as an expansion of farming practices, since the agricultural output should increase overall, but it is possible for intensification and extensification to co-occur – this can simply be considered *expansion*.

Fundamentally, developments in agricultural strategies should be seen as choices, contingent on local environmental conditions, social conditions, and broader political and economic circumstances. Strategy selection can vary at individual farms or within landscapes, where, for example, spelt may be intensively cultivated while barley is extensively cultivated. However, a broad characterisation of farming practices over wider regions is essential for understanding variations in labour organisation and provides indications of changes in the scale of production.

An accurate understanding of the intensity of cereal cultivation at individual sites relies on a detailed examination of functional weed ecology, combined with stable isotope analysis of cereal remains (Bogaard *et al.* 2016). This type of analysis is beyond the scope of this project. However, in Chapter 2, it was demonstrated that an increasing frequency of weeds associated with low soil fertility occurred in the mid-Roman period (*c.* second–third centuries A.D.) in several regions (Ch. 2, pp. 40–1). These results suggest that a greater area of land was exploited for arable cultivation during this period, but without an associated input from manure – effectively extensification. Commensurate with this pattern was an increase in wet-ground taxa, which also suggests an expansion of the area under cultivation. As well as relative frequencies of weed taxa, differing proportions of major crop species can also provide insights into patterns of farming practice. The period of time between the middle Bronze Age and the late Roman period heralded a long-term shift from emmer, as the dominant glume wheat species, to spelt. Spelt and emmer wheat are likely to have been grown as a maslin (i.e. a mixed harvest of both crops), and their relative proportions potentially provide information about farming conditions. Ecological data, experimental studies and archaeobotanical analyses, summarised in Chapter 2 (p. 45), have shown that spelt wheat increases in relation to emmer under autumn sowing, and is better at surviving in heavier soils and lower soil fertility. Therefore, higher proportions of spelt can be interpreted as a shift towards more extensive arable regimes where more land was cultivated with relatively lower inputs of labour and manure (Van der Veen and O'Connor 1998, 131–3). It is also possible that fields were temporarily left fallow or rotated with legumes to support soil fertility.

Identifying the intensity of pastoral farming relies fairly heavily on the study of field size and organisation, and a range of palaeoenvironmental indicators (Van der Veen and O'Connor 1998, 130). Extensive animal husbandry regimes are characterised by herds grazing over large areas of land with relatively low labour inputs, while intensive regimes, in contrast, tend to involve smaller numbers of animals stalled closer to domestic settlements, often undergoing labour-intensive practices such as dairying (Bogaard 2005). Extensive pastoral farming is more likely to occur in areas relatively unsuitable for arable agriculture, with grazing resources available for cattle, sheep or pigs. Under these conditions, movement between settlements and grazing areas would have been crucial. In the Middle Thames Valley, for example, zooarchaeological data, alongside the appearance of wide droveways and large enclosure complexes, many containing several waterholes, provide evidence for the extensive management of large herds of cattle (Allen 2016a, 130–5). The relatively low number of deposits of stable manure from rural settlements suggests a lack of evidence for livestock stalling, while structural evidence is also minimal, though in part this may result from a lack of surviving remains and adequate investigation techniques (Ch. 2, p. 81). If traction was a greater concern, cattle are likely to have been kept closer to the farmstead and, under these more intensive conditions, foddering and shelter would have been important considerations. Of course, livestock management has strong implications for cereal cultivation, with cattle stalling providing manure that can be spread onto fields by hand. Alternatively, folding animals into fields after harvest would allow manure to be directly applied to the soil, while providing the animals with nutrition from the remaining stubble (Van der Veen and O'Connor 1998, 134).

Both sheep and cattle can be husbanded under extensive and intensive management systems, though caution must be maintained when interpreting zooarchaeological assemblages. Variations in the proportions of these two species may be as much a reflection of poor bone preservation, local consumption preferences, or differences in carcass disposal practices, as much as it is about how livestock were farmed. Closer attention needs to be paid to the evidence for slaughter patterns, body size, and butchery practices, much of which has already been covered in great detail in Chapter 3. The appearance of larger cattle, for example, may reflect the introduction of types reared specifically for pulling ploughs, further suggesting the importance of arable farming (Van der Veen and O'Connor 1998, 132). Being significantly larger and presumably more powerful, improved cattle could have increased the rate at which land could be tilled, meaning that greater areas could be cultivated in the same period of time, while less malleable soils, such as heavy clays, could have been ploughed more effectively.

The final factor to consider is the scale of the agricultural economy. There is an almost complete lack of information regarding the size of farming estates and the financial values of agricultural products in Roman Britain. The best indications of scale lie in the presence and abundance of specialist structures used for bulk-processing cereals, such as corndryers and mills (Van der Veen 2016), and the relative abundance of animal bones and charred plant remains being deposited in archaeological features. Unfortunately, volumetric recording is not consistently applied in excavations of Romano-British settlements. Zooarchaeological analysis tends to rely on examining the relative frequencies of different taxa, rather than the absolute quantities of material per volume excavated. As mentioned above, large quantities of animal bone have been recorded at military sites, such as Piercebridge, Binchester and Vindolanda (Van der Veen and O'Connor 1998, 136), while mass dumps of cattle bone around towns indicate large-scale processing (Maltby 2007). However, it is unclear whether these livestock derived from intensive production on land around towns or at a few specialist farmsteads and villas, or whether they were aggregated from a large number of small-scale farming settlements. These scenarios imply vastly different patterns of social and economic organisation. In contrast, density values of charred plant remains are more consistently available in archaeological reports. In Chapter 2, it was demonstrated that an increase in the scale of cereal spelt wheat processing occurred in all case study regions throughout the Roman period. It is important to focus on these regional patterns once more to better understand how and why certain strategies might have been implemented.

REGIONAL FARMING PATTERNS

THE WEST ANGLIAN PLAIN

The West Anglian Plain is dominated by the major river valleys of the Ouse and the Nene, and includes several minor towns (defended 'small towns') including Water Newton, Godmanchester, Irchester, Towcester, and Cambridge (FIG. 4.1). The rural settlement pattern includes a large number of complex farmsteads, which become more common over time. Villas and roadside settlements are also fairly common after the first

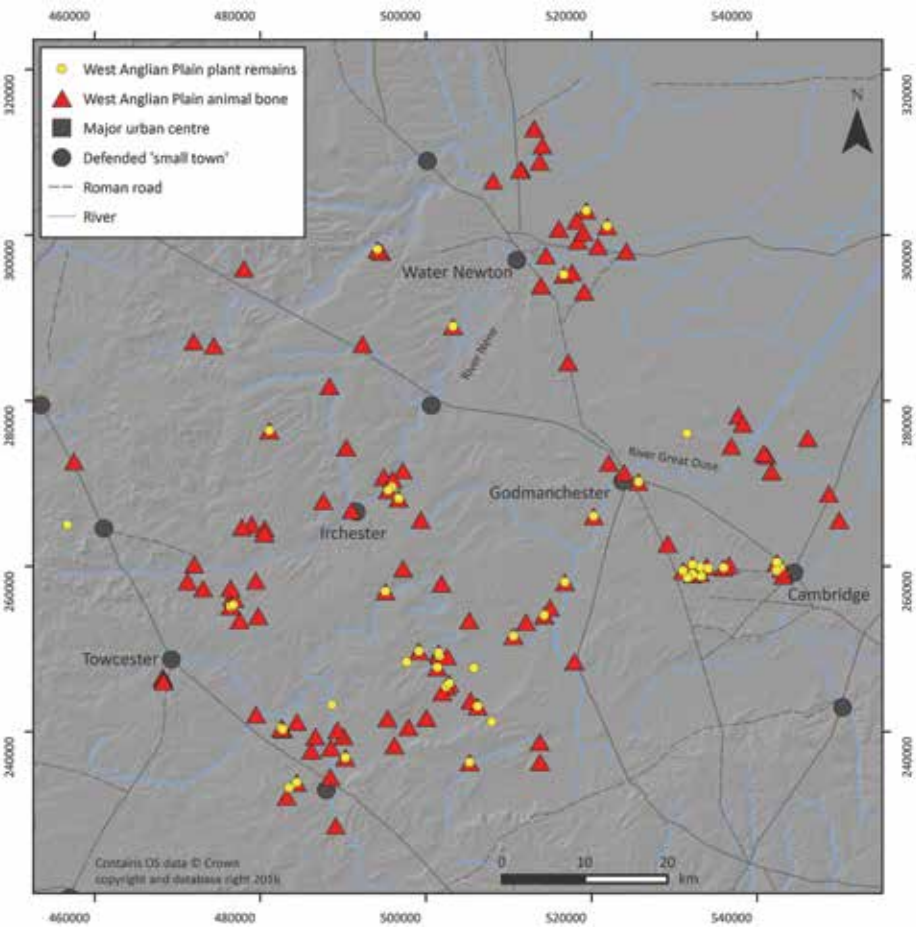

FIG. 4.1. Distribution map of animal bone and botanical assemblages in the West Anglian Plain case study area

century A.D. (Smith 2016a). The case study area contains 59 botanical assemblages from 47 rural settlements, and 161 animal bone assemblages from 118 rural settlements.

Glume wheats dominated the majority of pre-conquest assemblages, contributing on average 80 per cent of the plant remains recovered (FIG. 4.2a). However, barley made its greatest contribution during this period, averaging just below 15 per cent of the archaeobotanical remains identified. In some samples, high densities of barley grains were found in association with cereal chaff and grassland weeds, suggesting that hay and stubble may have been used as a fuel for crop-drying. Late Iron Age and early Roman settlements with relatively high proportions of barley include Little Paxton Quarry, Cambridgeshire (A. Jones 2011), and the Former Bridgman Joinery Works in Harrold, Bedfordshire (Luke and Preece 2003). Free-threshing wheat, a crop that is commonly thought to have been an innovation in Roman cereal husbandry (M. Jones 1984), is only found in relative abundance at late Iron Age and early Roman sites in this case study area, such as at A421: High Barns Road Site 2, West Stagsden, and Bedford Academy, Elstow, all in Bedfordshire, and at Little Paxton Quarry, Cambridgeshire. The relative abundance of minor crops in the region is generally low, but this is largely the result of their frequent absence in later Roman deposits (FIG. 4.3).

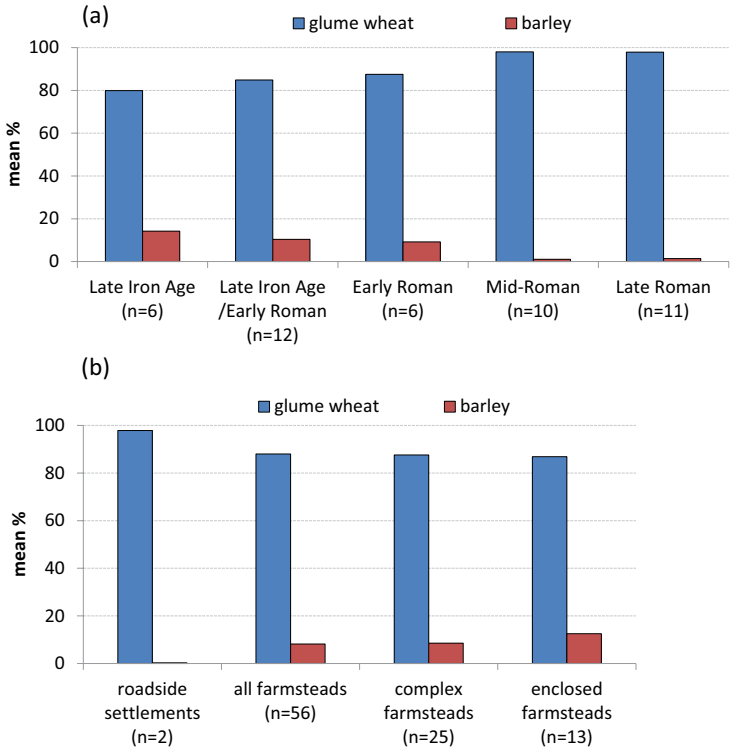

FIG. 4.2. Mean percentages of glume wheat and barley over time (a) and at different site types (b) on the West Anglian Plain

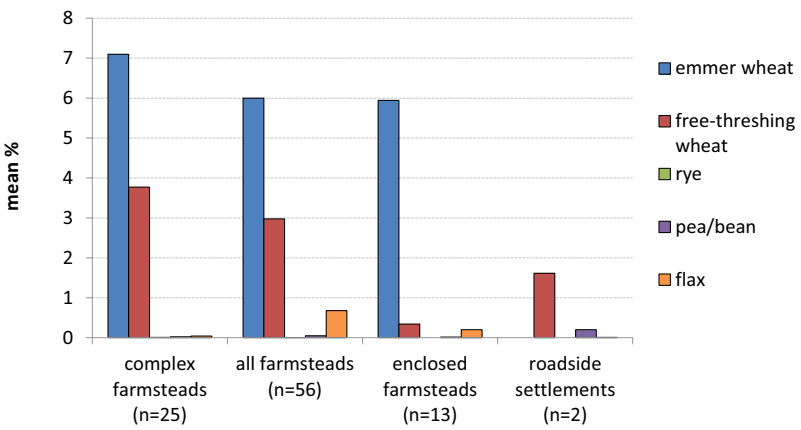

FIG. 4.3. Mean percentages of minor crops at different site types on the West Anglian Plain

Most late Iron Age farmsteads in the case study area were fairly simple, enclosed settlements, a few of which provide *in situ* evidence for cereal processing and storage. At Blackthorn, Northamptonshire, a substantial, double-ditched enclosure encircled a roundhouse and a number of large grain-storage pits (Williams 1974), while at Grange Park, Courteenhall in the same county (Area 6), an enclosure for domestic habitation was adjoined to the south by a separate annexe that surrounded two four-post structures and an oven, which probably operated as a simple corndryer (L. Jones *et al.* 2006). Analysis of the charred plant remains from this enclosure suggests that it was used for cereal processing, while a third enclosure appeared to be comparatively empty and is likely to have been used for containing livestock.

After the early Roman period, the proportion of barley present decreases substantially, becoming represented by around 1 per cent on average at sites dating to the mid- and late Roman periods, when glume wheats overwhelmingly dominate in cereal assemblages (see below). Glume wheat samples also become increasingly dominated by spelt wheat at the expense of emmer after the late Iron Age (FIG. 4.4). This pattern is likely to reflect a move towards the expansion of areas under cultivation without an increase in manure input – effectively extensification.

Establishment of new farmsteads in the later first century and early second century provides some indication that 'new' land was being increasingly exploited during the early Roman period. Also, on the lower gravel terraces of the valley and in areas closer to the Fen edge, there is strong evidence for the continual recutting of ditches over pre-existing sites (FIG. 4.5). At several settlements this pattern of land management occurred throughout the Roman period, indicating the continual need to maintain drainage, most likely to support livestock. From the second century A.D. there is a notable increase in the proportion of cattle remains at the expense of sheep, and cattle are particularly well represented at complex farmsteads (FIG. 4.6). At Haddon, Cambridgeshire, a late Iron Age enclosed farmstead expanded with new land divisions in the mid-first century A.D., but by the beginning of the second century A.D. the settlement had been completely reorganised with a system of inter-linked enclosures, trackways, at least two aisled barns, and water cisterns (FIG. 4.7; Hinman 2003). The settlement appears to have operated a highly organised, integrated agrarian regime, becoming well equipped for intensive livestock management, with both sheep and cattle bones forming much of the zooarchaeological assemblage. Pollen evidence suggests that the surrounding landscape was largely open and dominated by pasture, while a relatively high proportion of sprouted spelt grain indicates that malting was undertaken.

Late Roman archaeobotanical samples from several complex farmsteads show a clear shift towards the cultivation and processing of spelt wheat, such as at Grange Park, Courteenhall, Northamptonshire, Marsh Leys, Kempston (Farmstead 3/5/7), Bedfordshire, and Wavendon Gate, Buckinghamshire. These sites frequently produce evidence for final-stage processing of glume wheats, commonly identified as charred de-husking waste (glume bases), often used as fuel in corndryers. At Lower Cambourne, a complex farmstead on the heavy boulder clays of West Cambridgeshire, glume wheats overwhelmingly dominated between the late Iron Age and the late Roman period, rather than just in the latter. Roman samples tended to produce higher proportions of glume bases with less grain, which was argued to indicate post-storage de-husking 'en masse', perhaps using rotary querns which were relatively common in Roman deposits (C. Stevens

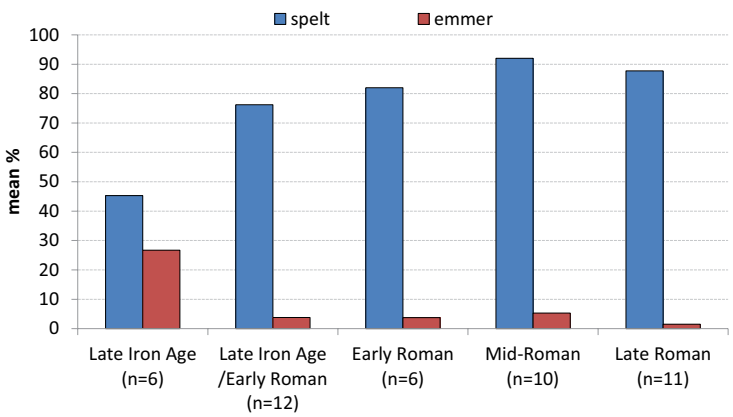

FIG. 4.4. Mean percentages of spelt wheat and emmer wheat over time on the West Anglian Plain

FIG. 4.5 Plans of enclosure complexes at (a) Cat's Water, Fengate, Peterborough (Pryor 1984), (b) Pineham North, Upton (Carlyle 2007), (c) Milton Ham, Northampton (Carlyle 2008), and (d) Land off Broadway, Yaxley (Phillips 2014)

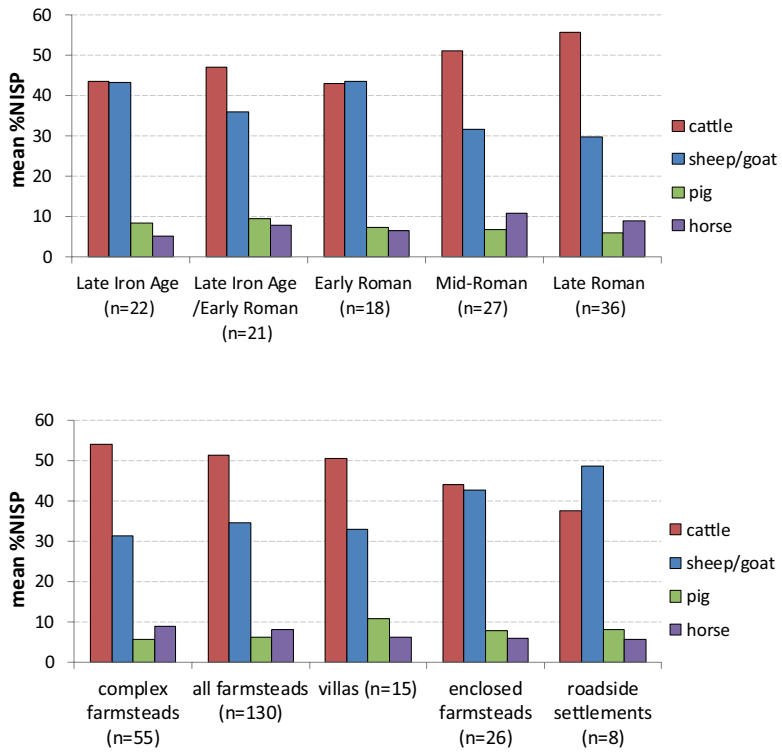

FIG. 4.6. Mean percentages of major domestic mammals over time (a) and at different site types (b) on the West Anglian Plain

2009a). Weed seeds from the site suggest that cereals were arriving at the settlement from a range of habitats, including light, calcareous soils, and low, wetland areas, as well as the surrounding heavier clays, which were indicated by the recovery of stinking mayweed, suggesting that farmers were expanding onto less fertile soils. The site also produced high proportions of adult cattle with few remains from young calves (Hamilton-Dyer 2009, 87–8). Several pathological specimens were also indicative of the use of cattle as draught animals, including phalangeal exostoses and eburnation marks found in the acetabulum of a pelvis, reflecting osteoarthritis of the hip joint (*ibid.*, 88–93). The slaughter of retired draught cattle most likely reflects animals culled as a by-product of local, extensive arable farming (Ch. 3, p. 111).

Further evidence of agricultural expansion on the West Anglian Plain is indicated by the proliferation of sites with corndryers. By the late Roman period over 20 per cent of sites included a corndryer, found locally in a variety of forms but primarily of the common T-shaped type (Ch. 2, p. 56). At Parnwell, Peterborough, large-scale excavation revealed a field system covering at least 8 ha, which was co-axially aligned to a rectilinear enclosure with a substantial 'double H-L' malting oven structure (Webley 2007). The presence of grain mills in the region may also reflect the centralisation of arable surplus, as at Orton Hall Farm, where a number of enclosures, probable storage buildings, and numerous corndryers, were organised around a central courtyard (FIG. 4.8). The recovery of seven large millstones indicates that cereal processing may have occurred on an industrial scale between the later first century A.D. and the early fifth century A.D. (Mackreth 1996), while the recovery of exceptionally large cattle bones suggests the presence of some powerful plough animals (Ch. 3, p. 103).

Unfortunately, only two roadside settlements in the region include quantified botanical remains: one at Higham Ferrers, Northamptonshire, which has assemblages dating to the late Roman period, and one at Church End, Kempston, Bedfordshire, which dates more broadly to the 'Roman' period. Deposits at Higham Ferrers included remains from de-husking and cleaning of spelt, with an abundance of wheat chaff that was possibly used as fuel (Moffett 2009). However, while the cultivation of spelt wheat is commonly associated with higher proportions of cattle in this region, the faunal assemblage from Higham Ferrers, Northamptonshire, is largely dominated by sheep in all phases, including areas of domestic occupation and the mid-Roman shrine (the latter is not considered here, but see Vol. 3). These remains may reflect a local emphasis on sheep husbandry. As was mentioned in Chapter 3, the sheep slaughter pattern at Higham Ferrers partly focused on yearling lambs, suggesting that dairying was an important commodity in the local economy.

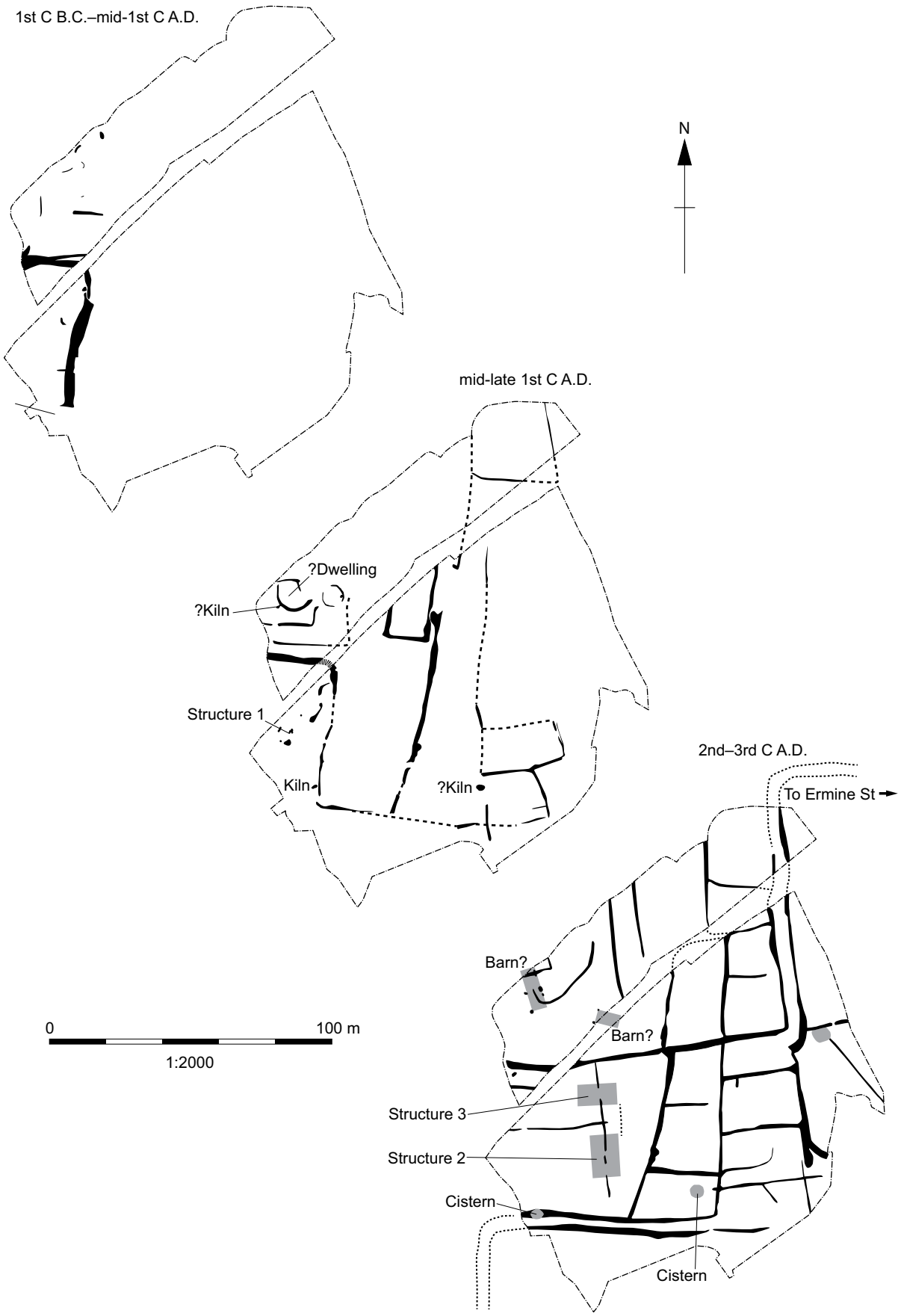

FIG. 4.7 Phases of settlement development at Haddon, Cambridgeshire (Hinman 2003)

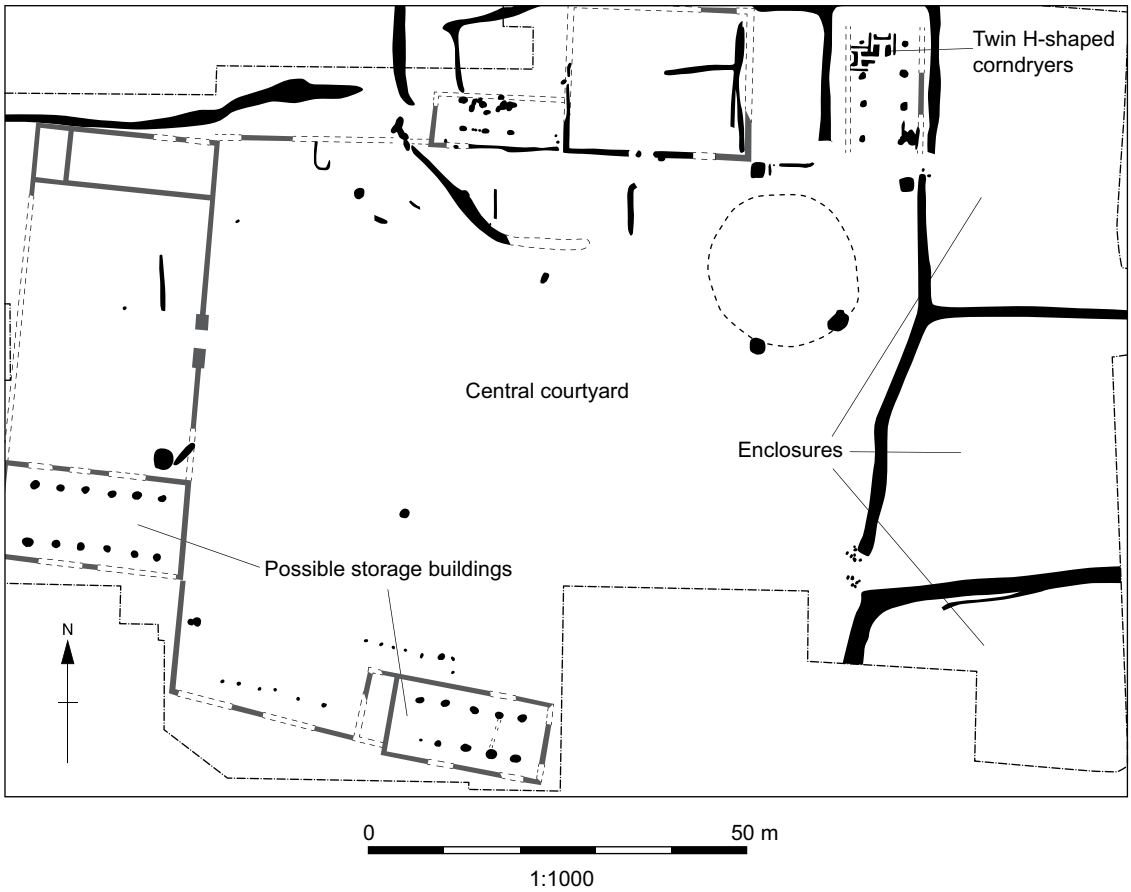

FIG. 4.8. Plan of Orton Hall Farm, Cambridgeshire, during the fourth century A.D. (Mackreth 1996)

In contrast, faunal assemblages from the roadside settlements at Camp Ground, Colne Fen, Cambridgeshire (also a port; C. Evans 2013), and Sandy, Bedfordshire, include higher proportions of cattle, while spelt wheat chaff dominated cereal assemblages at Camp Ground. This variation in livestock remains from roadside settlements may reflect differing subsistence strategies; many would have been largely self-sufficient, with their inhabitants producing cereals and farming livestock.

In summary, environmental assemblages from rural sites on the West Anglian Plain provide evidence for a shift from relatively mixed, arable farming regimes in the late Iron Age and early Roman periods, towards a late Roman economy heavily based upon the cultivation of spelt wheat. Whether this reflects soil degradation resulting from increased areas of land being turned over to arable without being suitably manured, which biases against emmer wheat, or deliberate attempts by farmers to grow spelt, excluding other cereals (mono-cropping), is unclear. Either way, this change strongly indicates that arable production expanded from the second century A.D. onwards, while the increasing importance of mature cattle at many rural sites further indicates investment in tillage and transport (cf. Van der Veen and O'Connor 1998, 131–2). Besides the small towns listed at the beginning of this section there are no *civitas* capitals (Leicester lies just outside the study area) or permanent military installations in this region, and it therefore lacks substantial market centres and associated consumer populations. The reasons for farming expansion are not immediately obvious. However, this case study area embraces two important roads: Ermine Street, linking London with the northern frontier, and Watling Street, running between London, north Wales and the north-west, including the *civitas* capital at Wroxeter and the legionary fortress at Chester. These destinations would have provided markets for agricultural surpluses, with London potentially exporting by sea to cross-channel markets. As suggested above, roadside settlements in the case study area may have been largely self-sufficient and less reliant on their rural hinterlands for agricultural subsistence, while defended settlements, such as Water Newton, Godmanchester and Cambridge, could have provided safe storage for grain transported along the road network. If agricultural surplus from the West Anglian Plain was making its way to the military in the north, riverine transport through the Fens is an obvious outlet, further supported by the considerable

evidence for cereal and livestock processing at the Roman inland port at Camp Ground, Colne Fen (C. Evans 2013).

Overall, the evidence for expansion of agricultural production on the West Anglian Plain, alongside the establishment of a sophisticated transport network, indicates that this area is likely to have been a major producer for external markets. It is also important to point out that there is a great deal of evidence for industrial activity in this case study area, with numerous sites focusing on ironworking and pottery production (see Ch. 5). Nene Valley pottery was reaching Hadrian's Wall from the earlier third century A.D. (Tyers 1996, 175, 199), and it is possible that cereals were moving alongside consignments of pottery. The economic diversity of the region is also indicated by a number of farmsteads that operated a mixture of agricultural and industrial practices. At Wavendon Gate, Buckinghamshire, for example, iron smelting was conducted, while the environmental remains show the common, regional, pattern of a dominance of spelt wheat and cattle. Seasonal labour used in agriculture could also have engaged in ironworking or pottery at quieter times of the year, with waste from cereal processing being utilised as fuel in industrial activities. It is possible that the expansion and diversity of the economy in this region was related to state demands (see discussion), though whether it was reorganised as part of an imperial estate, as has been widely discussed elsewhere, remains open to question (Salway 1970; Taylor 2000; Fincham 2002; Malim 2005).

KENT AND THE THAMES ESTUARY

The Kent and Thames Estuary case study area comprises much of the chalkland of the North Downs, which is bisected by several river valleys flowing north from the Weald into the Thames Estuary (Allen 2016a). The region also includes Watling Street Roman road, which ran broadly east–west between Richborough and London, and most of the sites in this case study are located in relative proximity to this ancient thoroughfare. Very few rural sites are located in the Weald to the south, where environmental assemblages are almost non-existent. The dataset for this case study area is relatively small, so several Essex and Greater London sites with suitable zooarchaeological assemblages have also been

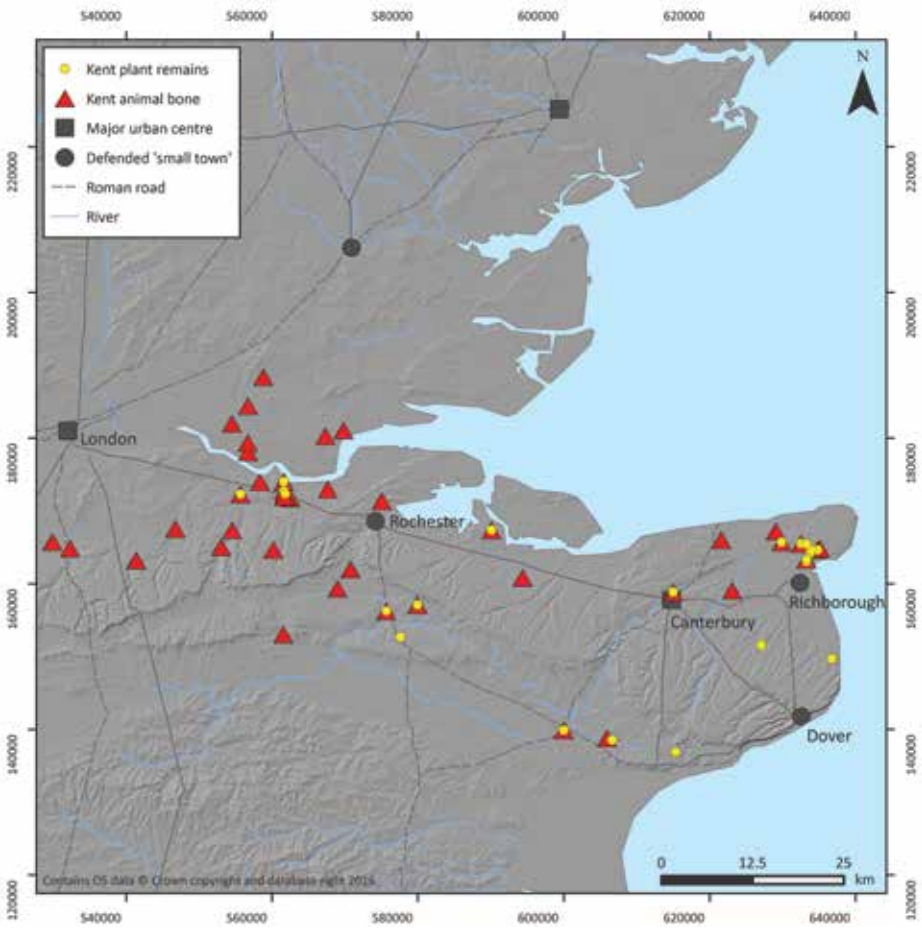

FIG. 4.9 Distribution map of animal bone and botanical assemblages in the Kent and Thames Estuary case study area

included. These are very much part of the same hinterland as those located in Kent, and they should not be excluded solely on the basis of lying slightly outside of the modern county boundary. In total, the region includes 28 botanical assemblages from 22 sites, and 69 zoo-archaeological assemblages from 45 sites (FIG. 4.9). Unfortunately, most of the farmsteads in the Kent case study area with quantified plant assemblages are unclassified in terms of their settlement morphology. However, several villas and roadside settlements provide the opportunity to compare data from different site types.

As in the West Anglian Plain, most cereal assemblages are dominated by glume wheats (FIG. 4.10a). There are too few botanical assemblages to consider the Roman-period data as distinct, chronological phases (i.e. early, middle and late Roman), but overall there is little difference in the average proportions of glume wheats and barley between the late Iron Age and the Roman periods. Barley is better represented at farmsteads and villages, compared to villas and roadside settlements, where it is generally recovered in very low quantities (FIG. 4.10b). The only complex farmstead in the botanical dataset is at East Kent Access Road (Zones 8 and 9) on the Isle of Thanet, and this assemblage is fairly typical of farmsteads in the region, with relatively high proportions of emmer (18 per cent) and barley (16.5 per cent) and smaller quantities of minor crops, including Celtic bean, pea and flax. High proportions of emmer occur at several farmsteads in the region including A2/A282 Improvement Scheme at Dartford (21 per cent), Little Stock Farm, Mersham (35 per cent), Queen Elizabeth Square, Maidstone (15.6 percent), and Saltwood Tunnel (9.6 per cent). Overall, there is a higher average percentage of emmer in the Kent case study area, where it contributes 8 per cent of the crop remains, in comparison with the other areas, where it has been recorded in quantities of less than 6 per cent in the West Anglian Plain, 3.5 per cent in Wessex, and a mere 2.5 per cent in the Upper Thames Valley. However, sample level analysis in Chapter 2 showed that there was a substantial decrease in emmer from the late Iron Age/early Roman (averaging 15 per cent per sample) to the early Roman period and beyond (averaging 3 per cent per sample). This indicates a strong shift towards more extensive arable practices after the conquest. Free-threshing wheat is less

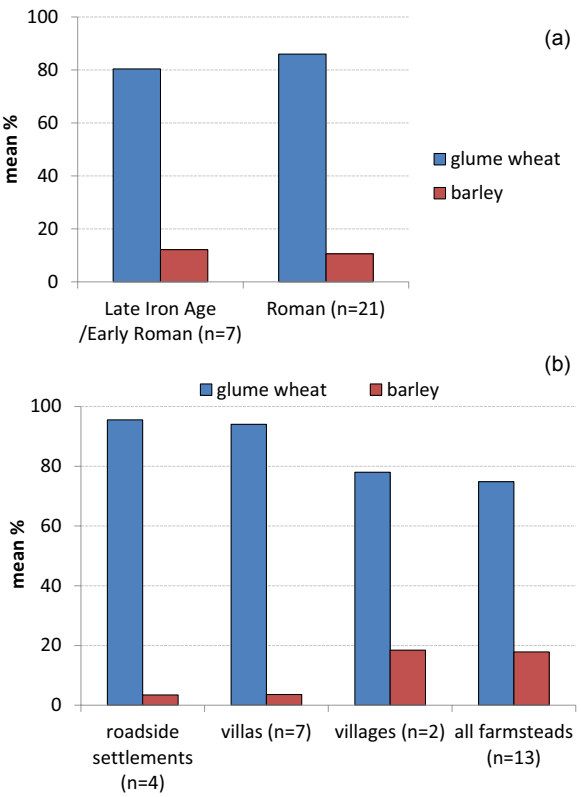

FIG. 4.10. Mean percentages of glume wheat and barley over time (a) and at different site types (b) in Kent

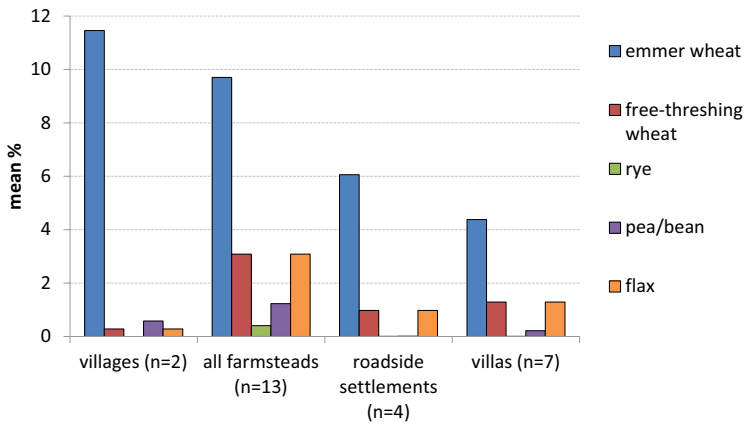

FIG. 4.11 Mean percentages of minor crops at different site types in Kent

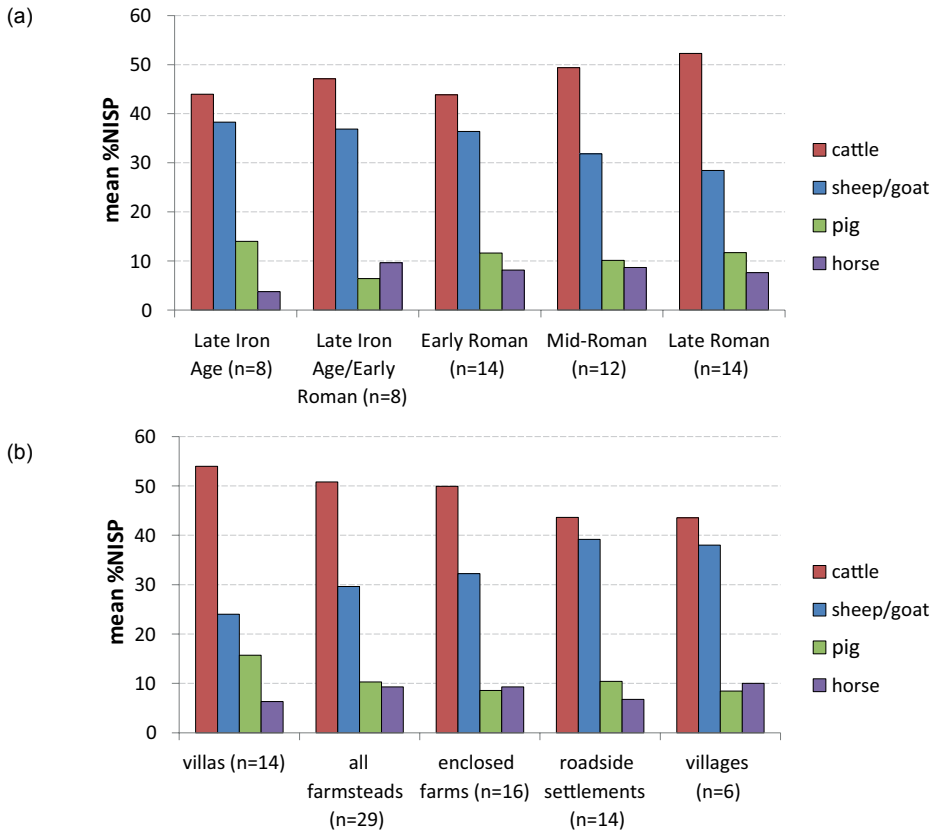

FIG. 4.12. Mean percentages of major domestic mammals over time (a) and at different site types (b) in Kent

common than emmer, but is best represented at farmsteads, such as Saltwood Tunnel and Market Way, Canterbury.

In general, farmsteads tend to produce more mixed botanical assemblages, in terms of the range of taxa identified, than villas and roadside settlements (FIG. 4.11). As highlighted in Chapter 2 (pp. 33–6), peas and beans are frequently identified in assemblages from Kent, with relatively high proportions of pulses found on sites on the Isle of Thanet, such as at Monkton and Mount Pleasant, while the large cache of nearly 2000 pulses, of which 439 were positively identified as Pea *Pisum sativum* (Pelling 2004), recovered from a late Iron Age pit at Queen Elizabeth Square, Maidstone, suggests that peas and beans may have been fairly common crops at some sites. It is uncertain, however, whether pulses were grown concurrently with cereals, or were alternated as part of a crop-rotation system, perhaps intended for foddering (Ch. 2, p. 80).

As with other regions, zooarchaeological data show that faunal assemblages tend to have relatively mixed proportions of cattle and sheep in the late Iron Age and early Roman periods, but with an increase in cattle from around the second century A.D. (FIG. 4.12a). Notably, farmstead and villa assemblages tend to be cattle-dominated (FIG. 4.12b). This is somewhat surprising, considering the majority of farmsteads with zooarchaeological data are late Iron Age or early Roman in date (only one farmstead assemblage, from East Kent Access Zone 20, is categorically 'late Roman'), while the majority of villas are mid–late Roman. This partly reflects the third–fourth century decrease in settlements in the south-east of England, but also the number of farmsteads that began to adopt villa-style architecture in the Roman period (Allen 2016a, 81–2, 90–3). The sites at Thurnham, Kent, and Beddington, Greater London, are good examples of this trend. Both of these sites produced late Iron Age faunal assemblages dominated by sheep, though in the late Roman villa phases cattle bones were far more common (FIG. 4.13).

Higher relative frequencies of sheep are recovered from nucleated settlements (roadside settlements and villages), following the pattern seen in the West Anglian Plain case study. This observation suggests that many roadside settlements implemented a subsistence strategy that differed from major towns where regular supplies of cattle were relied upon (Ch. 3, p. 112; Maltby 2015). It is possible that small numbers of sheep (or perhaps more likely goats) were maintained in household plots at nucleated settlements. Sheep slaughter profiles at Springhead shows that a high proportion were maintained to

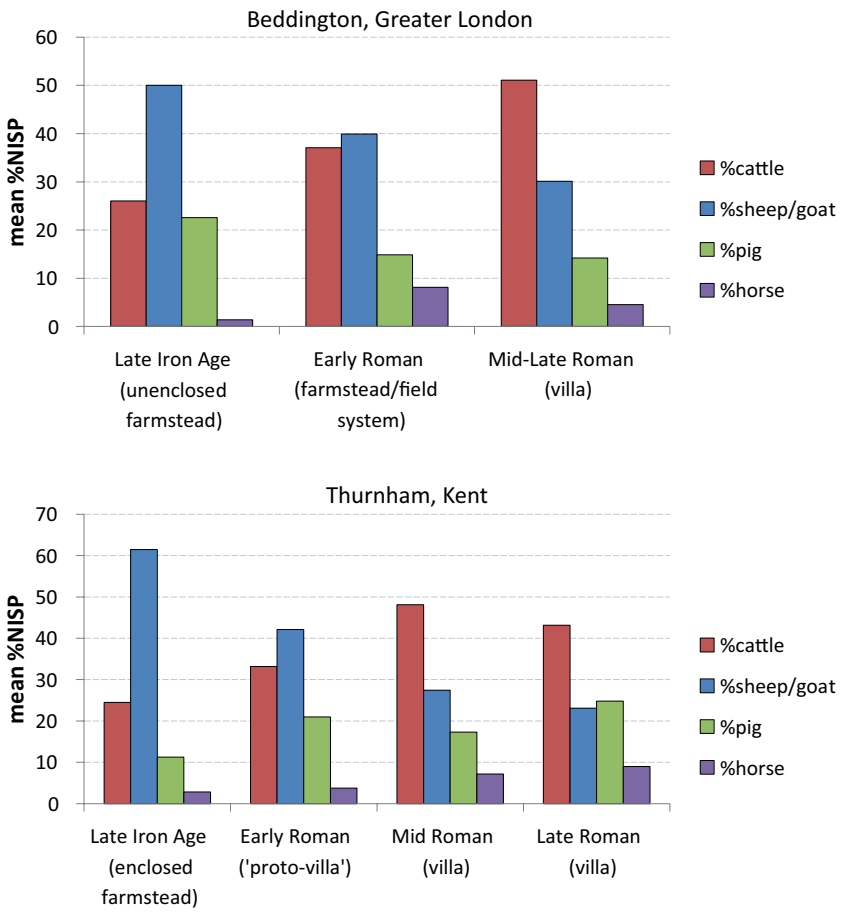

FIG. 4.13. Mean percentages of major domestic mammals over time at Beddington (Surrey) and Thurnham (Kent) villas

adult and elderly ages, implying that wool production was important, while a notable percentage of lambs culled between three and ten months may also reflect a focus on dairy (see Ch. 3, p. 116; though Grimm and Worley (2011, 35–6) suggest that meat production was more important). This does not mean that beef production was not important at these settlements (maturing calves/young adult cattle were predominantly slaughtered at early and mid-Roman Springhead), but it perhaps shows a greater emphasis on the exploitation of sheep secondary products at certain roadside settlements.

In summary, the Kent and Thames Estuary case study provides good evidence of a move towards more extensive farming regimes in the second century A.D. with an overall increase in cattle and spelt wheat. The number of sizeable roadside settlements along Watling Street between the first and the third centuries A.D. suggest that considerable road traffic was travelling along it during this period (Allen 2016a, 82). It is likely that these both benefited from and facilitated the movement of Kentish foodstuffs to the ports of London, Dartford, Rochester and Richborough, as well as to the *civitas* capital at Canterbury. There is fairly widespread evidence for malting at sites such as Springhead roadside settlement and Northfleet villa (Ch. 2, p. 64), while salt-production on an almost industrial scale on the Essex coast also signals the productive character of this landscape (Biddulph *et al.* 2012; see Ch. 5). As the distribution of Thameside BB2 implies (Bidwell, Ch. 7), the estates of north Kent and south Essex may also have been supplying garrisons on the Antonine and Hadrian's Wall and elsewhere on the northern frontier.

UPPER THAMES VALLEY

The Upper Thames Valley is characterised by a series of low-lying, river gravel terraces covering a mixed underlying geology, and is surrounded by upland landscapes including the Cotswolds on its north-western side, the Wessex Downs to its south, and the Chilterns to its east. The largest and most important town in the region is Cirencester, located close to the source of the Thames, while other minor urban centres were established at Dorchester-on-Thames and Alchester (FIG. 4.14). The archaeology of the region has received considerable attention over the past 25 years,

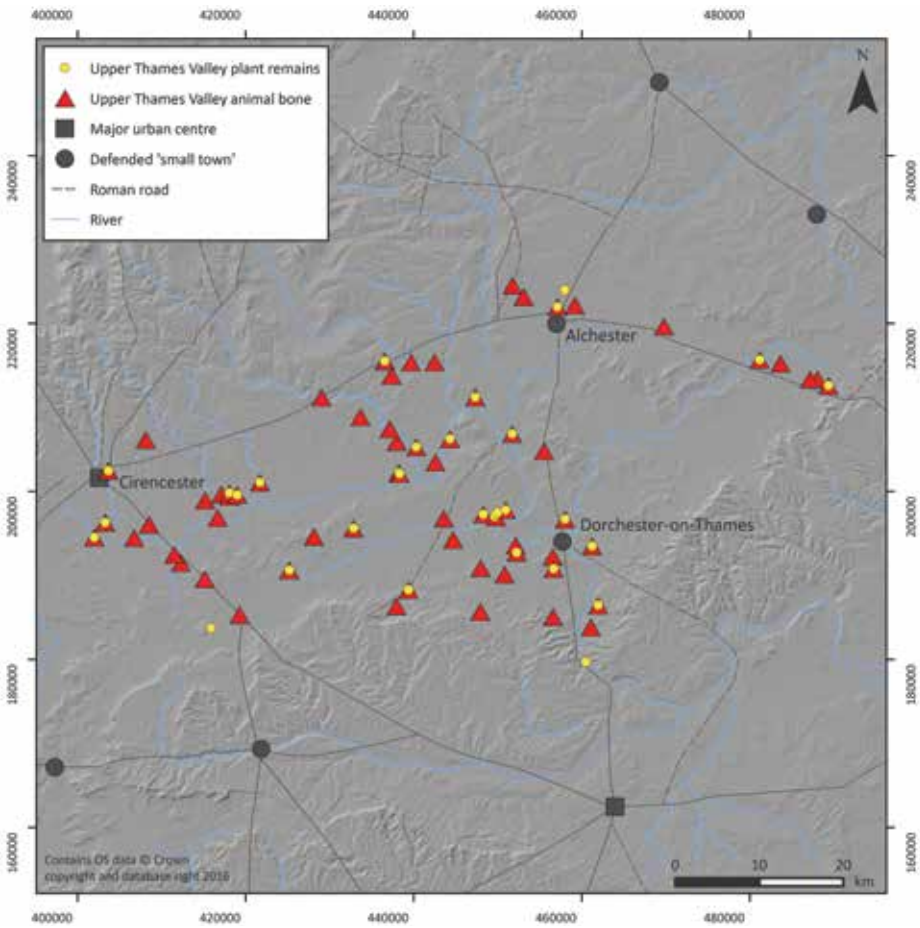

FIG. 4.14. Distribution map of animal bone and botanical assemblages in the Upper Thames Valley case study area

partly due to modern development, but also because of widespread quarrying by the mineral extraction industry. Much of this work has revealed substantial evidence for late prehistoric and Romano-British settlement and land-use, including a widespread reorganisation of rural settlement around the end of the first century/beginning of the second century A.D. (Booth *et al.* 2007; Miles *et al.* 2007), while regional environmental evidence has also received particular attention (Robinson 1992; Hesse 2011). The archaeobotanical dataset includes 42 assemblages from 31 sites, and the zooarchaeological dataset includes 96 assemblages from 65 sites. The rural settlement pattern in the Upper Thames Valley is fairly similar to the West Anglian Plain, with a large proportion of late Iron Age and early Roman enclosed farmsteads but with a more sudden switch to predominantly complex farmsteads in the mid- and late Roman phases (Smith 2016b). Villas and roadside settlements are reasonably well represented, though not in the numbers witnessed in the Cotswolds or on the Wessex Downs, and there are several villages located away from the major road network.

As in other regions, glume wheats are the most abundant cereal crop in the Upper Thames Valley, though barley makes a very significant contribution, being much better represented here than on the West Anglian Plain and in Kent. This crop is best represented in late Iron Age and late Roman assemblages, providing almost a third of the plant remains in these phases and averaging 18 per cent in villa assemblages (FIG. 4.15). This pattern is in contrast to the trend observed in Kent, where glume wheats heavily dominated at villas and roadside settlements. In comparison to barley, minor crops are comparatively poorly represented in terms of their relative abundance. Emmer wheat is rarely found in large quantities and analysis in Chapter 2 showed that the transition to spelt had already occurred in the Upper Thames Valley earlier than in other areas, where it averaged only 3 per cent of late Iron Age samples and was also very poorly represented in middle Iron Age deposits (Booth *et al.* 2007, 277). Free-threshing wheat is not common in the region, though relatively high proportions were recovered from the mid-Roman phase at Claydon Pike (10 per cent), late Roman Yarnton (13 per cent), and the later Roman villas at Barton Court Farm (20 per cent) and Roughground Farm (51 per cent). Although there are issues of poor dating and

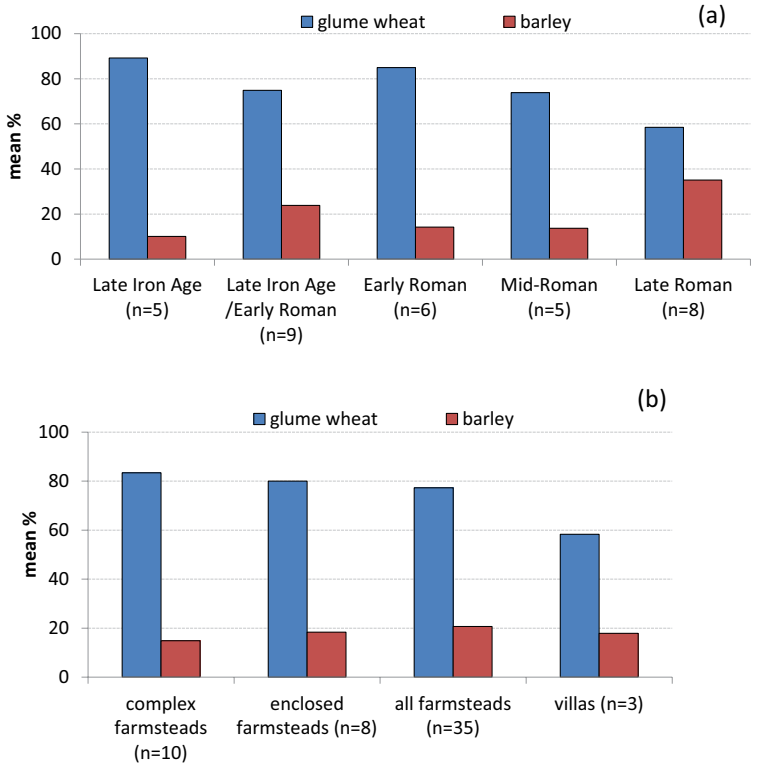

FIG. 4.15. Mean percentages of glume wheat and barley over time (a) and at different site types (b) in the Upper Thames Valley

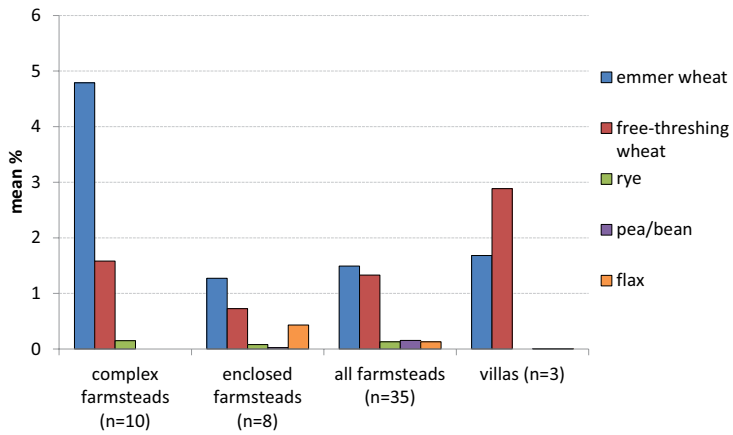

FIG. 4.16. Mean percentages of minor crops at different site types in the Upper Thames Valley

misidentification, larger samples containing free-threshing wheat at these four sites, as well as at nearby late Roman Cirencester, suggest that some Upper Thames Valley farmers may have considered it an important crop (Carruthers 2008). Peas and/or Celtic beans have been recovered on *c.* 30 per cent of rural sites in the region, though not often in abundance (FIG. 4.16). Since they are rarely found in high frequencies they were probably not cultivated in substantial quantities during the late Iron Age and Roman periods, though it is uncertain how much of this is due to preservation bias.

The relatively high proportion of barley may be related to the importance of animal husbandry in the region, although whether barley was considered primarily for human consumption or utilised as a fodder crop is much debated (Ch. 2, p. 18). Extensive use of the valley bottom for livestock grazing is widely accepted to have been important since later prehistory and throughout the Roman period (see Ch. 3, p. 92; Albarella 2007; Hambleton 2008; Hesse 2011). Insect and archaeobotanical evidence recovered from Thornhill Farm and Claydon Pike, both in Gloucestershire, indicates that extensive, dung-enriched grasslands were managed on the lower terraces, while evidence for arable farming is less common (Robinson 2004, 141; 2007, 204). The most substantial evidence

for hay meadow management is in the mid-Roman period, which corresponds with the lowest mean percentage of barley (14 per cent), perhaps representing a switch in fodder crop. There is little variation in the relative proportions of major livestock over time, though cattle tend to be better represented in most periods (FIG. 4.17). There is a particularly notable difference in the relative frequencies of major livestock between different settlement types in the case study area, with cattle being very well represented at villages and complex farmsteads, but in equal proportion to sheep at enclosed farmsteads and roadside settlements. This may be partly due to differences in the locations of these types of settlement, as complex farmsteads are more commonly found on the lower valley terraces, while enclosed farmsteads tended to be located on higher ground (see Smith 2016a, 175, fig. 5.35). The high proportion of cattle at villages is heavily influenced by the zooarchaeological assemblages from Gill Mill, Oxfordshire, in the Windrush Valley (Booth and Simmonds forthcoming). This settlement developed in the second century A.D. with a series of continuous and very regular enclosures aligning a minor road (FIG. 4.18). The quantity of cattle and horse bones from the site, and lack of evidence for cereal processing, led the excavators to interpret the settlement as a centre for the corralling and organisation of herds.

Booth *et al.* (2007, 280) suggest that increased floodwater levels in the early Roman period caused the abandonment of some lower-lying pastoral settlements, giving rise to the development of increasingly mixed agricultural practices, with arable playing a more important role. Based on remains of grassland flora recovered in wells at Claydon Pike and Farmoor, they argued that the valley floor became increasingly managed for hay production rather than for year-round grazing (Lambrick and Robinson 1988; Robinson 2007). Hay has an important role in supporting livestock over the winter, especially if areas of low-lying grassland become inaccessible at certain times (see Ch. 2, pp. 80–1). Culling of immature cattle at each of the three sites mentioned above continued into the Roman period, though with a slight shift in emphasis towards the maintenance of older animals (Ch. 3, pp. 111–12). While this may have signalled an increased importance of secondary products, it also suggests that more mature cattle were being maintained for traction. However, the relative lack of corndryers suggests that arable farming occurred on a lesser scale than in the West Anglian Plain. Any arable surpluses that were produced probably supplied larger

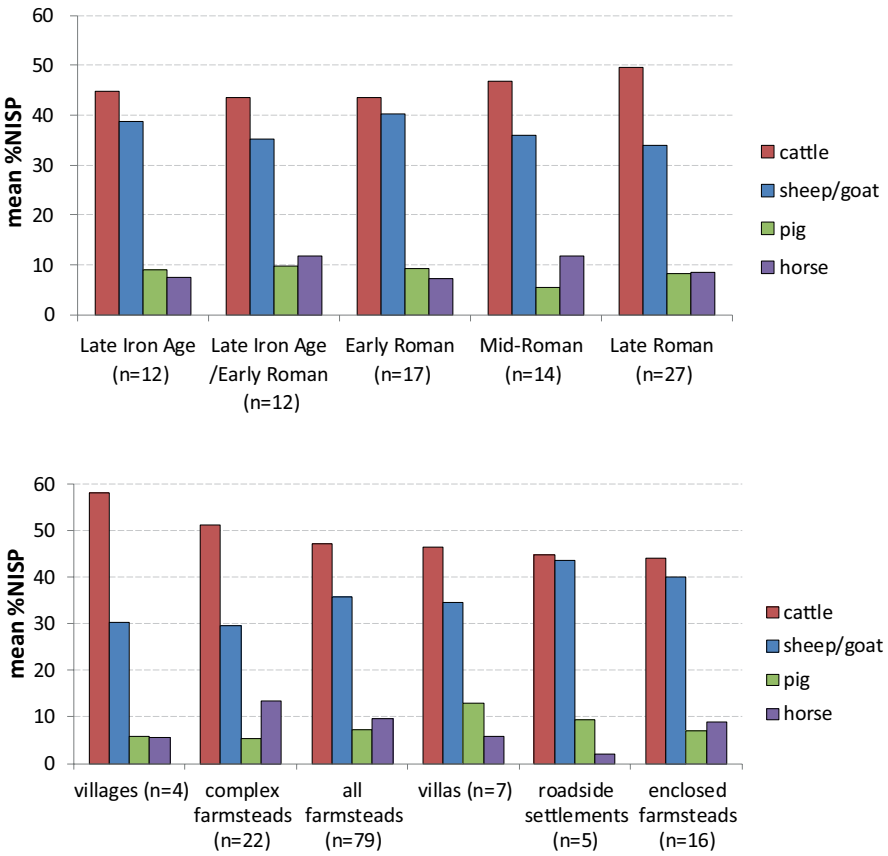

FIG. 4.17. Mean percentages of major domestic mammals over time and at different site types in the Upper Thames Valley

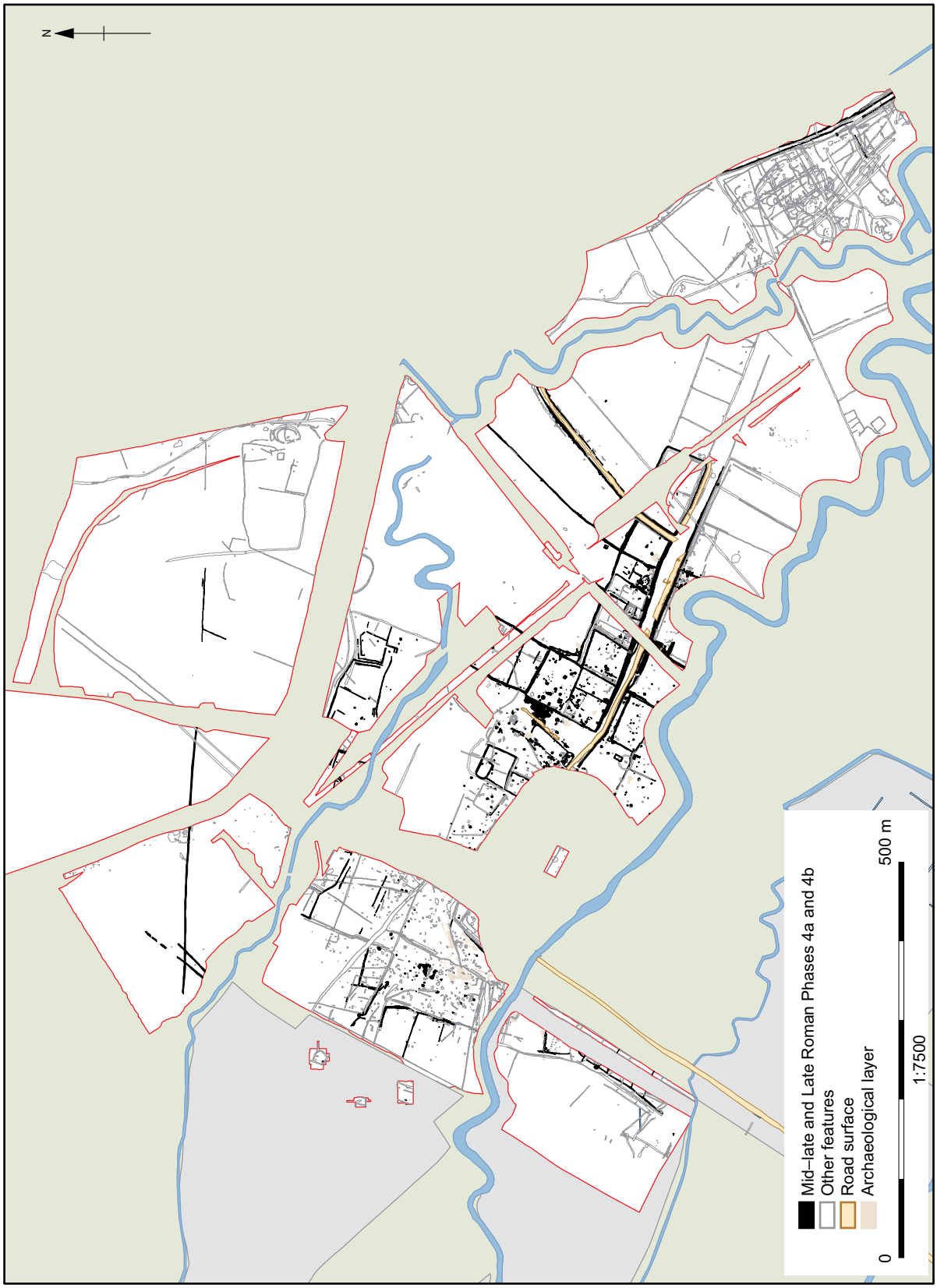

FIG. 4.18. Plan of Gill Mill, Ducklington, Oxfordshire (Booth and Simmonds forthcoming)

centres, particularly Cirencester, and perhaps the army located farther away, facilitated by the improved transport links seen throughout the Upper Thames Valley from the second century A.D. (Booth 2011).

A number of Roman-period settlements show signs of diversification, such as the evidence for hay production at Claydon Pike (Miles *et al.* 2007). The same site also produced remains of a range of horticultural plants, particularly from mid-Roman deposits when the settlement was at its greatest extent, including cabbage, coriander, plum, celery, cherry, dill, and pear (Robinson 2007, appendix section 4.4). Although some of these plants may have been imported, it seems likely that a few were grown locally. Other examples include coriander and celery at Mount Farm, Berinsfield (Lambrick 2010), plum, dill and coriander at Farmoor (Lambrick and Robinson 1988), and plum, apple, Celtic bean, dill and coriander at Barton Court Farm (Miles 1986). Unfortunately, the lack of waterlogged samples from sites in Kent means that it is difficult to make a direct comparison between the evidence for horticulture here with that from the Upper Thames Valley. Whether these products were for consumption on site, or export to nearby urban centres such as Cirencester is unclear.

In summary, farming regimes in the Upper Thames Valley appear to have been quite different from those on the West Anglian Plain and in Kent and the Thames Estuary. This is partly driven by the nature of the landscape and the expanse of fertile pasture on the lower gravel terraces. Here, the evidence for manure-enriched soils suggests that large-scale animal husbandry was occurring in the late Iron Age. However, changes in farming patterns appear to coincide with increased, post-conquest flooding of the valley bottom, the establishment of the Roman infrastructure and, perhaps most importantly, a major reorganisation of the settlement landscape in the region (Booth *et al.* 2007). The increased number of complex farmsteads, field boundaries and ditched trackways on the upper gravel terraces appears to have been associated with an expansion of arable agriculture, though not at the scale as in the other case study areas. However, there are signs that diversification of plant husbandry took place at several complex farmsteads in the Upper Thames Valley during the Roman period, with remains of cultivated herbs, fruits, flax, and vegetables appearing for the first time, suggesting that cultivated, 'garden' plots were becoming a feature of some settlements. Nonetheless, pastoralism continued to form the primary focus of the farming economy in the region, with the management of cattle playing a central role, supported by barley, spelt and hay cultivation.

WESSEX

The Wessex case study area is dominated by the chalk downland that covers much of modern Hampshire, Wiltshire and Dorset. It includes the *civitas* capitals of Silchester, Winchester, and Dorchester, and these towns are likely to have had a considerable economic impact on settlements in their immediate hinterlands. This case study includes 36 archaeobotanical assemblages from 30 sites, and 97 zooarchaeological assemblages from 63 sites (FIG. 4.19). Complex farmsteads are comparatively rare compared to enclosed farmsteads in this region. However, the majority of enclosed farmsteads are late Iron Age or early Roman in date. Several late Roman unclassified farmsteads have produced environmental assemblages, as have a number of later Roman villas. The number of roadside settlements with botanical and zooarchaeological samples is limited, though several villages on Salisbury Plain have produced animal bone assemblages and small charred plant assemblages.

Aerial surveys in combination with small-scale excavations have shown that much of the chalk downland of Wessex was under arable cultivation during the late Iron Age and Roman periods (see Allen 2016a, 117–20). The evidence is characterised by patterns of dense, rectilinear field systems covering large areas of land, interspersed with trackways, enclosures and settlements of various size (Cunliffe 1977, fig. 2; McOmish *et al.* 2002). These farming landscapes predominantly supported the cultivation of glume wheats and barley, with the latter being very well represented in assemblages from the region, particularly from late Iron Age and early Roman deposits where it contributes just over 30 per cent of the botanical remains, falling to just under 20 per cent in the late Roman period (FIG. 4.20). High average proportions of barley are found at all site types other than villages, though the latter only includes two sites. For the most part, spelt was the main wheat species in the Wessex region. Emmer is usually recovered in small proportions, though higher frequencies in late Iron Age/early Roman deposits at Cowdery's Down, Hampshire (26 per cent), and Tolpuddle Ball, Dorset (28 per cent), indicate a shift towards more extensive cultivation methods over time, given the different characteristics of spelt and emmer (FIG. 4.21).

Several enclosed farmsteads dating to the late Iron Age/early Roman periods have produced assemblages with higher proportions of barley. At Brighton Hill South, Suddern Farm, and Cowdery's Down, all in Hampshire, and Figheldean in Wiltshire, barley represents between 22 and 54 per cent of the botanical assemblages. Balksbury Camp, Hampshire, is one of the few

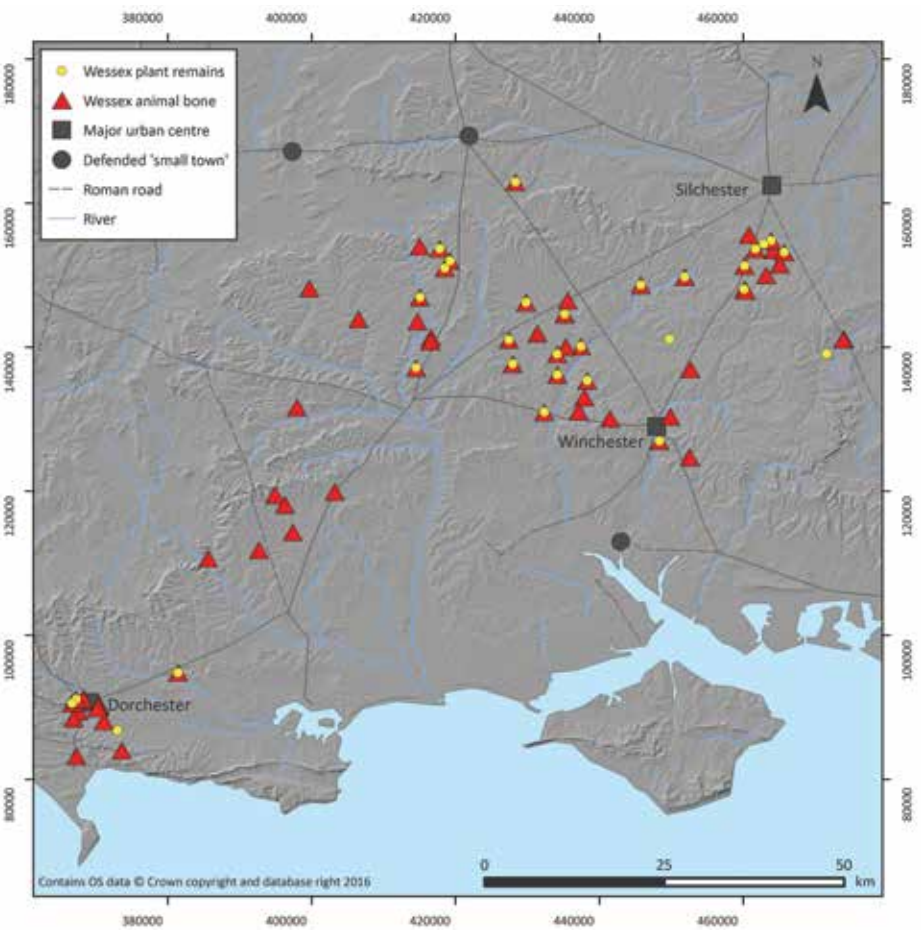

FIG. 4.19. Distribution map of animal bone and botanical assemblages in the Wessex case study area

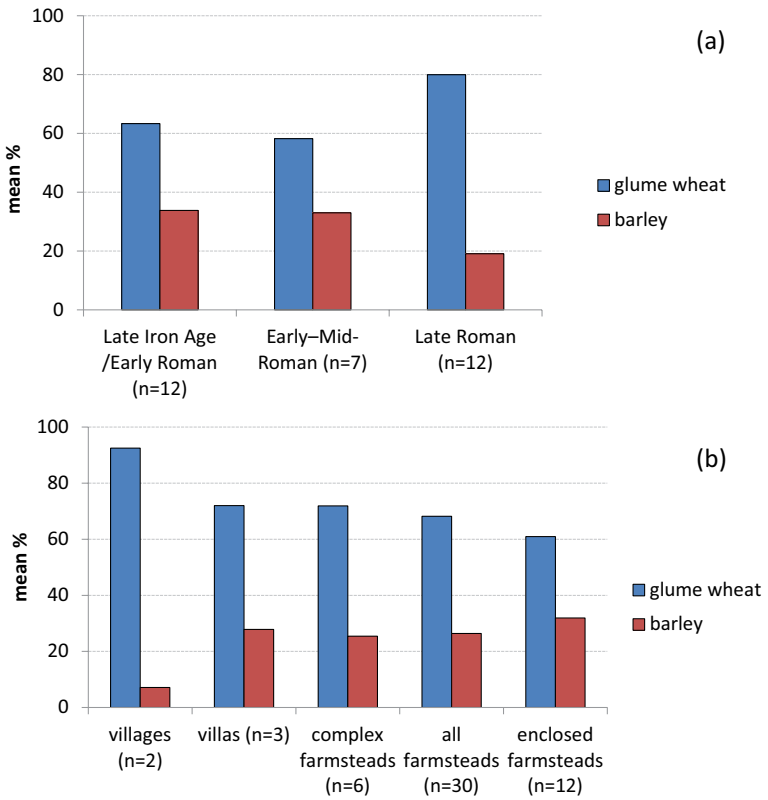

FIG. 4.20. Mean percentages of glume wheat and barley over time (a) and at different site types (b) in Wessex

complex farmsteads with quantified botanical assemblages in the region, with barley being well represented in each phase of occupation (late Iron Age: 43 per cent; early Roman: 57 per cent; and late Roman: 23 per cent). In the late Roman period, high proportions of barley were recovered from the farmsteads at High Post and Figheldean, Wiltshire, much of which derived from corndryers indicating that the crop was being processed alongside spelt wheat. Few late Roman villas in the region have produced large botanical assemblages, though at Fullerton, Hampshire, large quantities of barley were recovered from an enclosure ditch, consisting mostly of burnt clean grain with signs of germination and sprouting (Campbell 2008b). It seems likely that this deposit represents malted grain that had been accidentally charred, perhaps cleaned out from the corndryer at the site. Previous survey of a number of assemblages from Danebury environs sites has shown that the recovery of processed barley waste from ditch deposits is fairly common, such as at Grateley South, while ovens and corndryers consistently produce high proportions of spelt wheat (Campbell 2008a, 66, fig. 3.3), indicating the bulk processing of spelt wheat versus the day-to-day accumulation of barley.

The relative abundance of barley in the Wessex case study area suggests a pattern of mixed cereal cultivation. Campbell (2008a, 68) argues that hulled six-row barley and spelt wheat were sown together in the autumn and grown as a maslin (a crop mixture) until the late Iron Age, after which they were cultivated separately, with wheat being autumn-sown and barley being spring-sown. This interpretation is yet to be proven, but it is possible the seasonal cultivation of these two crops was integrated as part of a rotational system. Barley also copes well on chalk soils, where it can better withstand dry conditions, lower fertility and some salinity compared to wheat (Rippon 2013, 132–3; Zohary *et al.* 2012, 52).

The light chalk soils of Wessex are unlikely to have needed heavy ploughing, particularly on the hillslopes of the downs, which tend to have a thin layer of surface soil, though manure would have been required to maintain the fertility of regularly-cultivated plots. This is reflected in the high proportion of sheep in the region, particularly at farmsteads and villas, while cattle tend to be better represented at villages and roadside settlements (FIG. 4.22). Sheep husbandry is well adapted to extensive arable farming on chalk downland; they are comparatively low-maintenance livestock, grazing on cereal stubble after the harvest and replenishing the soil with the high-nitrogen content of their manure. This is a method known as 'direct manuring', whereby sheep were folded on the arable fields, which requires relatively small fields with well-defined boundaries, such as those found on the Wessex Downs (e.g. McOmish *et al.* 2002, 3, 107, fig. 4.21), as opposed to 'indirect manuring' where manure is manually spread by farmers. As highlighted in Chapter 3, however, there is good evidence for sub-regional variation in livestock exploitation – rural settlements around Dorchester produce the highest mean frequency of sheep bones, followed by those in the hinterland of Winchester, while those closer to Silchester produce comparatively high proportions of cattle. Also, while sheep are the best represented livestock mammal in the region, a steady increase in cattle over time suggests that some changes to the agricultural economy were occurring.

In the later Roman period, systems of elongated, arable strip-fields were laid out on hillslopes at several sites, such as at Fullerton villa, where the fields were arranged perpendicular to the slope of the valley (Allen 2016a, 139, fig. 4.76). Such fields were easier to cultivate with heavy ploughs (Bowen 1969, 40–4) and their boundaries would have created water breaks, which would have reduced the impact of soil erosion after ploughing. It is uncertain whether these field systems represent an

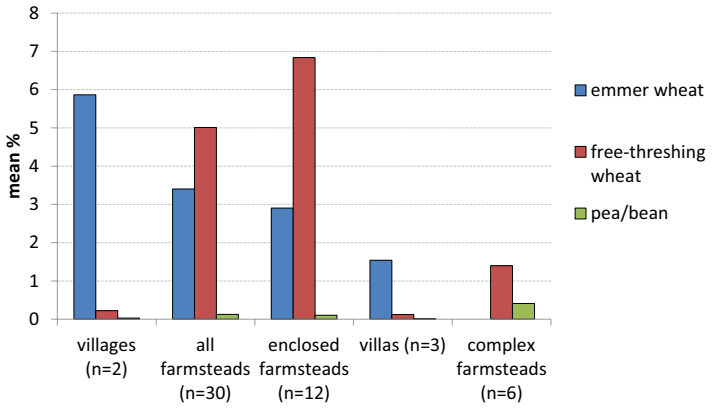

FIG. 4.21. Mean percentages of minor crops at different site types in Wessex

expansion of the amount of land being cultivated or a re-organisation of land already under cultivation. Evidence for manual manuring of arable fields has been identified through extensive spreads of Roman pottery on the Berkshire Downs at Maddle Farm, Lambourn, where Gaffney and Tingle (1989, 209–23) have reported that early Roman pottery was notably more common than late Roman pottery, leading the authors to suggest that the intensity of manuring reduced in the later period. The deliberate collection and spreading of manure by hand is more labour intensive than direct manuring, though farmers can maintain more control over its distribution and the quantity used, undoubtedly quickening the process of soil re-fertilisation and reducing the time between harvesting and re-sowing (see Ch. 2, p. 37). Research in these landscapes and on Salisbury Plain (Fulford *et al.* 2006) has shown widespread cultivation of the chalk downland continued throughout the Roman period.

At late Roman Fullerton, seeds of yellow rattle, hardheads, plantains and other grasses, indicate the presence of hay, perhaps from meadows managed on the valley floor (Campbell 2008b). This would have enabled more intensive livestock management, alongside large-scale cereal cultivation, particularly for stalling draught cattle over winter. Sheep husbandry also continued to be an important element of the farming economy of Wessex in the late Roman period, perhaps making use of upland pastures in the summer months. Sheep are relatively abundant at late Roman complex farmsteads and particularly at villas. A high proportion of elderly sheep (*c.* 8 years+) in fourth-century deposits at Dunkirt Barn villa in Hampshire (Worley 2008), for example, suggest that some sites began to place an increasing emphasis on wool production.

In summary, cereal cultivation appears to have become more extensive over time in Wessex throughout the Iron Age and Roman periods with both spelt wheat and six-row barley forming the primary crops. However, sheep husbandry was also clearly of major importance in this case study area. A seasonal rotation of hill-top grazing with sheep folding onto arable fields after the annual harvest to replenish soils could have been practised across much of the region. However, the relative importance of cattle in some areas suggests that farming strategies may have varied, particularly in the later Roman period when larger, more regularly organised fields were laid out on valley slopes. Pottery spreads on the Berkshire Downs and Salisbury Plain show that manual manuring was being undertaken through the Roman period, perhaps making use of domestic waste and manure from stalled cattle. Arable farming continued to be a major economic activity on the Hampshire Downs, with large numbers of corndryers at sites

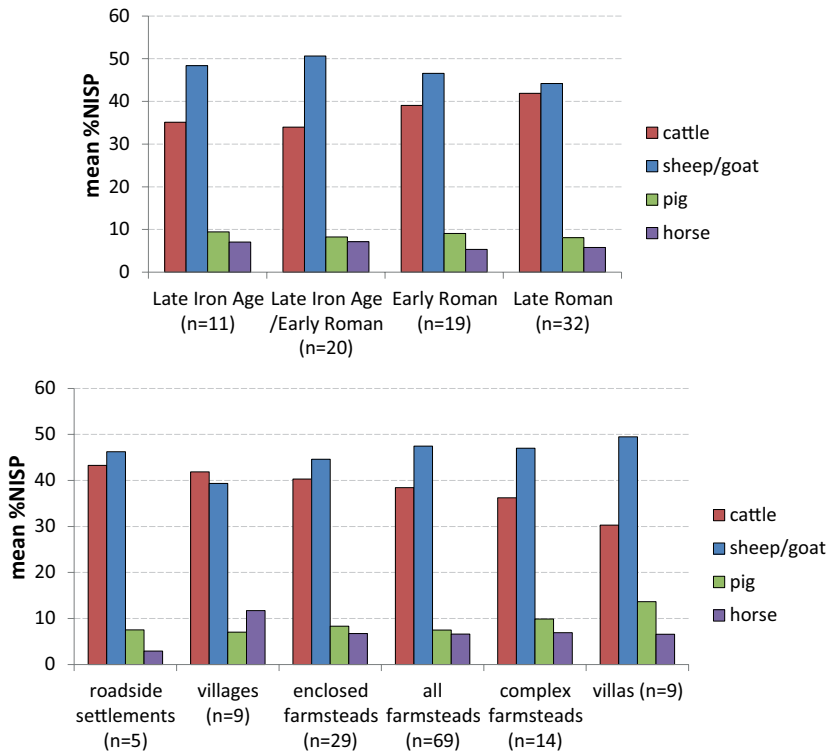

FIG. 4.22. Mean percentages of major domestic mammals over time and at different site types in Wessex

such as East Anton, and perhaps increased in scale over time (Allen 2016a, 138, fig. 4.75). Urban demands for grain and flour in the region would undoubtedly have been a factor in the decision of some Romano-British farmers to invest in large-scale cereal-processing units, and part of the wealth generated through farming may be reflected in the proliferation of villas in Hampshire in the third and fourth centuries (*ibid.*, 135–7).

GWYNEDD, NORTH-WEST WALES

This case study covers the modern government areas of Gwynedd, Conwy and the Isle of Anglesey. Together these areas formed the Welsh county of Gwynedd as it stood between 1974 and 1996. The majority of settlements in this region were enclosures built of stone and earth, normally with circular and sub-rectangular buildings built into the enclosure wall using the same construction materials. Commonly known by the vernacular term 'hut groups', they are a very distinctive type of farmstead and a more detailed overview of their form and chronology is presented in Volume 1 (Brindle 2016b). In total, 24 excavated farmsteads are included in this study, most of which are of the classic 'hut group' type. The majority of the excavated farmsteads in the region are located in low-lying areas, particularly close to the north-western coastline and on the Isle of Anglesey (FIG. 4.23). In addition to these sites, a number of military *vici* are known to be associated with Roman forts in the region, and the forms of several have been revealed through recent geophysical survey (Hopewell 2003; Hopewell and Burnham 2007), though unfortunately very few have received sufficient excavation for them to be considered further in this chapter. A number of large hillforts are also known, including Braich y Dinas (Hughes 1923) and Dinas Emrys (Savory 1960). A possible villa may be present at Glasfryn, Tremadog, where a bathhouse was excavated in the early twentieth century and, more recently, a large lime kiln (Breese and Anwyl 1909; Kenney 2006; Ch. 5, p. 209). A fairly unusual settlement (at least unusual in its regional context) has also recently been identified at Tai Cochion on Anglesey, directly opposite the fort at *Segontium*. This site is not yet published, though small-scale

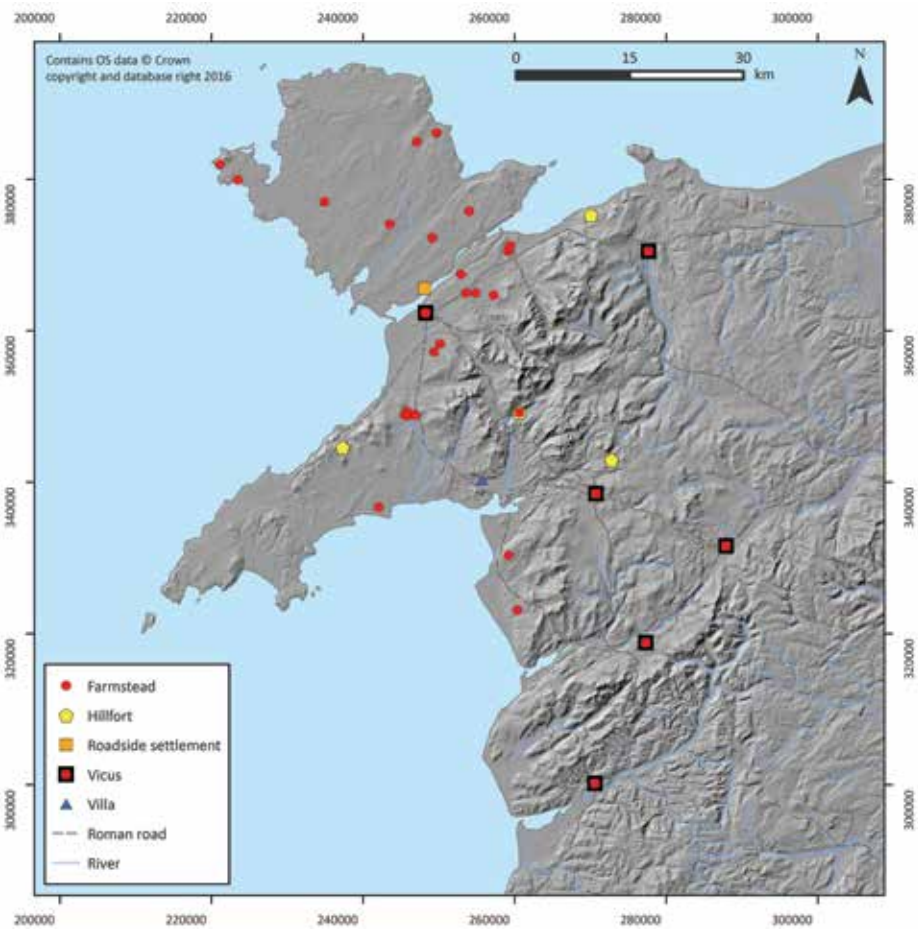

FIG. 4.23. Distribution of excavated rural sites in Gwynedd

excavations and extensive geophysical survey suggest that it may have been a roadside settlement, perhaps leading from an as yet unknown port on the coast (Hopewell and Smith 2012).

Animal bone and plant assemblages are not common, making it difficult to examine the agrarian economy of the region. However, arable farming must have been of some importance. Evidence for field systems around many of the known hut groups are commonly identified by the presence of lynchets. The formation of these earthen banks is an indication of ploughing over long periods of time, while the occurrence of perennial weeds at Cefn Du, Gaerwen and Cefn Graeanog II has been suggested to indicate the use of ards (Fasham *et al.* 1998; Cuttler *et al.* 2012). Evidently, these land boundaries changed over time, as indicated by a number of hut groups that were built over pre-existing lynchets. At Caerau, two hut groups sit in close proximity within a field system that is broken into units of varying shapes and sizes by lynchets (FIG. 4.24; St John O'Neill 1936). Just how the land was shared between the settlements is not known, but it certainly appears that they were engaged in small-scale arable farming.

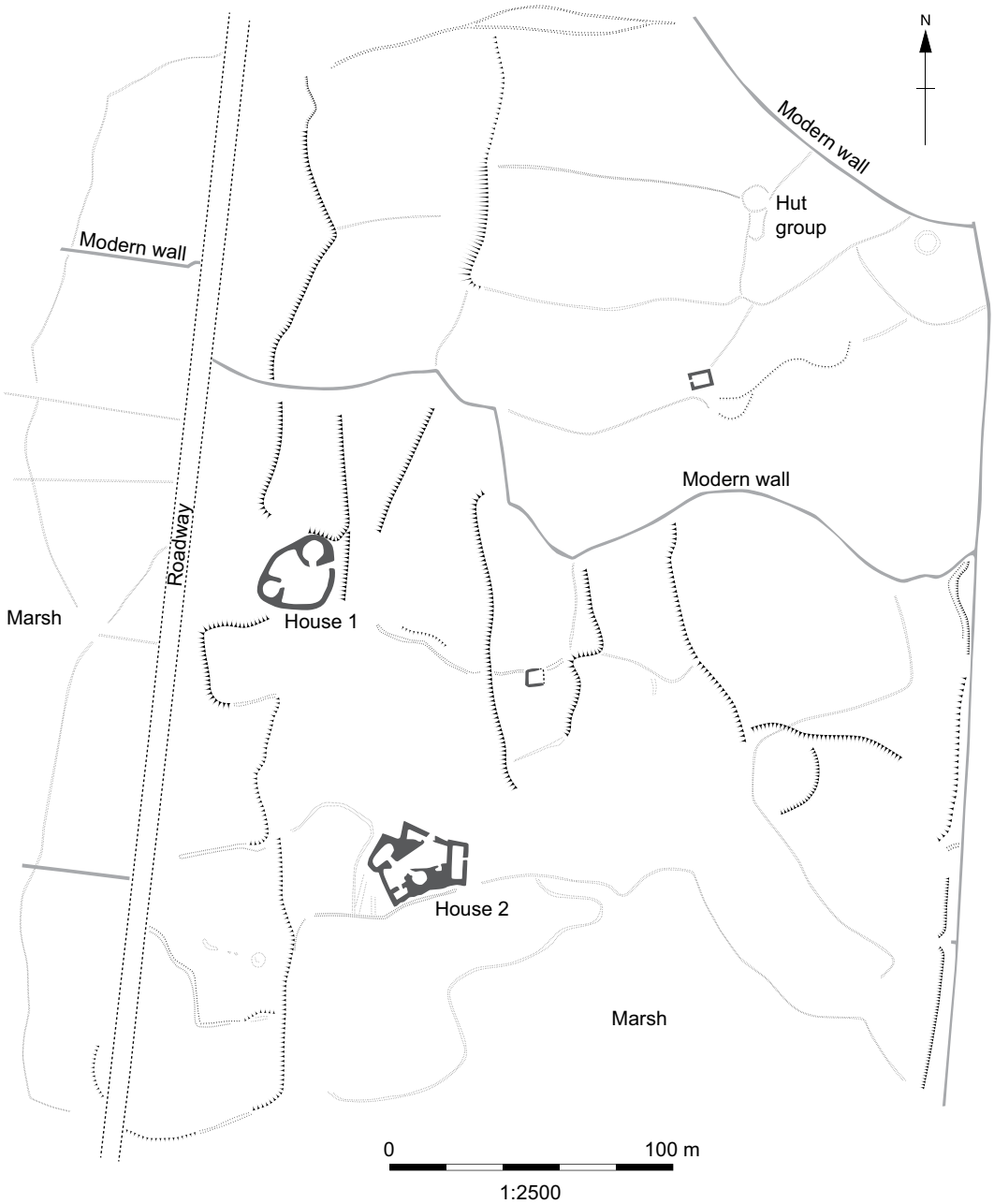

FIG. 4.24. Survey plan of the field system and hut groups at Caerau (St John O'Neill 1936)

The almost complete lack of corndryers at farmsteads in the region indicates that intensive cereal processing was rare. The only evidence for surplus production of cereal is found at Tremadoc, where a substantial, T-shaped corndryer – a type normally only found in central and southern England – was recently discovered close to the bathhouse mentioned above (Kenney 2006). Recently excavated at Cefn Du, a small, rectangular, nine-post structure was thought to have been a granary, though such structures are also quite rare (Cuttler *et al.* 2012). In contrast, quernstones are relatively common and have been recovered from a number of hut groups and other farmsteads in the region. Occasionally, archaeobotanical evidence also provides evidence for small-scale, cereal-processing. At Melin y Plas, Bryngwran, botanical samples dating to the first–second century A.D. included barley and oat grains in some quantity, while others included mainly emmer and spelt wheat chaff, left behind after processing (Cuttler *et al.* 2012). The arable nature of this site contrasts with the farmstead at Bryn Eryr, where although barley and wheat were also cultivated, cereal grains and, most notably, cereal pollen were very rare (Longley *et al.* 1998, 239–40). High phosphate levels in the soil at this site, most likely generated by livestock manure, suggest that pastoral farming was important.

There is no evidence for ditched enclosures in the region, though the presence of stone-walled fields, such as at Cors-Y-Gedol, would have provided suitable enclosure for livestock (Griffiths 1960). Some of the hut groups may have been large enough to have functioned as byres, or at least had areas for stalling small numbers of animals. Breeding stock would certainly have required housing for the winter. Evidence for internal walling, dividing the space within farmsteads, has been observed at Cefn Graeanog I (FIG. 4.25; Hogg 1969) and Caer Mynydd, Rhiwlas (Griffiths 1959). Whether this was for cordoning off areas for animals or for other reasons is not known, though this was almost certainly the case at Cefn Graeanog II where phosphate analysis strongly indicates that some buildings were used as livestock shelters (Fasham *et al.* 1998). Unfortunately, the zooarchaeological dataset from the region is poor, owing to the acidity of the soil, but based upon the available evidence it appears that livestock husbandry was generally non-intensive. Low numbers of textile-processing finds have been recovered from five farmsteads, suggesting that wool processing was undertaken at individual settlements.

Economic diversity is evidenced by the fairly regular identification of industrial activity on farmsteads in the region, with metalworking in particular being more common on sites dating to the Roman period (FIG. 4.26; see Ch. 5). However, the poor dating of Iron Age phases of some settlements may have hindered the identification of this activity. The only site with conclusive evidence for ironworking in the Iron Age is at Bryn

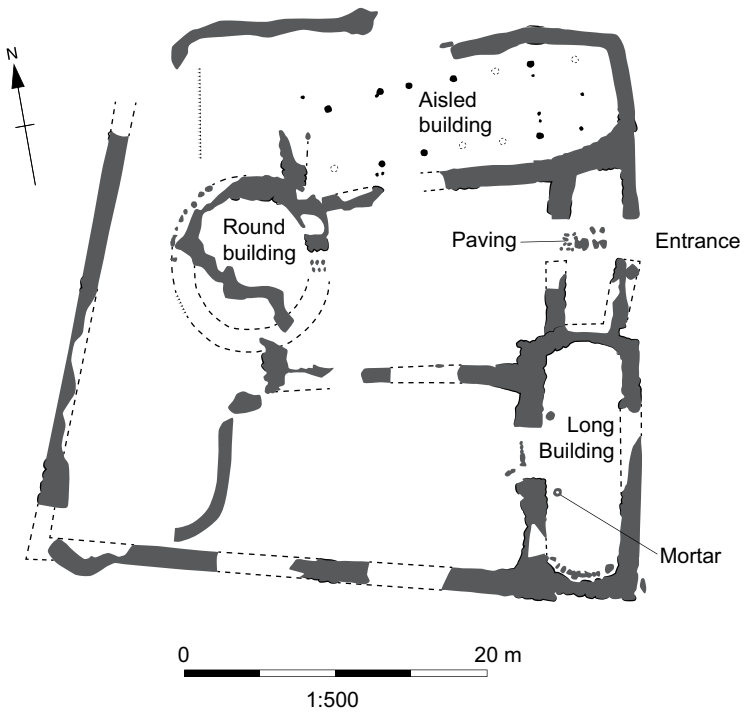

FIG. 4.25. Plan of Cefn Graeanog I showing internal walling dividing space within the settlement (Hogg 1969)

Y Castell, where a relatively small but fortified hilltop settlement produced over 1.2 tons of waste material from both iron smelting and smithing (Mighall and Chambers 1989). Radiocarbon dating placed this activity between the first century B.C. and the third century A.D.

At a number of Roman-period 'hut groups', workshops and areas of industrial activity can be distinguished from domestic quarters (FIG. 4.27). At Hafoty-wern-las, Rhostryfan and Din Lligwy, smithing was identified in rectangular buildings, while at Caer Mynydd, Rhiwlas, a circular building was used (Williams 1923a; Griffiths 1959; Hogg 1975). At Coed-Y-Brain, Rhostryfan, a metalworking area was sandwiched between two roundhouses, close to the entrance of one with which it may have been associated (Williams 1923b). The industrial activity at these sites varies

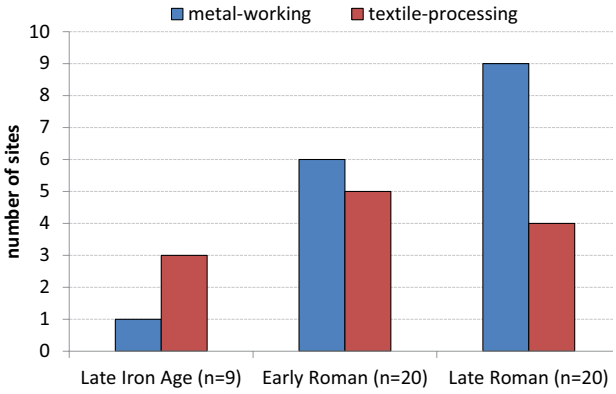

FIG. 4.26. Evidence for metalworking and textile processing over time in the Gwynedd region

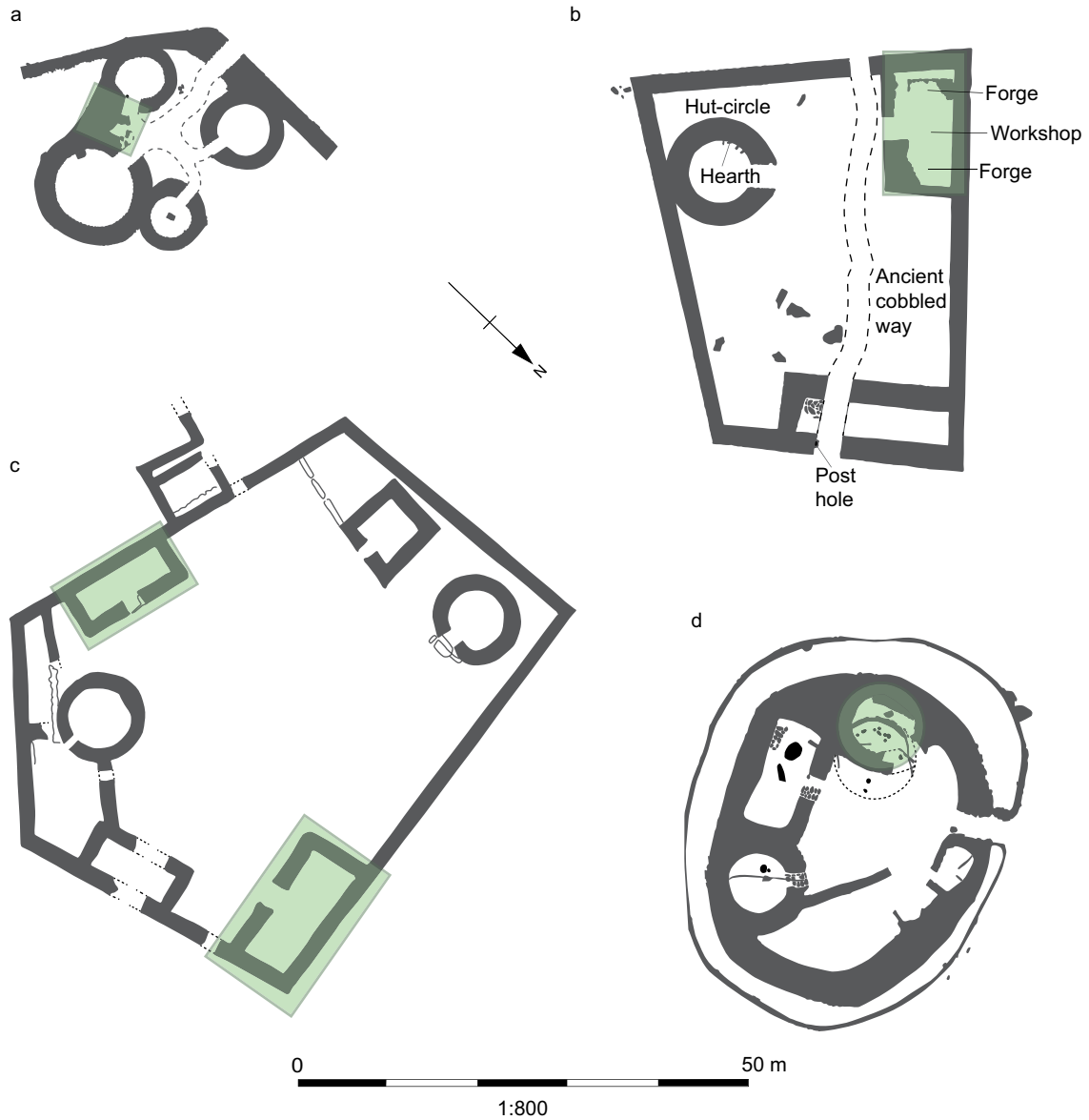

FIG. 4.27. Plans of hut group settlements, with buildings identified as smithies marked in green: (a) Coed-y-Brain, Rhostryfan (Williams 1923b); (b) Hafotty-wern-las, Rhostryfan (Williams 1923a); (c) Din Lligwy (Hogg 1975); (d) Caer Mynydd, Rhiwlas (Griffiths 1959)

slightly in date, but was generally occurring between the second and the fourth centuries A.D. Another feature of several sites is the construction of slab-lined, drainage gullies found in or next to a number of buildings (St John O'Neill 1936; Griffiths 1959; Cuttler *et al.* 2012; Kenney 2012). It is uncertain what these drains were used for, but metalworking or another industrial activity is possible. It has been suggested that glass-bead manufacture occurred at Cefn Cwmwd, Rhostrehwfa (Cuttler *et al.* 2012) and Parc Bryn Cegin, Llandygai (Kenney 2008) during the second and third centuries A.D. At both of these sites the presence of imported fineware pottery suggests inclusion within wider distribution systems and receptiveness to such material, and perhaps an element of high status. The increasing importance of metalworking and other industrial activities on settlements during the Roman occupation may have differentiated some sites from those that were solely engaged in subsistence agriculture in the region.

Pottery is generally rare in Gwynedd, though a number of hut groups have produced imported Roman types, such as BB1, which suggest some interaction with markets at the military *vici*. Instead of ceramics, other materials would have more commonly been used for household items, such as, for example, the burnt remains of a wooden bowl found in a hearth at Cors-Y-Gedol (Griffiths 1960). Certainly no evidence for pottery or tile production is known from any of the farmsteads in the region. The late first or early second century A.D. tile kiln at Llech Idris, Dolgai, was suggested to have been intended to supply the fort at Tomen y Mur, 7 km to its north (Crew 1990). Tile production is evidenced at Newborough Street, Caernarfon, which, alongside the recovery of well-preserved, worked wood and leather, prompted the excavator to argue that local workshops were supplying the military (White 1985). Here, also, the recovery of children's shoes, herbs such as dill and coriander, and domestic items such as wooden combs, suggest that local trade provided some of the civilian community with a level of affluence not seen at most of the rural farmsteads.

Overall, the settlement and economic landscape of the Gwynedd case study area appears quite different from the regions examined in the south and east of England. Understanding of farming patterns is hindered by a lack of suitable environmental assemblages, though the few that exist, alongside evidence from field systems, suggest that agricultural production was fairly small scale in comparison. The relationship between these communities and the strong military presence in the region is not overly clear. Although army garrisons would have been stationed to exert a level of political control, their presence may have been more concerned with the exploitation of mineral resources across north Wales (e.g. Burnham and Burnham 2004; see Ch. 5). This seems most likely to have been the case in the second century A.D., and, although a number of forts were abandoned by the third century A.D., the fort at *Segontium* was occupied into the fourth century. Minimal exchange between military *vici* and farmsteads is indicated by the recovery of BB1 pottery at some of the latter. This suggests that some farms were producing at least a small surplus of livestock or grain that could be traded at market. *Segontium* may have stimulated the local economy to some degree (Brindle 2016b, 382), but it does not seem likely that local farming was at a scale to fully support the army throughout the period, which almost certainly imported much of its requirements.

STRATEGIES FOR AGRICULTURAL EXPANSION

The five case study areas covered in this chapter clearly show that there was a wide degree of regional variation in the farming economy. As mentioned at the beginning of this chapter, strategies employed for crop cultivation and livestock husbandry are often complementary, and will be influenced by the local environment and opportunities for trade and exchange. Despite the limitations of the data, comparison of the average proportions of the major cereal (glume wheats and barley) and livestock taxa (cattle, sheep/goats, pigs and horses) from rural settlements in four of the case study areas shows a correlation between higher frequencies of cattle with glume wheats (mostly spelt), and sheep with barley (FIG. 4.28; note that this does not include Gwynedd owing to a lack of data). In the West Anglian Plain and Kent, cattle contribute just over 50 per cent of the major livestock remains, while barley contributes less than 8 per cent of the cereal remains in the former and less than 12 per cent in the latter. In contrast, sheep are slightly better represented in the Upper Thames Valley, where barley contributes 23 per cent of the cereal remains, while in Wessex, sheep are the dominant livestock animal, contributing over 47 per cent of the major livestock and the highest proportion of barley at 26 per cent. Within these mean calculations, there is very little variation between different cereal assemblages in the West Anglian Plain and, to a slightly lesser extent, in Kent, where there is a clear emphasis on glume wheats, almost to the complete exclusion of barley (FIG. 4.29). While glume wheats also dominate in assemblages from the Upper Thames Valley and Wessex, there is far more variation

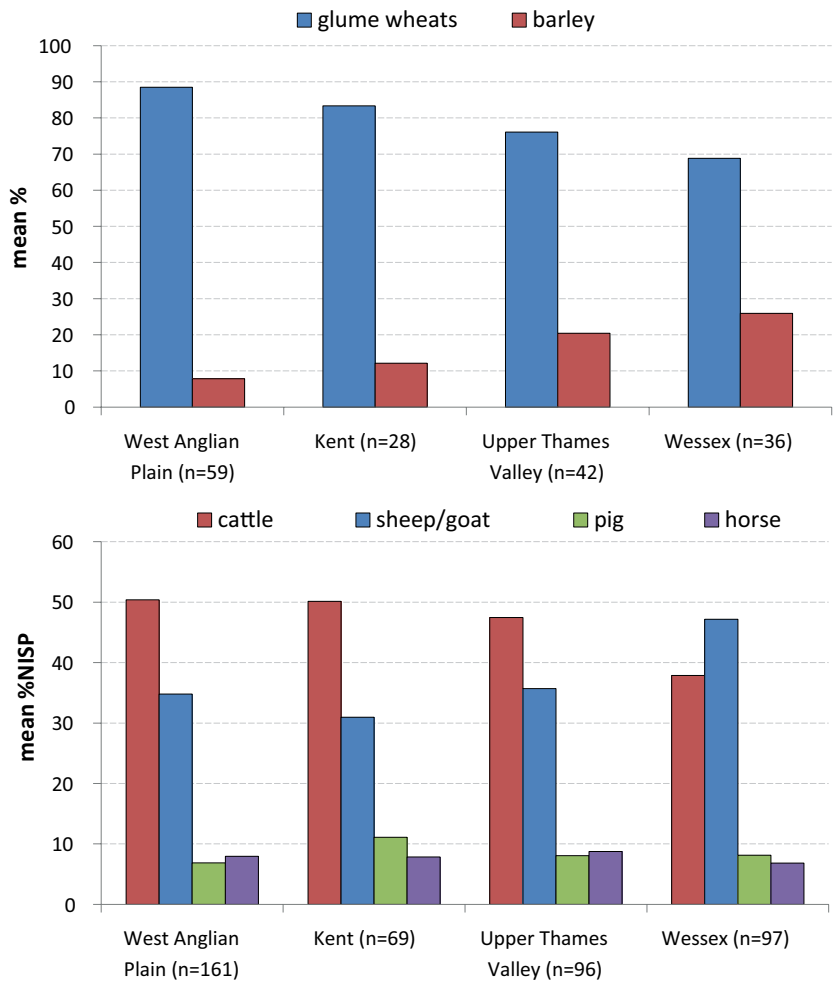

FIG. 4.28. Relative frequencies of major cereal crop and domestic mammals by case study area

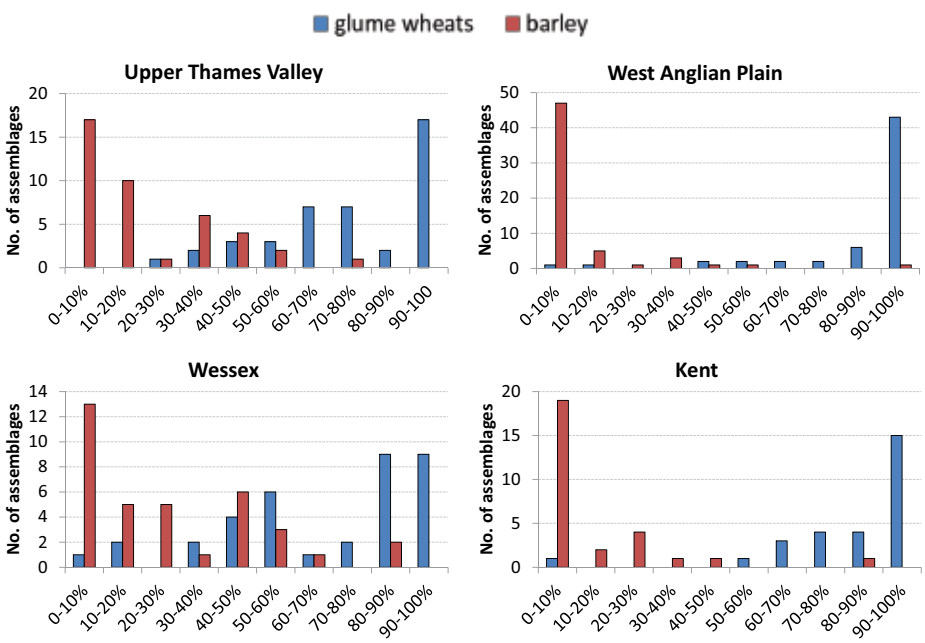

FIG. 4.29. Regional variations in the percentage of glume wheat and barley

between assemblages that produce medium and low quantities of barley (as seen above, some sites in these areas have produced deposits particularly rich in barley). Overall, there is a strong relationship between the relative proportions of livestock and cereal crops in different case study areas. The regions where spelt wheat and cattle are dominant, i.e. the West Anglian Plain and Kent, can be interpreted as practicing more extensive farming practices, reliant on animal-drawn tillage.

It is also worth pointing out that, although this chapter has focused on specific regional case studies, there is good evidence for agricultural expansion in other areas too. The 'brickwork' field systems identified most notably at Dunston's Clump, Nottinghamshire, have been found to stretch over wide areas of the Sherwood Sandstones (Garton 1987; Allen 2016b, 272–3). Field scatters show that these were manured and fairly intensively cultivated from the end of the Iron Age to the end of the third century A.D.

Extensive farming regimes rely on the availability of large areas of land and, therefore, can be directly linked to low population/settlement density. Settlement density is difficult to assess through excavated evidence alone and requires supporting data from aerial surveys, such as on the chalk downs of Wessex where there is substantial evidence for continuity of settlement and landscape organisation over the late Iron Age/Romano-British transition (Allen 2016a, fig. 4.29; Cunliffe 2008, 193–5). Cunliffe's extensive survey of Chalton Down in Hampshire has identified settlements that were, on average, positioned less than half a kilometre apart, while the land in between was covered by a dense patchwork of fields and tracks. He argues that the surrounding farmland would have been completely under arable agriculture, apart from the highest hilltops, which would have been left for pasture (*ibid.*, 194). However, most of the settlements in this area were relatively small farmsteads, capable of housing family-sized groups – a contrast to the large complex farmsteads common in the Upper Thames Valley and on the West Anglian Plain, which are rarely found in Wessex. At this level of settlement density, it may not have been possible to maintain the entire area under cultivation at any one time. Extensive arable farming may have been more achievable on the Salisbury Plain in the later Roman period where numerous large villages appear to have supported substantial human populations, the largest covering over 25 ha (McOmish *et al.* 2002, 96, fig. 4.11). Lynchets up to six metres in height have been recorded at Charlton, Upavon and Compton, suggesting that ploughing occurred over many years (*ibid.*, 100; Fulford *et al.* 2006).

Good evidence for an expansion of arable farming under extensive cultivation comes from the West Anglian Plain. Here, plant assemblages show a clear trend of increasing proportions of spelt wheat over emmer and barley, almost to the exclusion of these crops by the late Roman period, and a marked increase in the relative frequency of cattle with an emphasis on mature animals, particularly at mid- and late Roman complex farmsteads and villas. Extensive spelt farming is matched by an increase in the scale of agricultural processing, seen through the frequency of corndryers and higher density crop-processing waste deposits (Ch. 2, p. 82). Similarly in Kent, we see shifts towards spelt wheat dominance in the early Roman period, indicating a move towards more extensive cultivation, accompanied by large-scale processing of cereals for flour and malt. This expansion in arable farming is likely to have been associated with changes in animal husbandry regimes, though as seen in Chapter 3, such developments were not universal across southern Britain. Nonetheless, there is clear evidence for increases in cattle size in the early Roman period in the eastern part of southern England, and an increasing proportion of older cattle at rural settlements (Ch. 3, p. 139). An increased emphasis on livestock being used for traction appears to have been the main, underlying cause of these patterns, supporting the expansion in arable cultivation and the transport of exchangeable goods.

A contrasting view of the agricultural economy comes from the Upper Thames Valley, where the expansion of intensive animal management systems is indicated by new settlements with developed, interlinking systems of livestock enclosures – a phenomenon also seen elsewhere in the major river valleys of southern England (e.g. FIG. 4.7; see Allen 2016a, 131, fig. 4.68). Evidence for a rapid reorganisation of the settlement landscape in this area has been widely observed to have occurred in the early second century A.D., indicated by large, complex farmsteads and extensive systems of ditched trackways (Booth *et al.* 2007; Booth 2011). These changes would suggest the development of more organised patterns of livestock management and exchange, while evidence for hay production emphasises the need to set aside meadowland in order to support potentially large herds, which also facilitated traction and transport requirements (Robinson 2007). The emphasis on pastoral farming is further indicated by the absence of insect pests of stored grains and the remains of only a few substantial corndryers (Ch. 2, p. 60). Environmental evidence suggests that pastoralism was the primary element of the agricultural economy of this region during the late Iron Age and Roman periods.

This comparative review provides evidence for an overarching shift in the farming strategies employed in Kent and the Thames Estuary, the West Anglian Plain, and on the Wessex Downs, towards a predominantly 'spelt wheat and cattle' orientated agricultural system, suggesting the integration of more extensive patterns of cereal cultivation, with livestock herding, potentially larger fields and relatively low levels of manuring. A key finding is that, broadly speaking, rural settlements tended to develop the same agricultural strategies within each region, with most moving towards spelt-dominated agriculture at the same rate. Furthermore, the majority of farmsteads did not have archaeologically recognisable, specialist storage structures. This is important because it means that many farmers would not have been able to control the timing of the export of their arable surplus. In turn, this would imply that most farmsteads were not operating under a free-market system, where they could otherwise choose to focus on particular crops as a competitive, economic strategy, and decide when to send grain to market. Instead, it seems likely that farmsteads were maximising their production, perhaps because part of their product was required by the state, possibly as tax payments, or passed on as rent to the estate to be processed and sold.

MOVEMENT OF AGRICULTURAL SURPLUS

As discussed at the outset of this chapter, there were two primary markets for agricultural surplus in Britain: the major towns and the army. Most of the *civitas* capitals and *coloniae* were located in the agricultural heartlands of the south and east of England, and therefore would have had fairly easy access to surpluses of cereals and livestock. Army garrisons, on the other hand, were predominantly positioned in the north of England, for a time in southern Scotland, and in Wales. There is also limited evidence for the export of agricultural produce to the Continent, based on written records from a number of sources, such as Zosimus' (*Historia Nova* III, 5, 2) description of a fleet of 800 ships built to supply British grain to the Rhine frontier in A.D. 359, and Ammianus' (XVIII, 2, 3) account of granaries being stocked with grain that was usually brought from Britain, suggesting that these requisitions may have been fairly regular (Ireland 2008, 144). It is generally accepted that Britain partly relied on food imports in the later first and second centuries A.D., but was largely self-sufficient by the third and fourth centuries A.D. (Fulford 1984; 2004). Previously, however, there has been little consideration of where in the province food supplies came from. As discussed by Fulford (2004, 309–12), tracking the movement of perishable goods is challenging and relies on occasional presence and absence data. Strontium (SR) isotope analysis of animal bone can provide indications of source areas, as isotope ratios are linked to underlying geology (Sykes *et al.* 2006; Minniti *et al.* 2014), while pottery wares can be considered as a proxy for the movement of food products (see Bidwell, Ch. 7). Alternatively, links can be made between regions where surplus agricultural production is evident and areas where the demand for food was high, but the scale of production was low.

The standing army on the northern frontiers would have required cereals, meat and ale to sustain the soldiers, as well as fodder for horses. Vindolanda is known to have been variously garrisoned by full cavalry and part-mounted units, meaning that up to 500 horses could have been stabled at the fort at any one time (Huntley 2013a, 34). Excavations at Wallsend have shown that horse stables were built into the *contubernia*, where the cavalry soldiers were barracked (Hodgson 2003). Alongside structural evidence, analysis of environmental remains is increasingly identifying the presence of stable manure in some quantity (Ch. 2, p. 81), such as at Ribchester, which is known to have been a full cavalry fort (Hall and Huntley 2007, 54; Large *et al.* 2009, 52–3). Aside from grazing requirements, which would have been considerable, Huntley estimates that 500 horses (a *cohors equitata milliaria*) would need around 2.25 tonnes of hay and 0.75 tonnes of barley grain every day (Huntley 2013a, 36). If this quantity is added to the grain requirements needed to support the soldiers, large granaries (*horrea*) would have been essential, as would a regular supply. Direct evidence for the supply of agricultural produce derives from military granaries where the contents have become accidentally destroyed. Analyses of plant remains from storage deposits at several forts in northern England have tended to identify quantities of clean spelt wheat grain rather than barley, the former almost certainly destined for human consumption, such as at South Shields, Tyne and Wear, where bread wheat remains were also found (Van der Veen 1994), Ambleside, Cumbria (Carruthers 1993), and Coney Street, York (Kenward and Williams 1979). Interestingly, macrobotanical remains from a granary at Birdoswald on Hadrian's Wall suggest that spelt, barley and hay were stored in separate areas of the building (Huntley 1997).

Of these assemblages, weed seeds present at the *colonia* site at Coney Street, York, indicate the long-distance import of grain from the Continent (Kenward and Williams 1979). Cross-channel

grain supplies are also evidenced at Caerleon legionary fortress in South Wales, where *Lathyrus aphaca*, *Lathyrus nissolia*, *Lathyrus cicero* and *Lens culinaria* were recorded from a store of cereals (Helbaek 1964), and at Alchester, Oxfordshire, where imported millet has been identified from the fortress ditch (Sauer 2006). Certainly, the northward movement of agricultural produce is indicated by the identification of bug species with natural distributions confined to south-eastern England, which were found in association with hay in a well at The Bedern, York (Kenward *et al.* 1986), while the presence of grain pests in the north-east indicate the movement of contaminated cereals and large-scale storage at sites along the road network (see Ch. 2, p. 70). Using Black-Burnished ware pottery (BB1 and BB2) as a proxy, Bidwell has suggested in Chapter 7 the long-distance movement of agricultural produce to the army from lowland Britain. Based upon the available data, it is difficult to assess the degree to which farmsteads in northern regions were able to satisfy the demands of the army. While areas such as the Tyne and Wear Lowlands could have produced an abundance of wheat and barley, settlement and landscape evidence suggests that farming would not have supported large-scale arable cultivation (Brindle 2016a). Similarly, in Gwynedd, the rural settlement pattern of fairly small, enclosed farmsteads indicates a focus on small-scale, mixed agriculture. The presence of small quantities of Dorset BB1 pottery at some of these sites undoubtedly shows that some level of interaction occurred between farmers and the military *vici*. Evidence from some areas in the North-East, such as on the Magnesian Limestone and around York, are suggestive of a more developed agricultural economy, with several sites containing corndryers and producing generally higher proportions of cattle over time (Allen 2016b). However, comparatively low arable productivity overall in areas north-west of the Central Belt perhaps suggests that the bulk of agricultural produce consumed by the army was supplied over long distances from parts of central and southern Britain.

Without doubt, the military required large quantities of agricultural produce and the logistics of supply would have been considerable, yet just how this network was organised is unclear. Rural settlements in the West Anglian Plain certainly appear to have been producing large quantities of spelt wheat, almost to the exclusion of other crops, and yet there were no major urban centres in this region. While small markets may have been present in defended small towns such as Water Newton, Godmanchester and Cambridge, offering some opportunity for trade and exchange (Smith 2016a, 205–6), it is reasonable to assume that most agricultural surplus was being exported to the army in the north and west or to London and other major towns in the south. But while bulk quantities of spelt wheat could have been supplied from the productive arable landscape of the West Anglian Plain, it seems unlikely that barley was supplied from this region, since there is very little evidence that large-scale processing was taking place (though this may be partly due to differential preservation as barley is a free-threshing crop). Evidence for barley production is greater in the Upper Thames Valley and Wessex, and it is possible that barley was also being produced in reasonable quantities in the north, since barley can tolerate poorer soils (Zohary *et al.* 2012, 52) and is the most frequent cereal in the North and North-East regions (Ch. 2, FIG. 2.4). A possible comparison may be found in the Batavian region along the Rhine in the Netherlands, which became dominated by the Roman military after the first century B.C. (Roymans 1996; Willems 1984). Here, barley was the predominant crop at rural sites and may have been locally supplied to the army, along with horses, which were frequently identified in relatively high proportions at farmsteads (Vossen and Groot 2008, 89–94). Analysis of environmental remains has suggested that this region was predominantly pastoral and unable to produce large quantities of spelt wheat, though barley could have been grown in some quantity. Spelt wheat was more commonly cultivated on productive loess farmland to the south in northern Gaul, where villas were also fairly ubiquitous (Kooistra 1996, 319–20). If these farms were supplying spelt grain north to the frontier it may partly explain how some of its wealth was being invested into architecture.

The analysis of charred cereal remains in Chapter 2 indicated that it is not possible to identify precisely where crops were being prepared for long-distance movement. However, given the architectural emphasis on processing structures (corndryers) over storage structures (granaries) other than at notable villas, it is clear that the regular movement of fully processed cereals was taking place from the site of production. However, agricultural supplies must have been moved over long distances and it is possible that defended settlements on the major arterial routes acted as collection centres, aggregating local supplies that could then be sent off in larger deliveries as required. Millett related the growth of 'small towns' in part to the decentralisation of the taxation system in the later Roman Empire, whereby small towns became collection points for 'tax in kind', or the *annonae* (Millett 1990, 143–51). However, limited excavation in these

settlements means that substantial evidence has yet to qualify this assumption. A possible second-century A.D. timber granary and a substantial fourth-century A.D. masonry granary were recorded at Gateway Supermarket Site and Coulter's Garage in Alcester, Warwickshire, with evidence for spelt wheat storage (Booth 1989; Cracknell 1998), and possible store houses have been identified at Catterick, North Yorkshire (Burnham and Wacher 1990, 114), and Godmanchester, Cambridgeshire (*ibid.*, 37). At Catterick Site 511, a deposit rich in hulled barley grains (over 1000), with only tiny amounts of wheat and oats, was discovered in a building fronting onto Dere Street (Huntley 1994), and it is possible that this grain store was intended for export. Granaries at the frontier town of Corbridge, Northumberland, were clearly under military control (Burnham and Wacher 1990, 58–60). In the general absence of granaries it is possible that defended small towns acted as places where mobile grain stores (wagon trains?) could be temporarily assembled before moving on.

Despite the limited number of known storage facilities, the economic relationship between defended small towns and the countryside is still based largely on conjecture (Burnham 1995, 10). Coin distribution profiles show that there was little difference between defended small towns and most other roadside settlements (see Ch. 6), and the latter must also have had a role in handling surplus agricultural produce. A substantial crop-processing area was identified at East Anton, Andover, Hampshire, on the outskirts of the settlement, where a large number of corndryers have been excavated (Firth 2011), while substantial assemblages of charred crop-processing waste has also been recovered at Croydon (Taylor *et al.* 2011), though little is currently known of this settlement (Bird 2004, 63–6).

The possibility that the military garrisons in the north of England and Wales were supplied with livestock driven over long distances has been discussed in the previous chapter, and does not need to be detailed again here (Ch. 3, p. 140), but it highlights the complexity of the livestock exchange network that developed after the Roman conquest. This was no doubt facilitated by the use of the roads system, though, as with cereals, we currently have little idea of how this network was organised and where livestock were moving from, though Stallibrass (2009) suggests that cattle may have been driven to the frontier zone from southern Scotland. While roads would probably have formed the primary transport routes for both livestock and cereals, some grain supplies and preserved meat may have arrived in the northern frontier via shipping. As mentioned above, the abundance of BB2 pottery (and 'allied' ceramics) from Thameside potteries at forts on the Antonine Wall and the eastern part of Hadrian's Wall in the second and third centuries A.D. demonstrates that products from the London region were regularly supplied to the army, and it seems likely that agricultural produce would have been transported along the same trade routes (see Bidwell, Ch. 7). The export of produce outward by canal, river and sea through the Fens must also be a consideration, particularly in light of recent excavations at Colne Fen, Cambridgeshire, which suggest that the site functioned as a port, with considerable evidence for the processing of bulk quantities of cereal grain and livestock carcasses (C. Evans 2013).

Urban populations presented another major market for food supply. Continental imports are evidenced by a store of cereals in a shop, destroyed in A.D. 60/1, adjacent to the Forum in London. Non-native plant species in this deposit included einkorn and lentil, accompanied by weeds of common corn-cockle *Agrostemma githago* and bitter vetch *Vicia ervilia* (Davis 2004; Straker 1987). *Agrostemma githago* was one of a range of new weed taxa known to have been introduced to Britain in the later Iron Age and Roman period, including *Anthemis cotula*, *Scandix pectin-veneris*, and *Coronopus squamatus* (Campbell 2000a; Preston *et al.* 2004). When several of these archaeophytes co-occur in a grain store, such as the Forum assemblage, it is reasonable to suggest a continental origin. Otherwise, more occasional occurrences of these weed seeds likely indicate their rapid establishment among the native weed flora, and cannot be used as a proxy for import. The presence of *Tribolium castaneum* (red-rust grain beetle) from 1 Poultry, London, also stands as evidence for trade in grain from warmer regions owing to its inability to over-winter in Britain (Smith and Davis 2011). However, weed seeds in other grain stores at 1 Poultry (*ibid.*) and Southwark (Davis 2003; Giorgi 2009) are consistent with native sources, highlighting the diversity of the food supply network to the provincial capital. Beyond environmental remains, samian ware can be used as a proxy to show that many bulk commodities were being imported from the Continent (Fulford 1984, 135). Pre-consumption deposits dated to the period of the Boudican uprising from 1 Poultry in London and Curry's Pottery Shop in Colchester have produced flavourings such as anise, coriander, dill and fennel mustard, which were imported alongside samian and continental glass vessels (Murphy 1977; Hill and Rowsome 2011, 294–6; Fulford 2014).

Research aimed at detecting the movement of livestock is still very much in its infancy, but, hopefully, this will develop considerably over the

coming years as strontium isotope analysis of faunal remains becomes more commonplace. One such study has focused on the analysis of cattle teeth from middle Iron Age, late Iron Age, early Roman and mid-Roman deposits at Owslebury, Hampshire (Minniti *et al.* 2014). This site is not a town, but a rural settlement. However, the results showed, quite clearly, that cattle in the middle Iron Age were predominantly of local origin, likely reflecting the self-sufficiency of the settlement during that phase, while in the late Iron Age more cattle appear to have been imported, a pattern that was increasingly emphasised in the early Roman period and maintained into the mid-Roman period (*ibid.*). This evidence strongly suggests that Owslebury became engaged in developing livestock trade networks prior to and after the Roman conquest. Strontium isotope analysis is unable to specify the exact source of livestock, and possible origins of the Owslebury cattle include south-west, midland and northern England, Wales and Scotland (*ibid.*, 309). Interestingly, some geological areas of northern Gaul and Germany share isotopic signatures with certain areas of Britain, and it is possible that some of the cattle found at Owslebury had been transported across the channel. Just how this rural settlement operated within the wider exchange network, and its relationship with towns (such as Winchester, only 8 km to the north), remain uncertain.

It is clear that towns were receiving regular supplies of large numbers of cattle (Maltby 2007). Without strontium isotope analysis, however, the range of potential sources of this supply network is yet to be established, though it is conceivable that live cattle were both imported and exported through urban markets. Maltby's research on sex ratios at Roman Winchester has been much highlighted already in this and the preceding chapter, where he showed, through biometric analysis of cattle metapodia, that cows were more common than bulls in urban deposits, and that this contrasted with a more mixed assemblage of bulls and cows at rural Owslebury (Maltby 2010, 146–52; Ch. 3, p. 114). The suggestion that the high proportion of cows represented retired dairy cattle later sent to market is reasonable and, if true, it must reflect intensive pastoral farming occurring close to the town. From the analysis of relative frequencies of livestock remains, it is apparent that urban centres were exerting demand on surrounding rural settlements, as shown by the high proportions of sheep in the hinterlands of Dorchester and Winchester, compared with higher frequencies of cattle at settlements around Silchester and Chichester (Ch. 3, p. 88, FIG. 3.4). These patterns are to an extent reflected in the faunal assemblages recovered from within the towns.

As mentioned at the outset of this chapter, it is, at present, impossible to tell whether livestock destined for towns were received in bulk from specialist production centres or were gathered together from a wider range of smallholdings. As shown in Chapter 3, livestock slaughter patterns vary between different rural sites, though there is little conclusive evidence for livestock ranches that specialised in urban supply. However, there is emerging evidence that livestock were being accumulated, perhaps at the estate level, and moved around the landscape in relatively large numbers. The discovery of the aggregated enclosure complex at Gill Mill in the Windrush Valley in the Upper Thames case study area, with its prominent cattle bone assemblage and lack of evidence for cereal processing, suggests that livestock were being centralised in this region between the second and the early fourth century (Booth and Simmonds forthcoming). It is possible that sites like Gill Mill acted as regional redistribution hubs, drawing livestock from local farms to be sold off and potentially sent to markets elsewhere, though many were clearly slaughtered and consumed on site. In this region, the major market centre for livestock would have been Cirencester, where there is considerable evidence for the organised supply of cattle (Maltby 1998). Several wide drove roads have also been identified in the Middle Thames Valley and may have been involved in the supply of livestock from grazing land to London and Silchester (Allen 2016a, 133). Although it seems that the infrastructure for long-distance livestock exchange was well developed by the later Roman period, it is the continued use of sophisticated, scientific techniques such as strontium isotope analysis that offer the greatest opportunities for expanding our understanding of the trade networks of Roman Britain.

In addition to staples, the recovery of remains of less common animal and plant foods, such as hunted mammals and birds, fish, fruits, vegetables and herbs, demonstrates the comparatively broader dietary range enjoyed by some people in urban and military communities (Maltby 2015, 185–7; Robinson 2015, 169–70). Many of these new plant foods can be cultivated in Britain, such as coriander, plum, cherry, celery and cabbage. Horticultural plots have been identified near Newgate, and at Whittington Avenue in London (Cowan and Hinton 2008), and numerous *ollae perforatae* from London indicate horticultural plants were being brought into the city (Macaulay-Lewis 2006). The distribution of bedding trenches in the eastern Central Belt suggests that farms were cultivating horticultural crops, perhaps to supply London. Equally, the recovery of horticultural remains on settlements in the Upper

Thames Valley, such as Mount Farm, may reflect specialist production. However, the archaeobotanical evidence is as yet inconclusive in indicating site types specifically engaging in production of fruits, flavourings and vegetables for the urban market. Horticultural crops have a short shelf-life, and would have required rapid transport to their place of consumption.

CONCLUSIONS

The combined analysis of zooarchaeological and archaeobotanical data in four key regions of rural Roman Britain has produced a new understanding of regional diversity in agricultural strategies. Against a backdrop of late Iron Age innovations, there was strong continuity in crop and livestock choice in the early Roman period, with technological innovations including corndryers and mills, which became fairly common by the second to third century A.D., alongside limited developments in plough technology in the third to fourth century A.D. By grounding previous assumptions of regional diversity in large empirical datasets, we have established a shift towards spelt and cattle-dominated agriculture in the early Roman period on the West Anglian Plain and in Kent and the Thames Estuary, and by the mid-Roman period in Wessex. These patterns contrast with the Upper Thames Valley where barley was better represented throughout the Roman period, and the emphasis here appears to have been placed on pastoral rather than arable production. We have interpreted this 'cattle and spelt' agricultural strategy as a move towards more extensive farming practices, with lower labour inputs per unit but higher outputs per area, facilitated by the use of older and larger cattle as traction animals. The regional variation in agricultural strategy is no doubt due to an interplay of economic, social and environmental factors, with the West Anglian Plain and Kent, and later Wessex, having a key role in supplying spelt wheat to the urban populations of the south-east and the military populations of the north and west.

The move towards more extensive cereal production and large-scale processing across entire regions is likely to have supported the need to produce surplus food to provide for the state and its infrastructure. A heavy reliance on one crop, spelt wheat, and one animal, cattle, is a risky agricultural strategy, choosing focused productivity over farming a wider range of cereal and livestock species, which would help to buffer against singular crop failure, drought, disease, etc. (Bakels 2012). While the network of farmsteads, nucleated settlements, villas and towns were active, inter-annual crop failures could be supplemented through local supply, but once this network broke down in the fifth century A.D. such an agricultural strategy would have become problematic. These interpretations have been built through identifying regional-level agricultural strategies, and much work remains to establish agricultural strategies on an individual site basis, where sufficient bioarchaeological assemblages exist, and also to further establish the role of towns in the agricultural economy.