

## **Chapter 11**

# **An Archaeological Resource Assessment and Research Agenda for Environmental Archaeology in the East Midlands**

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### **Introduction**

Environmental archaeology is now a routine part of the methods used in archaeological investigations and the results are integrated into some of the papers in this volume by period. However, the information gathered by these methods requires consideration across periods and areas in order to examine changes over time and investigate regional differences in environment and economy. For this reason environmental archaeology is considered separately here. In addition much of the recent work, mainly resulting from developer funded work since 1991, is unpublished or in progress, and a particular problem is that the materials and information recovered from samples are rarely recorded as categories on Sites and Monuments Records. Hence the purpose of this resource assessment is to draw attention to the sources of this information in order to enable and inform future work. An integrated approach to archaeology, including environmental archaeology, is the long term aim (Albarella 2001a); it is only by using all the available information together that reasonable conclusions can be made about life in the past.

Environmental archaeology is taken to mean the evidence from the analysis of a range of plant and animal remains, together with other scientific analyses, used to contribute to the understanding of the environment and living conditions of people in the past. There are two main interconnected themes of this study throughout prehistory and history; firstly the changes in the environment, natural and anthropogenic, and secondly the development of farming to produce the crops and domestic animals which provide food. Analysis of remains can also provide evidence about way of life and land use. As settlements and then towns developed, remains can provide evidence of trade, diet, health, status, living conditions, and activities within settlements. In addition analysis of plant and animal remains can contribute to the study of how settlements were provided with food and other commodities. Urban archaeology is therefore an important area of study.

Apart from larger bones and shells many of the remains which provide this information are very small (eg seeds, small bones, fish remains, snails) or microscopic (eg pollen, insect remains, parasite ova) so are only found by taking appropriate samples and analysis of the materials recovered. Different methods are used for waterlogged and 'dry' deposits which are described below, and sampling is now a routine part of excavations and some watching briefs. Samples are also taken for study of sediments, and for chemical and other analysis. Comparable data is needed from sites of all periods from all parts of the region to investigate change over time, and differences between areas, site types and situation within the varied landscape of the region. Therefore it is important that the recovery and analysis of these remains is specified in archaeological briefs or this information will be lost for ever.

### **Recovery of the evidence and preservation**

**Waterlogged deposits:** Much of the information about the environment is found by sampling waterlogged deposits which preserve organic remains in anaerobic conditions. Pollen has sometimes been the only material studied because it originates from a wide area providing evidence of the vegetation type to show whether the landscape is open or wooded. More recently a range of remains are studied including plant macrofossils (seeds and other plant parts), and insects which give evidence of local conditions and land use, for example dung beetles are found on pasture land,

while particular groups of beetles and caddisflies are indicators of different water conditions. Plant macrofossils are likely to represent the local vegetation and so can assist in the distinction of local and regional pollen. Beetles and caddisflies can also be used to detect climate change. Diatoms, ostracods and foraminifera can also be useful to reveal, for example, hydrological conditions, so analysis should be considered where appropriate. Radiocarbon dating of deposits analysed is usually essential (see below) and such evidence can contribute to geoarchaeological and land use studies. Analysis of waterlogged deposits from occupation sites can contribute to the evidence for food and activities on sites as well as provide evidence for site environments.

**Charred plant remains:** Charred plant remains are found on most occupation sites of most periods and they survive in most types of soil conditions. They include charred cereal grains, chaff, weed seeds and remains of other crops, fruits, nuts and useful plant material. They can show the crops cultivated and utilised, while the weeds present can give evidence about methods of cultivation and the surroundings. The proportions and ratios of the types of charred plant remains in samples, (i.e. grains, chaff and seeds), can be used to interpret crop related activities such as the stage of crop processing (cf Hillman 1981, 1984, van der Veen 1992). In order to do this sufficient remains must be completely recovered from bulk samples by wet sieving and flotation. A minimum of 50 items at a concentration of over one item per litre of soil is needed, therefore samples of around 40 litres in size may be required. Remains are not always recovered fully by flotation so sorting and/or reflation of the residues should be carried out for the samples to be analysed. Samples are needed from a range of datable contexts from sites to establish areas of activity. Larger samples may be needed to recover the range of remains on early sites where they are at low densities and samples of 50 litres are recommended for Neolithic sites in particular (de Moulins and Murphy 2001).

**Animal bones:** Evidence from animal bones is particularly important to establish which animals were exploited and the type of animal husbandry used, therefore large enough sections should be excavated to recover sufficient bones for analysis (J. Rackham pers comm.). Deposits with good potential to produce bone should be sampled and sieved to recover the bones of small mammals, amphibians, reptiles and birds, as well as eggshell and fish remains in order to provide information about environment or diet. Sampling appropriate deposits is also important for the consistent recovery of the small bones of the larger animals because these can reveal the keeping of young animals, butchery and trade waste (Payne 1992). Detailed study of animal bones can give indications of the use of animal products such as milk and wool, and show the introduction of improved breeds and husbandry methods (Albarella 1997, Dobney *et al* 1996, Gidney 2000).

**Human bones:** Skeletal analysis is a vast area of study which can reveal information such as age at death, stature, diet and pathology of groups of people, while analysis of DNA can reveal relationships; such studies can provide direct evidence of culture, ritual and social conditions. A large number of burials have been excavated in the region both published and in developer reports, this information is beyond the scope of this assessment and a regional review is required.

**Sediments:** Analysis of sediments by micromorphology and particle size analysis can reveal information about landuse for cultivation or pasture (cf Limbrey 2000). Phosphate analysis can be used to define burials and to provide evidence for the use of enclosures for animal keeping. Study of soils can provide evidence about site formation processes such as whether sediments were deposited by water or other means. On the larger scale geoarchaeology uses sediment analysis together with studies of organic remains and the archaeology of an area to study landscape change and evolution of river systems and alluviation. Chemical analysis of heavy metals from sediments can be used to investigate and date mining activity as well as to study industrial pollution.

**Molluscs:** Sampling and analysis of deposits containing molluscs can provide evidence for land use from land snails. Rubbish deposits on occupation sites sometimes contain shell of marine molluscs including oysters which contribute to evidence of diet in the past. These shells can be

compared by statistical analysis of size and shape, together with study of their infestations, to investigate their source to give evidence of trade.

**Charcoal and wood:** Charcoal can be identified to show the timber and wood used as fuel as well as to indicate methods of woodland management. The study of wood used for metal working can provide important evidence about woodland management and exploitation (J. Cowgill pers comm.). Waterlogged wood which can be dated by dendrochronology can also provide such information; in addition wood technology can be studied from toolmarks on worked timbers.

**Other types of preservation:** Remains can be preserved by mineralisation (calcium phosphate replacement) in such conditions as found in cesspits so that fruitstones and pips survive; such samples can be analysed for parasite ova of parasites of the human gut, while remains of maggots and flies give evidence of conditions in the pits (c.f. Connor and Buckley 1999). Coprolites (semi-fossilized excrement) of humans and animals may also be found in these conditions, they can contain pollen and other remains to indicate diet and environment. Plant remains are occasionally preserved by desiccation in daub and plaster, and smoke blackened thatch can preserve evidence of crops and weeds as well as construction (Letts 1999).

**Biomolecules:** Analysis techniques for 'biomolecules' include residue analysis to investigate the use of pottery (cf Evershed 1999), and techniques of investigating animal bone for signs of cooking are now being developed (Roberts *et al* 2002). Exciting new techniques to analyse human bones for heavy metals to investigate whether people are local or from other regions, and for stable isotopes to reveal diet and lifestyles of the people are becoming readily available to apply to skeletal material found recently as well as that in archive stores (Richards 2000).

Appropriate specialists should be consulted on these and other techniques as they become available and applied to archaeological questions. More information can be found in English Heritage Guidelines for Environmental Archaeology (2002).

**Scientific dating:** New approaches to radiocarbon dating are discussed by Bayliss (1999). It is recommended at present that waterlogged deposits are dated by AMS of selected seeds of land plants. This avoids waterplants which take up dissolved ancient carbonates from limestone and avoids ancient carbon from coal in the sediments, both of which affect the result. Charred material such as single pieces of well stratified short lived charcoal, hazel nutshell or cereal grains should be used rather than collections of material. This avoids dating old wood fragments and mixed material. Dating a number of carefully selected related samples is now recommended, this has implications for site budgets which should be considered.

Other methods of dating include dendrochronology, thermoluminescence for pottery and fired clay, optical luminescence for sediments and palaeomagnetic dating for kilns, hearths and furnaces. Specialist advice should be taken.

Note: Radiocarbon dates quoted here as BC and AD are given as the calibrated range at 95% confidence (Stuiver and Reimer 1994) unless stated; dates quoted as BP (before present) are uncalibrated radiocarbon years.

## Sources of information

In order to assess the resource for the study of environmental archaeology in the region a catalogue of sites with evidence from plant and animal remains has been started so that the available information can be assessed and the gaps in the evidence established (table E1). The sites described in the county period summaries form the basis for this resource assessment ([www.leicester.ac.uk/archaeology](http://www.leicester.ac.uk/archaeology) (under hosted resources)); apart from the site reports other sources of information used are as follows:

1. The English Heritage Regional Reviews of Environmental Archaeology available are; 'Wood and Charcoal' (Murphy 2001a), 'Plant Macrofossils' (de Moulins and Murphy draft report 2001), 'Mollusca' (Murphy 2001b), and other remains may be reviewed eventually. These reviews include

selected published reports and Ancient Monuments Laboratory (AML) reports. However, they take little account of other unpublished archive reports.

2. Environmental Archaeology Bibliography maintained by Allan Hall of York University accessible by a link from the English Heritage Website.

3. Archaeo-Botany Computer Database (ABCD) which maps and lists remains from some sites and is accessible by a link from the English Heritage Website.

4. Published reviews and bibliographies; for plant remains (eg Greig 1991, Greig 1994-2001, Greig 1996, Kroll 1992-2001), and for insect remains (Greenwood and Smith in press).

5. Lists and copies of published work and unpublished archive reports kindly supplied by specialists who have worked in the region which are listed in the catalogue table. Unfortunately some unpublished work, particularly in developer reports, has been unobtainable to date.

### **Proposed cross period themes**

This region has great potential to examine these and other themes over time in widely different landscapes.

- **Environment:** change, human impact and land use.

- **Farming:** pastoral: evidence for domestic animals, pasture and fodder.

arable: beginnings, development and expansion of agriculture, crops grown.

economy: relative importance of arable, pastoral, woodland and wild resources.

countryside: change in land use, economy, resources, mainly Roman onwards.

- **Urban and rural life:** food, diet, living conditions, crafts, trade, evidence for supply of food and other resources; relationships of town and country.

## RESOURCE ASSESSMENT: ENVIRONMENTAL ARCHAEOLOGY

### PALAEOLITHIC

**Summary:** The major changes in geology and climate during this long period are described in detail by McNabb (this volume). For most of this period animal bone is an important source of evidence for the environment, and the region is fortunate to include the internationally important cave sites of Creswell Crags. Remains from the caves represent the last 70,000 years with major evidence from the last glaciation and the early Holocene. Sites at Creswell have been excavated since 1862 and some of the finds and archives have been lost or dispersed over the years. Efforts are now being made to re-assemble, analyse and interpret the evidence by Sheffield University with the support of Derbyshire and Nottinghamshire County Councils. Other evidence in the region is from the gravels such as at Allenton, Derbyshire, from surviving deposits such as those in Rutland at Wing and Glaston, while palaeochannels found in the Trent, Soar, Nene and other river valleys preserve waterlogged evidence dating from the Lateglacial and Postglacial periods (table E1).

Deposits with preservation of very early organic remains are sediments at Brooksby, Leicestershire which contained plant macrofossils (leaves, bud scales and seeds), pollen and other remains which indicated relatively mild conditions (Rice 1991) and were dated to around 478,000 years ago (Graf 2002). A lower deposit included evidence of pine, fir, birch, hazel and oak woodland, while on wetter ground alder and willow grew with bur-marigold, sedges and bulrush, water plants were represented by stonewort, while open ground was represented by heather, grasses, plantain and saxifrages. The upper deposit contained the same trees but lacked evidence for oak and contained more herbaceous plants including violas and valerianella; and in addition to heather, mountain sorrel and crowberry, the latter of a subspecies which now grows at higher altitudes (Conolly 1991). A recent investigation of this area has suggested that the sediments are possibly from minor channels associated with the Bytham river (Challis and Howard 1999), although these are yet to be analysed in detail they show the potential of the area to produce environmental and other material.

Other early evidence in the region is for a pre-Ipswichian waterhole and animal pathway with associated mammal bones from Little Houghton, Northamptonshire (Smith 1995), and hippopotamus bones found at Tattershall, Lincolnshire are thought to date from c.120,000 years ago (Brandon and Sumbler 1988). Evidence from the Ipswichian interglacial before the start of the last glaciation c.70,000 years ago, includes that from Allenton, Derbyshire consisting of hippopotamus bones and remains of the flora of a warm phase (Jones and Stanley 1975). At Wing in Rutland a deposit from a deep drift filled basin about 100 metres wide and up to 18 metres deep was studied by Hall (1980) who reported a pollen sequence through the greater part of an interglacial and early glaciation. The main deposit analysed was 8 metres in depth consisting of silty clays, laminated clays and compressed peats. Plant macrofossils were also studied to show the local as well as regional vegetation. The profile showed the rise of mixed oak forest, the change to temperate hornbeam forest and deterioration to tundra like vegetation. The sequence was dated by comparison with European and other British sites to the last interglacial, the Ipswichian, and the beginning of the last glaciation, the Devensian (Hall 1980), around 110,000 years ago (Graf 2002).

Much of the evidence from Creswell Crags in Derbyshire is from the last glaciation and at Pin Hole Cave remains were recovered of lion, hyaena, wolf, red fox, brown bear, mammoth, woolly rhinoceros, horse reindeer, and giant deer. Birds were also present including ducks and geese of open water and ptarmigan and red grouse of open ground (Jenkinson and Bramwell 1984). These are dated to the Upton Warren Interstadial c.42,000 years ago which was a warm interlude within the glaciation. These remains were excavated by Armstrong in 1928 in layers from the cave sediments and were sufficiently well recorded that they could be identified and quantified to produce stratigraphic data to show changes over time (Jenkinson and Bramwell 1984). This provides information about the environment of the Middle Palaeolithic period, evidence of this date has also been found at Robin Hood's Cave and Mother Grundy's Parlour, Creswell.

A deposit at Glaston in Rutland has recently been excavated which dates from c.30,000 years ago (Thomas and Jacobi 2001). Bones of hyaena, mammoth, glutton, woolly rhinoceros, reindeer, horse, mountain hare, lemming and voles were recovered together with lithics including a 'leaf point'. The site is thought to date from the Early Upper Palaeolithic from the animals present and the lithics, but the project is at an early stage. The deposit was situated beside and beneath a sandstone raft, in fault deposits or collapsed animal scrapes and burrows, found during the excavation of medieval features. The deposit may represent a hyaena den, and hyaena coprolites will be tested from pollen and other evidence of diet and environment. Bulk sampling and sieving was carried out to recover both flint and micro faunal remains using 0.5mm mesh sieves to recover diagnostic small mammal teeth because small mammals are good environmental indicators. Sampling strategies should be considered for the investigation of such finds in the future and investigation of such deposits should be considered a priority.

Other finds of mammal bones include many from the river valleys. Peat at Pontylue pit, Syston, Leicestershire, contained mammal, insect and mollusc remains from a cold treeless environment dated to c.37,420 BP (Rice 1972, Graf 2002). Many mammoth remains are recorded, notable finds include mammoth and woolly rhinoceros found at Barrow-on Soar (Rice 1968, 1972), and a small species of mammoth of an early date was recorded at Birstall (Brandon 1999, Graf 2002). Stray finds of mammoth tusks and large bones are often found in the gravels and curation and dating of these should be considered as they are of potential public interest. If found *in situ* they may provide useful dating evidence for deposits. Such remains have been noted in Lincolnshire as requiring recording (Membrey 2000), and mammoth tusks have been found in quarries at Cossington and Syston in the Soar valley in Leicestershire during recent watching briefs (Sturgess and Ripper 2000, Higgins 2001).

Early Upper Palaeolithic evidence has been recovered from Robin Hood's Cave and Mother Grundy's Parlour at Creswell. Bones of hyaena, ibex and mountain hare have been found with pollen indicating open country of sedges and grasses with some juniper, willow and birch trees present (Jenkinson and Gilbertson 1984). At Pin Hole Cave, Creswell, faunal remains dated to the end of the glaciation c13,000-10,000 BP were found. These included bones of many woodland bird species which are familiar today such as starling, rook, wren, robin, great tit, long tailed tit, tree sparrow, chaffinch, crossbill, corn bunting, owls and many others. The presence of many woodland birds before the end of the last cold phase was an unexpected and interesting discovery (Jenkinson and Bramwell 1984).

Evidence for the Upper Palaeolithic environment at the end of the glaciation has been found in waterlogged deposits from palaeochannels. In the Idle valley the vegetation was found to be open with few trees and evidence of an Arctic Structure Soil was found dated to 13,700 BP by thermoluminescence (Howard *et al* 1999). Channel sections from Barrow-upon-Trent, Derbyshire and from Hemington Quarry, Leicestershire (channel A) have been AMS dated to around 11,700 BP and contain remains of caddisfly larvae which live in cold conditions; plants from the latter channel include sedges and club-rush of local reedswamp in an open environment, evidence of flooding was found (Greenwood forthcoming). Another palaeochannel section from Hemington Quarry extension also has cold phase insects present including a species which lives on dwarf willow (Greenwood pers. comm.). At Croft, Leicestershire, a channel thought to date from the Loch Lomond stadial, has been described (Smith and Roseff *et al* forthcoming). Other Lateglacial channels have been dated in the Soar and Nene valleys where they occur in a time cluster of palaeochannels as a result of the major changes in rivers at this date (Brown *et al* 1994). Dating, mapping and analysis of these channels has great potential to provide evidence of the evolution of the river system and landscape (Knight and Howard 1994, Howard, Challis and Macklin 2001) and it is important to build on this work and extend it over the region for this and later periods.

The site at Creswell is now a Site of Special Scientific Interest (SSSI) and studies of the modern environment have been carried out as well as excavation of remains from Palaeolithic to post-medieval date (Jenkinson and Gilbertson 1984). Of particular interest is the early evidence for the

mammals and bird species present. Hence, Creswell Crags is an important resource for biological and ecological studies as well as archaeology. Other aspects of the area are that public interest is fostered by the visitor centre and there is the potential of study of the ancient environment in relation to the modern environment of the SSSI.

## MESOLITHIC

**Summary:** Information about the Mesolithic environment has been comprehensively incorporated into the synthesis by Myers (this volume), so little can be added here. The information available for this period is from waterlogged deposits from palaeochannels in the Trent valley such as at Aston and Staythorpe, and the other main river valleys but particularly from headwaters and small catchments. The peats of the Peak District and cave sites at Creswell also preserve evidence of this period (table E1). There is a lack of information from any occupation deposits about food consumed, but these are rare nationally. At the start of this period the Early Postglacial environment is known from palaeochannels from the Nene and Soar (Brown *et al* 1994), the Nene at Raunds (Brown 1999), Croft Leicestershire (Smith, Roseff *et al* forthcoming) and at West Bridge, Leicester (Shackley and Hunt 1984). These show the marshy conditions of the valleys in a generally open environment with evidence for some colonisation by trees.

The cool temperate forest of birch and pine (41% tree pollen) is described at Ditchford, Northamptonshire, in a pollen profile dominated by grasses and sedges at 9485  $\pm$  125 BP (Brown *et al* 1994) which shows the development of woodland as the climate warmed. Other such evidence is from Apethorpe, Northamptonshire, (Sparks and Lambert 1961) and Narborough Bog, Leicestershire, (Brown 1999). Woodland development is also known from, for example, Croft in Leicestershire where pollen in the profile was dominated by sedges and grasses with a little birch and pine which persisted until at least 9840 BP. After a hiatus in the evidence, this was succeeded by birch, hazel and willow woodland with some indications of open ground. Traces of features representing occupation contained Late Mesolithic flint (Smith, Roseff *et al* forthcoming). In Nottinghamshire Misterton Carr has produced environmental evidence of this date (Buckland and Dolby 1973), as have Girton Quarry and Bole Ings which have evidence of dense woodland from insect as well as other remains (Dinnin 1992, 1997). Early woodland has been indicated at Dog's Hole Fissure Creswell from bones of wolf, beaver and woodland birds, together with a mollusc fauna dated to c.8,500 BP (Jenkinson and Gilbertson 1984).

Recent work at Staythorpe, Nottinghamshire has found evidence for oak elm lime woodland on the terraces with alder willow aspen carr in the floodplain from palaeochannels of the early to mid sixth millennium, one possibly active for around a thousand years (Davies 2001). At this site a human femur of a female 153-157 cm tall has provided stable isotope evidence the individual living mainly on meat, without consuming coastal resources, as important evidence of diet and lifestyle (Davies 2001). Similar woodland with elm has also been found at Aston on Trent recently dated to around 5000 BC (C. Salisbury, M. Greenwood pers comm.), (table E1). There appears to be little information from Lincolnshire for this period although coastal sites, river valleys and kettle-hole data have great potential to add to the understanding of the period (Membrey 2000).

Human impact on the woodland has been suggested by indications of clearings from the East Moors Derbyshire (Hicks 1971, 1972) and evidence for clearings, probably for grazing in this period has been found in a dated sequence of pollen and ostracods also on the East Moors (Taylor *et al* 1994), while evidence for burning was found in pollen profiles at Lismore Fields Buxton (Wiltshire and Edwards 1993). Possible clearing by man has been found in recent work at Burton Latimer, Northamptonshire (Phillips 2000). Such sites have the potential to provide information about the use of clearings and the transition to Neolithic landuse, and should be investigated fully whenever possible.

Major environmental changes are seen in this period from open cold conditions of the Early Post Glacial, colonisation by trees and the rise of cold temperate forest and then the development of climax temperate woodland which eventually shows signs of human exploitation. Changes in the fauna also occurred with the changes in habitat, from large mammals of cold conditions to woodland grazing animals and birds. These may correlate with changes in flint technology and lifestyle but dating evidence is needed to show how and when this may have occurred.

## NEOLITHIC- EARLY BRONZE AGE

**Summary:** The sites with environmental evidence have been comprehensively discussed by Clay (this volume) but are included here because the beginnings of farming which occur in this period are an important area of study. The current information available about the environment and economy of this period is from waterlogged remains from the peats of the Peak District and from over a dozen palaeochannels of the river valleys. Charred plant remains have been recovered from over a dozen sites mostly in small numbers, while good groups of animal bones have only been recovered from a few sites. Other analysis such as of molluscs and soil micromorphology have also provided information for a few sites. Few of these sites are mentioned in the English Heritage Regional Reviews of Environmental Archaeology as some were unpublished or in progress at the time (table E1).

Evidence of the early lime woodland comes from North Derbyshire (Hicks 1971, 1972), the Trent at Langford and Cottam, Nottinghamshire (Hillam in prep., Scaife and Allen 1999), Croft and Narborough Bog, Leicestershire (Smith, Roseff *et al* forthcoming, Brown 1999), Butterbump, Lincolnshire (Greig 1982) and the Nene Valley, Northamptonshire (Brown 2000). Pre elm decline disturbance has been found from the North Derbyshire sites including Lismore Fields (Wiltshire and Edwards 1993), and clearings in the Soar and Nene valleys have been described and discussed by Brown (2000). The earliest dated cereal pollen includes that from Lismore Fields from at least 6000 BP, from Collingham Nottinghamshire (Bishop 2000) in pre elm decline levels, then from immediate post elm decline levels at Cottam (Scaife and Allen 1999). Recently cereal pollen has been found in a Late Neolithic partly cleared profile of c.2800 BC from Hemington Quarry, channel C, (Brown 2002, Smith 2002). Evidence of Neolithic cereal pollen seems to be lacking from much of the region, only appearing in Bronze Age profiles from the Soar and Nene valleys in a time cluster of silted palaeochannels, possibly formed as a result of clearance in the floodplains (Brown *et al* 1994). Waterlogged deposits from headwaters and mires may have better potential to preserve evidence of early cereal pollen and other land use beyond the floodplains (Brown 1999). Pollen analysis also has the potential to be used to investigate the duration and size of clearings (Brown 2000). Therefore closely sampled well-dated profiles should be analysed. The use of clearings for other purposes, such as ritual, should also be considered (Brown 2000). More well-dated pollen profiles are needed to show dates for cereal cultivation and provide evidence of human activities in the region.

The early clearings in North Derbyshire lack cereal pollen and are interpreted as used by herders with their animals. Evidence of the use of land for pasture should not be neglected from early deposits; analysis of insect remains can show this from the presence of dung beetles as found, for example, in the Late Neolithic palaeochannel at Hemington (Brown 2002, Smith 2002). Pastoral farming must also be significant in the maintenance and use of clearings which could be investigated by the study of insect remains from dated deposits. Clearance has also been dated by radiocarbon analysis of charcoal or organics from tree-throws at Raunds, Northamptonshire dated to c.3000 BC, and at Sproxton, Leicestershire in pre barrow contexts dated to 3990-3810 BC where evidence from snails and micromorphology of buried soils suggested cultivation followed by pasture (Clay 1981). Identification of charcoal from these and other sites has also contributed to the evidence for woodland and clearance for example at Irthingborough (Parry forthcoming). Few sites have produced many animal bones although at Skendleby Lincolnshire, Giants Hills 1, bones of cattle, sheep, red and fallow deer were found (May 1976).



Charred plant remains have been recovered mostly in small numbers from isolated pits. An exception is at Lismore Fields, Buxton, where numerous emmer grains with emmer chaff, flax and crab apple were found dated to 3990-3150 cal BC. This is taken to be evidence of cultivation which may imply some sedentism earlier than previously thought (Jones 2000). This evidence contributes to the debate about long fallow cultivation and Jones (2000) suggests that there are other possibilities, such as a range of garden-type cultivation methods, which can maintain productivity of the same area over a long period. Recent work at Sheffield University has drawn attention to the speed at which clearings become overgrown by brambles and other plants if not maintained, and a study in Northern Europe has shown that weeds from small woodland clearings in a shifting cultivation regime are different from those found on Neolithic sites. This suggests that cultivation may have been more stable and settled than that associated with shifting cultivation (Bogaard 2002). Analysis of weeds may therefore help to establish the type of cultivation practiced (M. van der Veen pers. comm.). However, good assemblages of plant remains are rare for this period so their recovery and study is a future priority.

Other sites which have produced charred plant remains often show a greater abundance of nutshell and fruits than cereal remains. This is the case at Deeping St Nicholas, Lincolnshire, where more hazel nutshell and sloe were found than barley with remains at low concentration up to only 1.08 items/litre of soil (Murphy 1994), at Briar Hill, Northamptonshire, where a little emmer was found with nutshell and sloe (Perry 1985), and at Willow Farm, Castle Donington, Leicestershire, a pit contained a cache of crab apples dated to 2200-1800 cal BC (Wk-10074) with nutshell and few cereal grains (Monckton in progress). This type of assemblage has led to the suggestion that there was more reliance on gathered than cultivated food. However, it has been pointed out (Moffett et al 1989) that use of cereals, as well as the collection of wild food plants, were usual aspects of the Neolithic economy. Reconsideration of the evidence by Robinson (2000) has agreed with this conclusion and added that, although the proportions of wild and cultivated foods is uncertain, nutshell and fruits were more part of the diet in Neolithic times than in later periods. It has also been suggested that the remains in pits may be related to the use of pits for the storage of nuts which were consumed nearby, or that inclusion of nutshell in pits was a common ceremony at the time (Robinson 2000). Examples of Neolithic pits containing nutshell fragments have been found in Leicestershire at Braunstone and Syston (Albone 2000, Meek 2000), (table E1).

A different group of charred plant remains from Potlock Cursus, Derbyshire, contains few wheat and barley grains with numerous seeds of blackberry, some of which were immature, some sloe, elder and haws, with plants of grassy and disturbed land. Open grassy vegetation and nearby scrub or woodland margin was indicated. This was thought to represent food waste together with burnt vegetation possibly cleared from the ditches (Monckton and Moffett forthcoming). However, the interpretation of the remains as originating from a hedge or boundary may not be out of the question in the context of the monument (R. Loveday pers comm). Another unusual deposit consisting of numerous emmer grains with some chaff and few hazel nut shell fragments was found in the cursus at Aston on Trent and dated to c.3500 BC (Loveday 2000, Alvey 1964). At Oakham, Rutland, small numbers of grains of wheat and barley were found to be more common than the few hazel nut shell fragments in the pits of the circle. At Skendleby, Lincolnshire, the long barrow Giants Hills 1, charred plant remains included wheat grains and hazel nut shell (May 1976). Results from Irthingborough and the Raunds project Northamptonshire are awaited. More sampling of dated deposits is needed to investigate if there is a pattern of plant remains from monuments or other sites in the area, and whether there is a change over time. When deposits of this period are located a range of large samples (50 litres) is recommended.

Few settlements have been found in the region. Lismore Fields, Buxton, is thought to be an unusual survival of remains from a building where grain was stored, preserved because the building burnt down. Obviously recovering information from such unusual finds should be a priority, however investigation of less obviously productive settlement sites is also important if results are to be meaningful and representative. In the Thames floodplain excavations at the large scale

settlement at Yarnton, Oxfordshire, has produced remains similar to those reported by Moffett *et al* 1989. At Yarnton a total of 201 cereal grains to 2728 nutshell fragments was found from over 7 tonnes of samples, which does not necessarily demonstrate a fully arable economy (Robinson 2000). The Trent valley has the potential for this type of investigation, initial results from samples from the Neolithic site at Willington, Derbyshire, have shown only a trace of cereal remains but with more nutshell present, processing of more samples is required to investigate this (Beamish *et al* 2001). Large samples are necessary but the importance of context has been emphasised, particularly middens and occupation deposits, where even if remains are at a low concentration they may be more revealing about the economy of the time (Robinson 2000).

## **LATE NEOLITHIC - MIDDLE BRONZE AGE**

The change in the character of the woodland during the Neolithic has been found at sites such as Croft, Leicestershire where the post elm decline woodland of lime, oak and hazel dominated by alder, shows a drop in the proportion of lime in a profile dated from 1890-1500 BC containing traces of cereal pollen (Smith, Roseff *et al* forthcoming). Cereal pollen is present in pollen diagrams from the East Moor, Derbyshire, from the Early Bronze Age and pre-barrow land use evidence of arable and pastoral is noted (Clay this volume). Recent work on a palaeochannel at Staythorpe, Nottinghamshire, has shown that the Trent valley was largely cleared by the Early Bronze Age although it is suggested that some areas of woodland remained (Davies 2001). Some half dozen palaeochannels provide snapshots of local landuse, evidence of pasture with some cultivation and clearance of woodland has been found (table E1). More evidence of the distribution of woodland and dates of clearance needed to establish the picture for the whole region.

More animal bone was recovered from this period but little from settlements; Billingborough Lincolnshire, dated c.1700-1600 BC, produced evidence of cereal production and for sheep/goats (Lane 1995), and Stanton on the Wolds, Nottinghamshire, has produced animal bones of sheep, pig and cattle including an ox femur with a flint tool, possibly a marrow extractor, embedded in it (see Clay this volume). Small groups of animal bones have been recovered from river channels and barrow sites too numerous to mention. The complete recovery of good groups of animal bone is a future priority.

Charred plant remains recovered include emmer grains and chaff from a pit at Lockington dated to 1875-1645 cal BC while spelt wheat chaff was identified from a second pit, dated by charcoal from the pit to 1425-1260 cal BC (both at 68% confidence), which shows spelt to be present from the Bronze Age (Monckton 2000). This compares with the earliest date quoted for spelt in Eastern England found at Godmanchester, Cambridgeshire, at 1671-1420 cal BC (Murphy 1998), the current lack of records of spelt in Bronze Age contexts in Lincolnshire is noted (Murphy 1998). Recent work at Langford, Nottinghamshire, has produced evidence of charred spelt and barley from possibly Late Neolithic / Early Bronze Age contexts which are yet to be dated (Snelling and Rackham 2001).

Charred plant remains from barrows and cremation cemeteries have been recovered. At the Early Bronze Age barrow at Deeping St Nicholas, Lincolnshire, grassland plants with roots and tubers were found, hazel nut shell and fruits including sloe and elder, with sparse cereal grains and chaff of emmer wheat (Murphy 1994). This was thought to represent a mixture of plant material accidentally charred beneath the pyre, kindling material and perhaps intentional food offerings (Murphy 1998). Very similar remains were found at Eye Kettleby near Melton Mowbray, Leicestershire from a Bronze Age cremation cemetery (Monckton forthcoming a). Round barrows have been sampled in Leicestershire and Rutland at Eaton, Oakham (Clay 1981, 1998), Tixover and Cossington (Monckton in press), and Lockington (Moffett 2000), and have produced only very sparse charred seeds or cereal remains. Pollen from corrosion products of the dagger at Lockington included cereals, heather, grassland plants and slight evidence for trees hazel and alder, this was thought to represent the local open vegetation with perhaps heather and straw or bread brought to the site and incorporated into the hoard (Greig 2000). Microphology of a buried soil below this

barrow found that there was no evidence that the soil had been cultivated, but grazing was indicated by the presence of calcite spherules as produced in the gut of grazing animals (Limbrey 2000).

In the Trent valley evidence is accumulating for the use of land as pasture although cereals have been found on some sites and more investigation is necessary. For example, insect remains from a palaeochannel associated with a burnt mound at Willow Farm, Castle Donington, Leicestershire, dated to 1390-910 cal BC (Beta 119651), has shown the use of the surrounding land as pasture, although some woodland was still present in the area and cereal pollen was present possibly from cultivation on drier ground. No insects of domestic rubbish or occupation were found, suggesting short term use of the burnt mound. A few charred cereal remains of emmer and barley with hazel nutshell fragments were found in samples from the burnt mound, although at a very low density so it was necessary to examine bulk samples to show this (Ripper and Coward forthcoming). This together with a few animal bones from the palaeochannel suggested food consumption at the site.

More evidence is needed at the landscape scale on the balance of landuse between pasture, cultivated land and woodland from different parts of the region to investigate changes throughout the period. The large scale pastoral economy of the Fens in the Bronze Age has been described by Pryor (1998). Pryor has suggested that the exploitation of the Trent valley for pastoral farming employed different strategies which require further investigation to compare with the Fens, and that differences in the development of pastoral and arable farming in the rest of the region should also be investigated. This may be forthcoming from future projects on the Trent, Nene, Welland and Witham but is also required for the areas away from the main river valleys in order to investigate occupation of the prehistoric landscape of the region.

## **LATE BRONZE AGE and IRON AGE**

**Summary:** To date over 40 Iron Age sites have been sampled and produced charred plant remains but only four of Late Bronze Age - Early Iron Age have been analysed. From Northamptonshire three extensive sites have been sampled; Covert Farm at Crick, Grange Park at Courteenhall and Stanwick Iron Age site are all in progress. A few others have recovered charred remains; Briar Hill and Twywell have few, while Wilby Way, Wellingborough and Culworth are in progress. In Nottinghamshire, Gamston, described as extensive, and the site of Dunston's Clump have produced some good samples of charred plant remains while Aslockton has fewer but more evidence of stock management. Recent excavations in the Trent valley by Trent & Peak Archaeological Unit at Hoveringham and Rampton Quarries, Nottinghamshire, and Swarkestone, Derbyshire, are being sampled which have both Iron Age and Roman occupation. In Leicestershire Elms Farm, Humberstone, described as extensive, and the farmstead at Wanlip produced a few good samples; a dozen other farmsteads and small occupation sites have been routinely sampled to provide comparable data but most have a low concentration of remains. Derbyshire appears to have little evidence from charred plant remains, (unless Carsington is Late Iron Age), although there is good evidence for arable activity from waterlogged remains from field boundaries at Gardoms Edge and the East Moors. In Lincolnshire the large settlement of Dragonby and some of the fenland sites such as Deeping St James have produced charred and waterlogged remains, the latter from Bronze Age to Iron Age date. Evidence of the pastoral use of a field system has been found at Market Deeping from waterlogged field ditches. Sites at Fiskerton and Tattershall Thorpe have produced waterlogged evidence of Iron Age activity and environment (table E1). Recent excavations at Welland Bank, Lincolnshire, have employed a range of analytical methods to investigate enclosures, droveways and settlements and found evidence of a mainly pastoral economy.

In the region bone is rarely preserved on the sand and gravels but sites which have good bone assemblages include Dragonby, Lincolnshire, and Crick, Northamptonshire, and three Leicestershire sites; Humberstone, Enderby site I and Tixover, the last two also with mollusc evidence. Market Deeping and Cowbit Lincolnshire have produced animal bone assemblages which have been analysed. Significant evidence for landscape change and landuse has been obtained by sampling palaeochannels in the river valleys, which are exposed and destroyed during

quarrying operations, and are an important resource. For this period they are mainly of Late Bronze Age date (table E1).

**Late Bronze Age:** Evidence for pastoral farming has been found from field systems, enclosures and droveways in Lincolnshire at West Deeping, Billingborough and Welland Bank which began in the Middle Bronze Age and were in use into the Early Iron Age (Pryor 1998). These are interpreted as having been used for stock control from their form and from other evidence, such as soil analysis of an enclosure at Welland Bank which suggesting it was used as a stockyard (Pryor 1998). Deeping St James and West Deeping have produced evidence of grassy vegetation from waterlogged deposits and evidence of hedges, probably for stock management found at the latter (Murphy 1998, Hunn and Rackham forthcoming). Charred cereals are sparse at these sites to date. An enclosure at Welland Bank, contemporary with the stockyard enclosure, was filled with a layer of dark earth which contained a spread of charcoal, domestic rubbish and had evidence of manuring and some cultivation, found from soil analysis; cultivation of cereals on the horticultural scale was suggested (Pryor 1998). The main activity was stock rearing of cattle, and some sheep, for which the extensive enclosures and droveways were constructed (Pryor 1998).

At Leash Fen, near Gardoms Edge, Derbyshire there is evidence of mixed arable and pastoral farming separated by areas of woodland which begins in the 2nd millennium and continues into the 1st millennium (Long unpublished). Settlements in Lincolnshire appear to have lacked spelt, samples from Hagnaby Lock contained only emmer and nutshell while at Deeping St James waterlogged remains of plants of weedy grassland were found with a few charred cereals including emmer, free threshing wheat and barley, flax, and nutshell which was more abundant. Emphasis on pastoral farming was suggested which was contrasted with the cultivation of spelt on drier sites in Eastern England noted by Murphy (1998). The earliest spelt from this region to date is from Lockington, Leicestershire from a feature dated to 1260 BC showing the early presence of this cereal in the Trent valley (Monckton 2000); cereal pollen is being found in palaeochannels including those of the Trent during this period although cultivation is probably at some distance from these wet sites. Spelt is not found on many sites of this date, Late Bronze Age contexts at Eye Kettleby have only produced emmer, barley and hazel nutshell in common with Early Iron Age contexts from Kirby Muxloe while Late Bronze Age / Early Iron Age features at Covert Farm, Crick, Northamptonshire contained spelt and barley (Monckton unpublished).

**River Valleys:** Information about the environment from the analysis of pollen, plant macrofossils and insect remains from waterlogged deposits in palaeochannels has been studied in the Trent valley and other rivers in the region. A number of sites in the Trent valley of Late Bronze Age - Early Iron Age date such as at Girton, Nottinghamshire, have evidence of local reed swamp with grassland in the floodplain, the presence of dung beetles showing the use of the grassland as pasture (Greig 1994, Greenwood and Smith in press). Little evidence for local woodland is found at most of these sites and the landscape is thought to have been substantially cleared in this period. However, evidence for fen woodland is found at some sites such as at Repton, Derbyshire in deposits after 2610 BP (Greenwood and Smith in press) showing that local variation occurs. Investigation of the Soar and Nene valleys has also shown clearance at this time together with evidence for alluviation of Iron Age to Roman date, following destabilisation of topsoils by cultivation (Brown et al 1994, Brown 1992). This may be the case in the Trent valley where Iron Age boats were found in a silted channel at Holme Pierrepont and burial of possibly Iron Age enclosures has also been found (Knight and Howard 1994, 16). At Fiskerton in the Witham valley in Lincolnshire an Iron Age causeway with evidence of the wetland vegetation was found (Greig 1986). Recent excavations in the area have discovered prehistoric logboats, probably of Iron Age date, and environmental excavations are part of an ongoing project there.

**Site environments:** Headwater deposits in west Leicestershire at Croft and Kirby Muxloe near a Bronze Age to Iron Age site (Cooper 1994) show that by the Bronze Age the character of the woodland has changed from the mixed lime woodland of the Neolithic to become less species rich alder woods (Smith, Roseff *et al* forthcoming). At Kirby Muxloe clearance of this woodland begins around 1000-700 BC with a dramatic fall in oak pollen followed by deforestation of the

valley bottom after 500 BC. Cultivation of cereals at some distance from the site is suggested by the cereal pollen and local use of grassland as pasture is suggested from the insect fauna (Brown *et al* in prep.). Evidence of hedgerows has been found in field ditches at Market Deeping, Lincolnshire, where macrofossils of shrubs suggesting hedges were found (Hunn and Rackham in press), other evidence from a palaeochannel at this site shows it to have been freshwater with occasional marine influences compared with the saltmarsh vegetation found at Cowbit, Lincolnshire, (Murphy 1998, 2001c). At Tatterhsall Thorpe, Lincolnshire, good evidence of the site including food storage, and local environment dominated by grassland used as pasture, was recovered from insects and pollen from the waterlogged enclosure ditch (Chowne, Girling and Greig 1986). More evidence from waterlogged deposits near to sites is needed to provide detail of environment, land use and cereal cultivation because only a few sites have provided such evidence to date.

**Woodland resources:** Exploitation of wood resources for timber and fuel is suggested from charcoal from sites such as oak, ash, hazel, alder, willow, and field maple, and this often includes scrub or hedge species such as hawthorn and blackthorn (e.g. Morgan 1998). This together with work on waterlogged wood can give environmental information and evidence of woodland exploitation and management (Murphy 2001a). More information about surviving woodland in the landscape is needed.

**Iron Age expansion of agriculture:** The increased number of settlement sites located must show an increase in settled population dependant on farming. Evidence for agricultural expansion is from field systems in Nottinghamshire and in Derbyshire where investigations are dating the boundaries and producing evidence of cultivation (Long et al 1998). It is noted by de Moulins and Murphy (2001) that there is little evidence from cereal remains to suggest intensification of agriculture in the Iron Age because of the lack of Late Bronze Age evidence for comparison in this region. However, recent work at Crick, Northamptonshire, for example, has shown an increase in maximum density of charred cereal remains per litre of soil from 1.3 items/litre in the Late Bronze Age / Early Iron Age to 16 items/litre in the Middle Iron Age, and 171 items/litre in the Late Iron Age (Monckton forthcoming a). This agrees with evidence from waterlogged deposits from Wollaston, Northamptonshire which shows Bronze Age woodland clearance followed by evidence of mixed agriculture in the Middle to Late Iron Age (Meadows 1995). More evidence from dated cereal pollen is needed to establish this trend. Spelt cultivation is thought to be part of the strategy of agricultural expansion (van der Veen and O'Connor 1999), and spelt present on few sites from the Bronze Age, becomes common in Middle Iron Age in the region as was found at Crick, Wanlip and Humberstone (Monckton forthcoming a, 1998, Pelling 2000). A group of arable weeds characteristic of extensification (ie cultivation of larger areas) rather than intensive garden-type cultivation has been described for the north of England by van der Veen (1992). A similar group of weeds occurs with the cereals at Crick, but more detailed analysis is needed to study crop husbandry for this region. A future priority is to look for regional diversity in the expansion of agriculture, and in the relative importance of animals and crops, for example, to find if there differences on different soils.

**Food, plant and animal products:** From the Middle Iron Age onwards the main wheat crop has been found to be spelt which occurs with a little emmer and very occasional grains of bread wheat type. Hulled barley, including six-row barley is also found on most sites as another main crop. Rye has only been found in the region at Dunston's Clump, Nottinghamshire to date (Jones 1987). Evidence of edible legumes has been found at a number of sites with horse bean identified at Dragonby (van der Veen 1996). Hazel nut shell, sloe, haws and elder are often found in small amounts, while Dragonby has also produced woad, flax/linseed and apple. Many plants have a variety of uses but it is rare to find the evidence of use, however, the record of woad at Dragonby shows this plant was available in the Late Iron Age for dyeing cloth or perhaps even for body decoration (van der Veen 1996). Other charred plant remains often include arable weed seeds, plants of grassy vegetation and damp ground plants. Most of these latter two types could be weeds

of the cultivated fields but could also represent plant material used as fodder, bedding, roofing or for other purposes.

Meat was an important part of the diet although the evidence of bones does not always survive in acid soils of the region. Where bones do survive butchery is attested by cutmarks on some of the bones. At Humberstone, Leicestershire, for example, the most cutmarks were found on the larger bones and appear to be disjuncting cuts on both sheep and cattle, but most common on cattle humerus, showing the inhabitants were enjoying legs of beef (Charles 2000). At Enderby, Leicestershire, the most common bones of domestic animals were of the head region suggesting local slaughter; beef, mutton or lamb, and pork were consumed as well as possibly the game animals; red deer, roe deer, wood pigeon and hare (Gouldwell 1992). Domestic fowl was also present suggesting the possibility of eggs as well as poultry. At Market Deeping, Lincolnshire, sheep were most numerous but cattle provided the most meat because of their larger size, wild resources were used occasionally and included swan, geese, duck and beaver (Albarella 1997). At Cowbit Wash, Lincolnshire, neonatal cattle, sheep and pigs were all found showing the animals were bred on the site, as calves were most numerous the possibility of milk production was considered but this could represent seasonal mortality (Albarella 2001b).

Other animal products except antler and horn are rarely found; the famous hides, woollen cloaks and hunting dogs described in the classical literature show they were used and traded. In the absence of other evidence wool and leather can be inferred from the quantity and age of the domestic animals found from the bones.

**Crop processing and storage:** Crop processing waste interpreted as fine sievings (i.e. chaff and small seeds) cleaned from the grain after dehusking have been found for example at Gamston, Nottinghamshire (Moffett 1992), Humberstone, Leicestershire (Pelling 2000) and at Crick, Northamptonshire (Monckton forthcoming a). Remains of waste from hand sorting grain (i.e. large weed seeds which remain with the grain after fine sieving) have also been found at Gamston, Wanlip, Leicestershire and other sites. At Dunston's Clump, Nottinghamshire cleaned cereals and evidence of wheat in spikelet form (in the chaff) was found in pits, although not thought to suggest pit storage because signs of *in situ* burning were lacking (Jones 1987). Evidence of above ground grain storage has been found at Humberstone, Leicestershire of Middle Iron Age date as cleaned spelt grain in a posthole of a four-post structure which was interpreted as a granary. It is possible that the grain was stored clean after dehusking, or that the grain was processed by parching nearby the granary after removal from storage as spikelets, some of the grain being charred in the process and accumulating in the postholes (Pelling 2000). Grain from four post structures was also found at Crick, Northamptonshire of Late Iron Age date consisting of cleaned barley grains in one post hole and a mixture of barley and wheat in another, suggesting the use of the granary for different cereals (Monckton forthcoming a). Abundant grain has also been found in postholes of four posters at Stanwick, Northamptonshire, Late Iron Age site (Campbell unpublished).

**Possible ritual activity:** A large deposit of processed spelt grain was found in an isolated Late Iron Age pit which contained a burial at Rushey Mead, Leicester; no evidence of *in situ* burning was found and the charred grain appears to be part of the fill of the pit possibly included with the burial (Monckton 2001). In the Late Iron Age ditch at Tixover, Rutland, the deposit with most cereal remains and bone from the site also contained the skeleton of a human infant (Beamish forthcoming). While at Wanlip, Leicestershire, an unusual assemblage of pottery and a saddle quern together with charred remains including cereals was interpreted as a placed deposit of ritual significance (Beamish 1998).

**Animal husbandry:** Sites with good bone assemblages have been compared in terms of the relative abundance of domestic animals for midlands sites by Hammon (forthcoming). At Crick cattle are most abundant followed by sheep and few pigs from the Middle to Late Iron Age (Hammon forthcoming); cattle are also most abundant at Enderby I (Gouldwell 1992). It is suggested at Crick (Hammon forthcoming) that this may be because cattle are more suited to lowland wetter environments because of their water requirements and the unsuitability of sheep to wet pasture (cf Grant 1984). Cattle have also been considered important in agricultural expansion

because of the need for traction and manure (van der Veen and O'Connor 1999). At the Leicestershire Late Iron Age farmsteads of Enderby I (Clay 1992), and Tixover (Beamish 1992) both recovered good assemblages of animal bone dominated by cattle followed by sheep and pigs; domestic fowl bones were found at the former (Gouldwell 1992), while a small mammal fauna at Tixover included evidence of scrub or woodland in the vicinity (Baxter 1994). At both these sites the snail fauna suggesting the presence of grassland probably used as pasture. Humberstone, Leicestershire, differed in that sheep and cattle were about equal. In Lincolnshire at Dragonby, sheep are the most abundant, as was found at Ancaster Quarry and Helpringham Fen (Willis this volume). This was also the case at Market Deeping while at Cowbit Wash calves were the most numerous, the mortality of young animals at this site showed that they were bred on site and may suggest seasonal use of the site (Albarella 1997, 2001). Further investigation of the different types of animal husbandry in different parts of the region is needed.

Food for animals is an important consideration, a barley deposit at Dunston's Clump, Nottinghamshire, was interpreted as fodder and it was found in an enclosure thought to be an animal pen, however, de Moulins cautions that barley can also be used as food for human consumption (de Moulins and Murphy 2001). In Leicestershire the low-lying farmstead sites at Enderby and Kirby Muxloe produced small numbers of cereal remains with very little chaff (Monckton 1995). This may be because the chaff was used for fodder as suggested by Pelling at the settlement at Humberstone where more cereal grains were found (2000). A mixed economy was suggested at these sites, although with more emphasis on pastoral farming at these farmstead sites (Clay 2002). Animal bone was not preserved at Kirby Muxloe but evidence for pasture was found in waterlogged deposits in a palaeochannel (Brown *et al* forthcoming). When such deposits of this period are encountered their study is a priority because such evidence contributes to the interpretation of the economy. Further studies are needed in order to consider plant and animal remains together, in the light of all other evidence from sites, in order to understand how the people lived at the time.

**Late Iron Age cereal cultivation:** In the Late Iron Age at Crick a higher density of plant remains was found than in earlier phases suggesting agricultural expansion continued with barley becoming more abundant. Cereal remains are notably abundant from the extensive settlements of Northamptonshire including Covert Farm, Crick with a maximum density of 171 items/litre of soil (see above), and also abundant in numerous samples at Stanwick and Courteenhall (Campbell unpublished, Ciaraldi unpublished). In contrast the Leicestershire farmsteads of Enderby I (Clay 1992), and Kirby Muxloe (Cooper 1994), for example, produced very low maximum densities of cereal remains with little chaff; 0.1 and 2.3 items/litre of soil respectively (Monckton forthcoming c). At the time poor survival of the remains was considered as the possible explanation for few cereals at these sites because the sites were truncated by ploughing. However, subsoil features survived well and the former site recovered a good assemblage of animal bone, the latter very abundant charcoal. As more sites have been investigated the pattern of results suggests that the explanation may be that the sites may be more suitable to pastoral farming, and the low number of cereal remains reflects this. Survival of remains must be questioned on each site. Sites can be compared on the basis of the density of remains in the best sample from each site: quoted here as 'the maximum density of charred plant remains as the number of items per litre of soil' (c.f. Murphy 1998), of course the quantity of samples and their composition must also be taken into account.

Recent investigations at the Leicestershire farmstead sites at Huncote and Desford and the site at Ashby have shown higher maximum cereal densities; 19, 187 and 32 items/litre of soil respectively, (Jarvis 2001a, b, Ciaraldi forthcoming). A grain rich sample from the latter contained about equal amounts of wheat and barley, the wheat included spelt grains and chaff with bread wheat type grains and some probably of emmer, and weed seeds (Ciaraldi 2001). Hence more abundant remains in the Late Iron Age than earlier are now being found on some Leicestershire sites. Samples from the extensive settlement at Gamston, Nottinghamshire included some with abundant chaff with a maximum density of 23 items/litre of soil (Moffett 1992) with chaff quite common. A site at Carsington, Derbyshire has a deposit of abundant cleaned barley grain but this may be of Roman date. In Lincolnshire a site at Market Deeping had a fairly low maximum density of cereal remains of 9 items/litre of soil (Murphy 1998), but other unpublished sites may have been

studied for which the data is unavailable at present. The extensive settlement at Dragonby produced abundant charred and waterlogged plant remains, animal bones and other evidence providing evidence of food production and the varied diet of the inhabitants. Regional differences are emerging and warrant further investigation.

Evidence of cereals becomes more common during the first millennium and the observation by Pryor that animal husbandry is the main activity in the lowlands during the Bronze Age, and cereal cultivation only becomes significant in the Iron Age requires investigation for different parts of the region (Pryor 1998). The plant remains data seen here does suggest that the Iron Age sees the development of agriculture and its expansion in the region and the question of the timing of this on different soils requires investigation. In addition the difference in economy on sites of different types, sizes and geologies is poorly understood so sampling is particularly important for sites in this period (see p.1 above). Radiocarbon dating for this period is particularly problematic so additional resources are required to date the material found (see p.2 above). There is a lack of evidence from large settlements outside Northamptonshire and, most unfortunately, from the Hillforts in general which would contribute to evidence about social organisation. Evidence from animal bone is particularly important to establish the type of animal husbandry from the proportions, ages and use of species present. The evidence for land use, particularly for pasture, from waterlogged deposits and other remains such as snails, phosphates and sediments which provide important information should be analysed when encountered. Some differences in emphasis of arable and pastoral farming in different parts of the region are becoming apparent as more data is collected, but only by sampling more well dated sites will the evidence be found to examine if differences result from settlement type, size, date or geology. Integration of the evidence, and use of information from experimental archaeology, in order to reconstruct life in the past is an approach which should be extended in this period, as it has the potential to increase understanding and communicate results to the public.

## ROMAN

**Summary:** Sites mentioned in the Regional Review of plant remains include three settlement sites and two salterns in Lincolnshire together with information from Lincoln, the Leicester urban sites of the Shires, Causeway Lane and Bonners Lane, while Dunstons Clump is the only site mentioned for Nottinghamshire, and no sites from Derbyshire or Northamptonshire are included (de Moulins and Murphy 2001). Additional sites included here are some unpublished information from assessments of Stanwick villa, Courteenhall and Craughton in Northamptonshire, a few Leicestershire farmstead sites, some corndriers and more urban evidence from Leicester, together with some evidence from Carsington in Derbyshire. Excavations of the saltern sites in Lincolnshire have recovered a range of remains. A site at Chesterfield, Derbyshire was sampled during excavation by Manchester University. Recent excavations by Trent & Peak Archaeological Unit at Captains Pingle, Swarkestone, Derbyshire, and at Hoveringham Quarry and Rampton Quarry in Nottinghamshire include Roman sites which were sampled. Animal bone has been recovered from many excavations but large assemblages have been studied from Leicester and Lincoln and further conclusions have been published (see below and table E1).

**Environment and Land use:** Evidence for the open environment in Roman times was found in waterlogged deposits at Croft, Leicestershire from the top of a deposit which was of Iron Age to Roman date (Smith, Roseff *et al* forthcoming). The nearby arable and pastoral landscape was indicated by the insect remains from a Roman well at Empingham, Rutland (Buckland 1986, and in Cooper 2000) and from pollen from a mire deposit at Stamford Road, Oakham which also had evidence of cereal cultivation (Greig *et al* forthcoming). A well at Piddington has insect remains indicating an open dry environment with evidence for some cultivation of brassicas and pulses and land used as pasture (Simpson 2001). At the excavation at Carsington, Derbyshire a series of waterlogged samples was taken for plant macrofossils, pollen and insect remains which have potential to provide evidence of the environment (D. Smith pers. comm.). There is a lack of a long



pollen profile which extends into this period or palaeochannels from the Trent valley at present, so it is necessary that sampling of these deposits continues in order to provide a picture of local variation in the environment. The exploitation of wooded areas is shown from charcoal analyses from many sites particularly those associated with metal working. Lincolnshire has produced good evidence from sites with waterlogged remains of plant macrofossils and pollen; open grassland has been found at Dragonby, Hibaldstow, West Deeping and Denton Villa with additional evidence for salt tolerant vegetation from the saltern site at Morton Fen (Murphy 1998).

**Sites with Late Iron Age and Roman evidence:** It is only by comparing remains across periods that changes in agricultural practice can be found. A few extensive sites have evidence of both periods. Dragonby, Lincolnshire has productive Iron Age but richer Roman samples with more varied remains when the site developed into a Roman small town. In Northamptonshire Stanwick also has abundant remains in samples of both Iron Age and Roman date including waterlogged samples. Assessment showed great potential to produce evidence of both Iron Age and Roman agriculture but limited potential for the transition period (Campbell unpublished). The site at Grange Park, Courteenhall, also produced rich Iron Age and Roman samples including some from the transition period, which have the richest plant assemblage from the site; these may reveal changes in the site economy if the hopes of the assessment are realised (Ciaraldi unpublished). A small number of samples of Roman date from Covert Farm, Crick, produced a low density of remains indicating only small scale domestic activity (Monckton forthcoming a); however, this may be because of the movement of the Roman settlement rather than less activity. At Market Deeping, Lincolnshire samples from Roman deposits contained much more cereal remains than those of earlier (Murphy forthcoming, and below). Dunston's Clump, Nottinghamshire produced both Iron Age and Roman material including evidence for animal enclosures and fodder in the later phases of the site (Jones 1987). At Dragonby and Stanwick evidence of the availability of more varied foods may suggest an increase in status. Increased cereal production may be reflected in the more abundant remains from some sites.

The site of a stone building and surrounding features at Carsington, Derbyshire produced a deposit of cleaned barley consisting of prime grain product. The barley was of a hulled form and included six-row barley. A sample of the grain was radiocarbon dated to cal BC 92 to 236 AD (Beta-68680) which was too wide a range to be helpful; however quite abundant Late Roman plant remains were also found on the site. Leicestershire farmstead sites include the small rural sites of Normanton le Heath site 1 and Gimbro Farm which have a low density of remains in both periods (Monckton 1994, Jarvis 1999). The site at Desford has a grain rich sample of Late Iron Age date and few remains in Roman samples (Jarvis 2001b). Similarly the site at Ashby also produced a grain rich Late Iron Age sample and a moderate amount of plant remains in a samples of the Roman period (Ciaraldi 2001). Some sites producing low densities of cereal remains continue to be so into the Roman period perhaps because they rely more on pastoral farming in both periods. Sites, which produce less evidence in the Roman period, may have a change of use or be failing in the Roman period. Examination of plant remains from sites which continue, fail or are new settlements contributes to the picture of the developing economy, however a range of sites must be sampled to see the pattern of resources exploited.

## COUNTYSIDE

**Agriculture:** The main cereals cultivated during the period were wheat, mainly spelt with occasional emmer and bread wheat type grains; hulled barley, including six-row barley was a second important cereal. Wild or cultivated oat is found possibly as a weed of the crops, and rye is found occasionally as, for example, at Dunston's Clump, Nottinghamshire. The Roman period is characterised by the finds of abundant burnt wheat chaff, as waste or spent fuel from cereal processing, dumped in features on many sites. The lack of finds of cereals in primary contexts such as from corn driers in Lincolnshire was noted by Murphy (1998) although the settlement at Market Deeping produced abundant cereal remains, identified as crop processing waste, found in pits and ditches. A maximum density of 178 items/litre of soil was found in Roman contexts showing the

larger scale of disposal of this waste than found in the Iron Age contexts of the site which produced a maximum density of only 9 items/litre of soil (Murphy 1998).

At Carsington, Derbyshire, Later Roman samples from a 3rd - 4th century layer which was extensive and contemporary with the building were dominated by chaff, mainly of spelt wheat, with a maximum density of 402 items/litre of soil. This was thought to indicate dehussing of wheat on the site, possibly for consumption there (Monckton 1997). Other sites with similar remains include Dunston's Clump, Nottinghamshire, which has evidence of cereal processing from chaff dominated samples (Jones 1987), the Later Roman site at Potterspury, Northamptonshire, which produced chaff dominated samples from ditches from a pipeline investigation which, by its nature, only touched part of the site (Meek 1998), and Scalford Brook near Melton Mowbray, Leicestershire, produced a chaff rich deposit from a gully (Beamish 1991, Monckton in press).

Stinking mayweed is considered to be an indicator of the more intense cultivation of clay soils and makes its first appearance in the Roman period in the region both in Lincolnshire in the West Deeping area (Murphy 1998) and at Causeway Lane and Crown Hills in Leicester, and Ashby, Leicestershire, (Monckton 1999, Jarvis 2000a, Ciaraldi 2001). This may be evidence for the extensification of agriculture on the claylands using better ploughing equipment in the Roman period (Ciaraldi 2001). It has been suggested that larger breeds of cattle would be needed for ploughing clay soil so correlation of data with animal bones is needed (O'Connor & van der Veen 1998). A number of sites, such as Carsington, Derbyshire, have produced good assemblages of weeds with the cereal remains, which may be compared with other sites in the future to investigate cereal production. Weeds, typical of extensive cultivation, have been studied for the north of England by van der Veen (1992), and more detailed study of the weed assemblages would be necessary to study aspects of cereal production in this region (van der Veen 1992).

**Corn driers and malting kilns:** Evidence from corn driers shows the increase in agricultural production and bulk processing of cereals. Corn driers are the most characteristic Roman agricultural feature which, when found with cereal remains *in situ*, can provide evidence for the variety of parching and drying processes for which they were used (van der Veen 1989). However, the evidence for such processes as malting is not always clear cut. Abundant remains from a number of corn driers at Stanwick villa have the potential to give evidence of the function of different types of structures and to provide evidence about the villa economy (Campbell unpublished). At Courteenhall corn driers with evidence of malting have been found (M. Ciaraldi pers. comm.). Other corn driers with evidence of cereal remains have been found at Empingham (Alvey 2000), Ridlington in Rutland (Monckton 2002), Appleby Magna (Jarvis 2000b), Ketton (Meadows pers. comm.) and Hamilton, Leicestershire (Jarvis pers. comm.). At Empingham, Rutland, the use of chaff as fuel and the presence of mostly germinated spelt grain was thought to suggest malting. Analysis of cereal remains from five corn driers at Ridlington showed their use for a variety of different functions including; processing spelt for dehussing, parching malted spelt, drying spelt for possible storage and processing barley for drying or dehussing (Monckton 2002). These were all thought to be activities carried out on the site. At Appleby Magna samples were interpreted as parching of spikelets of spelt probably for dehussing. Hence evidence for Roman agricultural production is accumulating although corn driers with cereal evidence have not yet been found in Derbyshire, Nottinghamshire or Lincolnshire.

**Pastoral farming:** A great deal of evidence from animal bone assemblages found in the towns shows the supply of meat and animal products to the settlements, however, there are fewer rural bone assemblages for comparison. Stanwick, Northamptonshire is an exception and the report is awaited. Other evidence such as remains of fodder shows the resources used to feed animals (see below). Also evidence for pasture from waterlogged deposits is known from the surroundings of some villas and other sites (see above) as well as from palaeochannels from previous periods. Animal bone has been recovered from several Northamptonshire sites, Derby Racecourse, and other rural sites. The main collections of bone are from the towns and recovery of good rural assemblages is needed. There is some evidence for fodder from the region. At Dunston's Clump,

Nottinghamshire, barley interpreted as fodder was found in later phases in an enclosure (Jones 1987). Recent work at Ashby has recovered a sample containing rye with cultivated or wild oat and barley was thought to possibly represent fodder but the date is to be confirmed (M. Ciaraldi pers. comm.). Evidence for hay was found from a charred sample containing abundant seeds of grasses and tall grassland plants at Causeway Lane, Leicester, (Monckton 1999), while waterlogged remains from wells at Stanwick contained evidence of hay as part of the agricultural economy (Campbell forthcoming).

**Field systems:** Field systems can provide important evidence of agricultural expansion and pastoral farming. At West Deeping a field system, which contained waterlogged remains, included pollen of grassland and damp ground (Murphy 1998, Hunn and Rackham forthcoming). Dunston's Clump, Nottinghamshire, is set in an extensive field system of brickwork plan and warrants investigation. If found, waterlogged field ditches have great potential to provide dating evidence from organic remains together with pollen which may provide evidence for the use of the fields for cultivation or pasture. Investigation of field ditches is a priority in order to provide dated evidence of land use (Hunn and Rackham forthcoming).

**Viticulture:** Other unusual evidence from Northamptonshire is from Wollaston where trenches were discovered with grape vine pollen present providing evidence that they were used for viticulture (Meadows 1996, Brown and Meadows 2000).

**Salterns:** Excavations of saltern sites in Lincolnshire have produced both charred and waterlogged remains as well as animal bones. Samples from Morton Fen saltern differed from all other Roman sites investigated so far in eastern England in having barley as the most abundant cereal rather than spelt. Grains and chaff of six-row hulled barley were found with some wheat including bread wheat type, spelt and emmer. Salt tolerant plants were also found, and the predominance of barley was thought to be because it is the most salt tolerant of the cereals. This site provides the only example at present of expansion of Roman agriculture onto saline soils (Murphy 1998, 2001c). The animal bones suggested that cattle were reared on the site, horse and cat bones were also found (Albarella 2001).

**Plant and animal products:** Apart from food from both plant and animal sources other products were also important. In addition to plant products such as hay and fodder, cereal waste chaff may also have been used as fodder (van der Veen 1999). There is evidence for the use of chaff as fuel for cereal processing although it could also have been used as fuel for other purposes. Chaff is more likely to have been used in places near to where cereals were produced and processed, although spelt can be transported in spikelet form and cleaned where it is required but this is less efficient because of the bulk. Straw could be used for animal bedding and for thatch on lower status buildings. Plant remains should be examined for this evidence. Animal products apart from meat included dairy products and eggs, the former leaving little evidence except perhaps when pottery residues are analysed, the latter found as shell which can be identified from its microstructure. Other animal products such as horn cores and antler off-cuts are found on sites as evidence of working these materials for use. Evidence for wool is inferred from the age of the sheep at slaughter but is rarely found as fibres or textiles; leather is occasionally found in waterlogged deposits but must have been very important and commonly used when the quantity of animals slaughtered is considered. Evidence for secondary plant and animal products should be given more consideration.

## VILLAS AND SMALL TOWNS

**Cereal processing:** Corn driers found at a number of villa sites have provided evidence of crop processing as at Stanwick, Northamptonshire and Empingham Rutland mentioned above. Evidence for the provision of cereals to Roman Leicester may be implied from the corn driers found at the edge of the town. Norfolk St. villa produced evidence of spelt chaff used as fuel in a corn drier there (Jones 1982, van der Veen 1989), which was probably dehusking waste used for the

processing of more cereals. Recent analysis of remains from a corn drier at Crown Hills, probably a villa site, also contains chaff rich samples with more seeds present including stinking mayweed (Jarvis 2000a). Seeds of this plant were also found with cereals in Leicester at Causeway Lane and may suggest that cereals were being processed for supply to the town, the lack of finds of abundant chaff in samples within the town also suggests that processing was carried out elsewhere (Monckton 1999). Hence retrieval and analysis of plant remains is a priority from these sites. Charred cereals have been reported from corn driers at Wood Burton villa near the small town of Towcester (Turland 1977) but it is unknown at present if analysis of the remains was carried out.

**Storage:** An interesting deposit of grain was found at Croughton villa in Northamptonshire (de Rouffignac 1996). This consisted of cleaned spelt grain which was found to have holes and traces of insect attack. If spelt is stored in the chaff (as spikelets) it is protected from insect attack by the chaff, and the grain would only become infested in this way if cleaned before storage and stored above ground. Bulk storage of cleaned grain is only known from important centres such as London and Colchester and some of the forts of northern England, and this is the first find of this type from a rural site and has implications of status and supply of produce. No large deposits of cleaned cereals are known from any of the Roman towns in the region.

**Food:** Apart from the range of cereals and hedgerow fruits and nuts commonly found on rural sites the small town settlement at Dragonby produced remains of beans, coriander, summer savory, opium poppy and celery as evidence of the Romano-British diet (van der Veen 1996). Waterlogged remains from wells at Stanwick villa have produced evidence of the wide range of foods in the diet including a wide range of fruit remains (Campbell forthcoming). The villa at Denton, Lincolnshire, has plant remains including beet (Conolly and Biek 1971) as found in Leicester and Lincoln. Such remains compare with the variety of foods found in the towns of Lincoln and Leicester described below; they suggest the higher status of these sites, or perhaps that they were the source of produce for the towns.

**Small towns:** Very few small town sites have been sampled although many have been investigated by excavations over the years. In Lincolnshire, Dragonby has produced a wide range of remains both charred and waterlogged, and Hibaldstow a few charred plant remains including bean (Greig 1979). Trial pitting at Medbourne, Leicestershire, to uncover the extent of the site, did not produce dated well sealed deposits to sample, because of the nature of the investigation (Pollard 1988). In Northamptonshire recent work at Irchester has recovered waterlogged samples with pollen evidence (A. Brown pers. comm.). More evidence is needed from the small towns to investigate status and economy, sampling small towns is a future priority.

## ROMAN TOWNS

In Leicester major urban excavations have provided the opportunity for environmental sampling of sites both inside and outside the town walls. Inside the town samples from excavations in the north east quarter at the Shires sites, Little Lane and St. Peters Lane, (Lucas and Buckley forthcoming) and Causeway Lane (Connor and Buckley 1999) can be compared with the sites in the southern suburb at Bonners Lane, Oxford St. and York Rd (Finn *et al* forthcoming). In the Roman period there is abundant evidence of the foods consumed in the town, these range from the cereals, mainly spelt wheat and barley, legumes and leaf beet as vegetables, fruits such as sloe, wild plum and apple, while coriander, fig and lentil may be introduced or imports, and opium poppy, columbine and possible sweet violet may be garden plants (Moffett 1993, Monckton 1999). Other food remains include a variety of freshwater fish, herrings and eels (Nicholson 1992, 1999), and abundant oyster shells, which were thought from their size, shape and infestations to have been brought from the Essex coast. These were from a 2nd century cellar at Little Lane (Monckton 1993) and later deposits at Causeway Lane (Monckton 1999). Roman cesspits were found at Causeway Lane, identified from the presence of gut parasites, mineralised seeds and fly puparia (Boyer 1999, Skidmore 1999). Apart from the evidence for domestic occupation a sample interpreted as the remains of charred hay was found possibly suggesting the stabling of horses on

the site. Outside the walls at Newarke St a cesspit predating a Roman cemetery was found which contained mineralised remains of legumes and other seeds suggesting some occupation and disposal of rubbish outside the walls (Monckton 1994). In the southern suburb only a scatter of burnt cereal grains was found in Roman samples, too little to suggest significant domestic or cereal related activity. A kiln or oven was found at Bonners Lane but the feature and surrounding features contained no evidence to suggest use connected with cereals (Finn forthcoming b).

Large assemblages of animal bone from the Shires sites and Causeway Lane (Gidney 1991-93, 1999) have shown the use of more sheep for meat in the early phases, the slaughter of Celtic shorthorn cattle of mature age, probable after having been used to produce milk, and the use of young pigs for meat. The bone provided evidence of butchery practices and also of horn working from abundant horn cores on Causeway Lane. Domestic fowl were consumed as were their eggs, and wild resources included wild duck, wild goose, red and roe deer and hare. Other large groups of animal bones include those from Great Holme St where a deposit including cattle skulls was interpreted as primary butchery waste, and raven bones were also present as an urban scavenger (Gouldwell forthcoming). A Roman pit from the High St cellars excavation has produced the unusual find of a white tailed eagle suggesting that the surroundings of Leicester may have provided a suitable habitat at this time (Baxter 1993a-c). Few rural bone assemblages are known to suggest the areas where the domestic animals were raised and their recovery is a priority.

Lincoln also has good environmental evidence from waterlogged deposits at three urban sites which preserved seeds of dill, celery, hemp, chestnut, strawberry and rose as well as the plants mentioned above from Leicester (Moffett 1995a,b, Greig 1989). However, because of the type of deposit less evidence of charred cereals was preserved, although the same cereals were represented. Animal bone from a number of sites in Lincoln has been analysed and a synthesis of information including that from the Late Roman period of the town has been compiled (Dobney *et al* 1996). Food supply and status are discussed and an interesting deposit of sand-eel bones from the Waterfront area raised the possibility of local fish-sauce production or use of bait for fishing. Information about water quality, flow rates and flood events was also found (Dobney *et al* 1996, Steane 2001).

The towns have great potential to provide detailed evidence of diet from plant and animal remains, evidence of living conditions, trade, and introduction of new foods from abroad. Bulk sampling and analysis of materials is essential on any urban excavations to add to evidence already obtained from well studied areas but also to recover evidence from other towns in the region.

## ANGLO-SAXON

**Summary:** Plant remains have been recovered and studied from sites at Raunds, West Cotton, and Higham Ferrers in Northamptonshire, sites from Lincolnshire include settlements at Nettleton, Boston, Riby, Gosberton, Flixborough, as well as a 10-12th century waterlogged deposit at Waterside in Lincoln; in Leicestershire an extensive settlement has been excavated at Eye Kettleby near Melton Mowbray. Animal bone has been collected from most excavations on suitable soils with good assemblages from the Northamptonshire sites mentioned above, from Lincoln, Flixborough, Riby and Quarrington in Lincolnshire and from Eye Kettleby in Leicestershire. Waterlogged deposits include palaeochannels at Raunds and West Cotton, mires at Eye Kettleby and Stamford Road, Oakham, and some palaeochannels such as one at Hemington Quarry Leicestershire may represent part of this period.

In Northamptonshire Early Saxon evidence at West Cotton was sparse consisting of a few grains of free-threshing wheat and barley with a few weed seeds of calcareous loam and clay soils suggesting continued exploitation of these soils from the Roman period. Early/middle Saxon samples from Langham Road, Raunds included a single seed of flax with a little barley and quite abundant free-threshing wheat grains, together with a few fragments of wheat chaff of both bread and rivet wheat suggesting the possible introduction of rivet wheat by c.850 AD (Campbell 1994), however, the

dating is still being investigated. At Higham Ferrers sparse evidence was found of early/middle Saxon date showing hulled barley to have been cultivated with oats present either as a weed or a crop, while few weed seeds were found. There was no convincing evidence of the continued cultivation of spelt at this site (Moffett 2001), or at Eye Kettleby, Leicestershire (Monckton forthcoming b). Early Saxon evidence from Nettleton Top, Lincolnshire, included the presence of flax and barley (Carruthers 1993). Hence no convincing evidence for the continued cultivation of spelt wheat has been found in the region, although elsewhere in the eastern counties there is evidence for some continuity of production into the post Roman period (Murphy 1994). This remains a topic for investigation on future sites.

In Leicestershire the excavation of the extensive Saxon site at Eye Kettleby of 6-7th century date has provided evidence of the crops cultivated. There was no evidence for the continued use of spelt and free threshing wheat was the only type of wheat found. This was most probably bread wheat from the form of the scarce rachis material. Barley of a hulled form including six-row barley was the most common and abundant cereal. Barley is sometimes thought to be used mainly for animal food, but can be used for human consumption before which the papery hulls are removed by parching and pounding, so may be accidentally burnt and preserved by charring. Barley is the cereal most tolerant of damp conditions and the presence of buried mire deposits near the site may suggest this was a wet area in the past. Cultivation of the clay soils continues from the Roman period and is shown from the evidence of the arable weed, stinking mayweed, found at Eye Kettleby (Monckton forthcoming b). At another mire found at Stamford Road, Oakham, pollen from Roman to medieval date showed less signs of cultivation in the middle of the profile (Greig *et al* forthcoming). This may suggest more emphasis on pastoral farming at this time in the area or perhaps reflect some more general change which requires further investigation.

In Leicester sampling the Saxon building contexts at Bonners Lane produced only a small amount of plant remains including free-threshing wheat and barley while little was found from a single small pit of Saxon date at Causeway Lane (table 3). This adds to the evidence above that the type of wheat grown changes from spelt in the Roman period to free-threshing wheat perhaps as a cultural change or a change in the method of cultivation.

Middle Saxon evidence from rural sites in Lincolnshire at Boston and Riby (Giorgi and Rackham 1996, Hall 1994) were dominated by six-row barley with free-threshing wheat, rye and oats. On the Lincolnshire silt fens such as at Gosberton, barley, oats and horse bean were common and cereal processing waste indicated local production. This assemblage was thought to represent an agricultural system based on salt tolerant crops similar to that found on the coasts of Holland and Germany (Murphy 1993). Charred cereal grains and pulses were also found at the high status site of Flixborough (Loveluck and Dobney 1998). In middle to late Saxon contexts at Higham Ferrers the free-threshing wheat recovered included bread wheat and rivet wheat identified from rachises (Moffett 2001). Rivet wheat has been found in the midlands and south of England in medieval contexts from the 11th century onwards suggesting that the crop may have been introduced from Europe after the Norman Conquest. Here it was radiocarbon dated by the AMS method to AD 770-1000 indicating that this crop was present in pre Conquest levels (L. Moffett pers. comm.). This is the earliest occurrence of this crop known at present. Other crops including hulled barley, rye and legumes, probably peas or beans, were also cultivated. Leguminous seeds of vetches were quite abundant which may have included vetches cultivated as a crop although the identification could not be confirmed. At this time there was a change in the weed flora to include corn cockle, thorough-wax and stinking mayweed which are typical medieval weeds while there were also less plants of damp ground. This may represent changes in cultivation methods or processing practices by this time (Moffett 2001).

Late Saxon to early medieval evidence was abundant at West Cotton (Campbell 1994 and forthcoming), provisionally dated to AD850-1100/1150. Remains of both bread wheat and rivet wheat, rye, six-row barley and oats were found. A deposit of barley and oats with weeds of spring-sown crops was thought to be remains of 'dredge', a mixture of oats and barley grown together.

This mixture contained many sprouted grains, interpreted as malted grains for brewing, and was found in an oven of 10th century date. Waterlogged deposits contained evidence of flax retting showing the cultivation and processing of the crop for fibre on the site. Remains of hay was found from the evidence of typical tall grassland plants and the use of hay for fodder was part of the agricultural economy of the site, cereal waste may also have been used as fodder. Evidence from the waterlogged deposits also shows the presence of pasture and the large weed flora has allowed some conclusions about arable practices. It was suggested that a two or three field system of crop rotation was in place in West Cotton by the late Saxon period with fallow or grazing alternating with the crops (Campbell 1994). It is concluded by Campbell (1994) that the results from this site showed that there was a well developed agricultural economy involving all the major cereal crops, production of hay from traditionally managed meadows, production and processing of flax and brewing as an important activity.

Animal bone has been studied from a number of sites. Of the Lincolnshire sites studied, Riby and Quarrington have evidence that stock rearing was the main activity (Albone 2000). At Riby cattle were the main stock and were possibly over wintered there in the middle Saxon period (Steedman 1995). Quarrington shows a shift in emphasis from cattle to sheep later in the period with most sheep at both sites killed relatively young for meat rather than kept for wool or dairy produce (Walker and Lane 1996). At Flixborough cattle, sheep/goats, pigs, geese and chickens were identified (Loveluck and Dobney 1998) showing the more varied diet of the higher status site. At Higham Ferrers, Northamptonshire, sheep/goats were found to be the most frequent than pigs which were probably fed on woodland products. Pigs were common, particularly in the middle Saxon period. Cattle were used mainly for traction from the evidence of their age, while sheep/goat and pigs were used for meat, with animals probably reared and butchered locally. The animal bone suggested no evidence for a high status diet; wild species were rare throughout the period. Fish bone of mainly freshwater fish was found with a few fragments of marine species suggesting trade with the coast (Albarella and Johnstone 2000). Evidence from Burysteads and Langham Road, Raunds, from a large assemblage of early to Late Saxon bones has been studied by Davis (1992) and is to be published. Animal bone has also been studied at Lincoln as part of the sequence from the Roman to the medieval period (Dobney *et al* 1996) and it was noted that there was a trend for the increasing consumption of lamb and mutton and for the farming of sheep for wool from the Anglo Saxon period onwards (Vince this volume) reflecting the changes in farming practices in the countryside.

### **Other resources**

There is a need to investigate wild food resources such as freshwater fish and wild fowl, their production, management and collection. Fish weirs and fish traps are known from this period on rivers such as the Trent but there is little evidence for the consumption of the fish or eels on sites and more investigation of deposits by sieving to recover the small bones is required. Marine fish and shellfish were exploited in the Roman and medieval period in the towns so evidence of this may be found in this period if suitable deposits are examined by sieving. Wild fowl were also exploited and bone assemblages should be recovered by sieving to ensure recovery of identifiable bones.

### **Woodland**

Woodland, parks and wood pasture were an important resource for timber, fuel as wood or charcoal, pasture, obtaining wild resources as well as for hunting. Investigation of these from documentary sources as well as archaeology has provided information about their importance and exploitation (Foard forthcoming). Environmental archaeology has the potential to contribute to such studies.

## **MEDIEVAL**

**Summary:** Major urban excavations in Leicester have produced abundant evidence of a wide range of plant and animal remains from a number of sites including evidence for diet and living

conditions such as at Causeway Lane Leicester (Connor and Buckley 1999). Urban deposits in Lincoln have produced particularly good animal bone assemblages (Dobney *et al* 1996), in addition charred and waterlogged plant remains were found (Moffett 1995a,b). Some evidence has been recovered from St Peters Street, Northampton (Williams 1979) and Nottingham castle ditch (Gnarnaratnam forthcoming), in Derbyshire a few remains have been recovered at Chesterfield, little has been recovered in Derby until recent excavations at Derby Magistrates Courts by Archaeological Investigations Ltd.

Evidence from rural sites is most abundant in Northamptonshire from the Raunds and West Cotton Projects and an interim report on the plant remains from these has been published (Campbell 1994), and animal bones analysed. In Leicestershire samples of plant remains have been analysed from several village sites and from the town of Oakham (Monckton in press) while a good assemblage of animal bones has been recovered from Market Harborough (Baxter 1998). In Derbyshire a site with a field system has been sampled at Thurstaston (Moffett 1999). Some evidence recovered from the town of Chesterfield. Few castles, monasteries or moated sites in the region have been sampled. Fishponds at Owston Abbey, Leicestershire produced evidence of the environment and fish species there (Hayne and Shackley 1988). Evidence for the environment from waterlogged remains has been recovered from palaeochannels associated with medieval bridges at Hemington, Leicestershire (Greig forthcoming, Smith forthcoming) and with the settlements at Raunds Northamptonshire (Campbell forthcoming, Robinson forthcoming).

## COUNTRYSIDE

Evidence for the open pastoral and cultivated environment was found in waterlogged deposits in silted channels at Hemington Bridges, Castle Donington, Leicestershire (Cooper and Ripper forthcoming, Smith 2000). The presence of some woodland with oak trees was also indicated in the pollen samples (Greig forthcoming). Waterlogged evidence has been analysed in Northamptonshire providing evidence of the farming landscape which is to be published soon (Robinson, Campbell forthcoming). A fishpond at Owston Abbey Leicestershire contained plant remains from the water plants and marginal plants of surrounding vegetation and remains of fish showing the species present as rudd, bream, chub, roach, pike and perch (Hayes *et al* 1988).

Woodland was an important resource in this period and studies have been carried out at Rockingham Forest (Foard forthcoming). Changes in land used as arable, pasture, meadow and different types of woodland over the period may be detected in documentary records and by study of the present landscape (Foard 2000). Other studies of woodland in the region have been carried out in Leicestershire where the remaining woods in the county have been studied by Squires (1994, 1995). In Nottinghamshire dendrochronology results have been published for Sherwood Forest (Laxton 1997).

In Northamptonshire charred cereal remains from West Cotton show the presence of rivet wheat as a new crop by early medieval times (Campbell 1994 and forthcoming). This occurs with bread wheat and the wheats may have been used for different purposes because of their different qualities; bread wheat was favoured for milling for bread flour, while rivet wheat is more suitable for biscuits and pottage. The straw also has different uses, bread wheat straw being more suitable for fodder as it lacks long awns which may choke some animals, while rivet wheat has very long straw which is useful for thatching (Campbell 1994). Barley of both two-row and six-row types was cultivated as well as oats and rye. Hence the major cereals were cultivated and evidence for crop rotation first found in the late Saxon period continued. In the 12th century deposits the occurrence of cultivated vetch was confirmed as an additional crop probably for fodder as part of a crop rotation system. In an oven of 12th century date barley and oats also occurred as a mixed crop used for malting to brew beer. Rye chaff was found in the oven and rye straw is known to be favoured to line malting ovens to support the grains during roasting of the germinated grains before extraction of the malt. Flax cultivation and processing also continued on the site (Campbell 1994 and forthcoming).



Analysis of the animal bone has provided evidence for animal husbandry at West Cotton (Albarella and Davis 1994) and Burysteads and Langham Road at Raunds (Davis 1992) adding to this picture of the developing agricultural economy of the region. At West Cotton animal bone of early to late medieval date included cattle, sheep, pig and equids; dogs and cats were common and wild animal bone was rare. Sheep were kept for wool, but meat and probably milk were used. Cattle were for traction, meat and dairy produce; less cattle were found later as horses became more frequent and were used for traction. Pigs decreased later as sheep increased, possibly because woodland used to feed pigs was reduced in favour of pasture for sheep. Cattle, equid and dogs were used for skins, while domestic fowl, geese, duck and pigeon were used for meat, eggs and feathers as well as meat. Cattle and sheep compared in size to those from Leicestershire and Yorkshire but were larger than Cornwall and Northumberland. These larger animals in central England were possibly products of improved husbandry methods and 'improved' sheep and cattle were perhaps kept in medieval Northamptonshire (Albarella and Davis 1994).

In Derbyshire, at Hemp Croft, Thurstaston, samples of charred plant remains consisted mainly of free-threshing wheat grains with rachis identified as probably of bread wheat (Moffett 1999). A few grains of barley were present with legumes including pea and field bean representing additional crops. Smaller legumes were also present which may have included cultivated vetch as a fodder crop, possibly used as part of crop rotation, although it was suggested that the remains may have been derived from thatch (Moffett 1999). Seeds and grains can fall from weedy straw used as thatch and be burnt in the domestic hearth and it has been shown that legumes, cereals and weeds occur in thatch (Letts 1999). This would therefore explain the mixture of vetch and food legumes. Lincolnshire and Nottingham appear to lack information from rural site at present.

In Leicestershire, Cropston Road, Anstey is a site with a known field system (Courtney et al forthcoming) and evidence for crops and diet of the 12th-13th century inhabitants was found from charred refuse in a boundary ditch. Foods included bread wheat with some rye, oats and barley, hazel nuts as gathered food, and legumes were also present. The wheat included grains with chaff and, as bread wheat threshes free from the chaff easily, the abundant chaff suggested that the wheat was grown nearby. Some of the legumes are of the size of cultivated vetch, which may again suggest that the cereal was grown following a fodder crop or possibly fallow. The weeds included cleavers and corn cockle which are typical of autumn sown crops such as wheat and rye, while stinking mayweed indicates the cultivation of heavy clay soils. The increase in the latter weed in medieval times is thought to be related to the use of the mould board plough (Greig 1991), because this enabled more efficient cultivation of clay soils. The deposit may represent waste from agricultural activity carried out near the buildings possibly processing a bread wheat crop. These remains give a glimpse of what was growing in the village field system. At Saxby (Monckton in press) a sample from the 13th-14th century ditch contained quite abundant grains of free threshing wheat and chaff (rachis), which included bread wheat and also rivet wheat as the first from a rural site in Leicestershire and Rutland. South Street, Oakham, like Anstey produced only bread wheat chaff, while Freeby and Barrowden produced no chaff at all (Monckton in press). Hence the site at Saxby provides the only evidence to date for the cultivation of rivet wheat in the county, where it seems less common than in Northamptonshire, although both types of wheat have been found in medieval Leicester (Moffett 1993, Monckton 1999). Rivet wheat is now known from an increasing number of sites in the midlands from the Early Medieval period onwards (Moffett 1991). More evidence from rural sites is needed in order to study of the distribution and dates of occurrence of rivet wheat, and to contribute to the study of the supply of cereals to the towns.

## MEDIEVAL TOWNS

Cesspits used for the disposal of latrine waste or sewage are often a rich source of evidence because the minerals in the sewage cause the remains to become semi-fossilized (mineralised). These pits may also contain coprolites (semi-fossilized excrement) and tests can reveal the presence of the eggs of gut parasites as evidence of public health, these together with the preserved maggots

of latrine flies confirm the presence of sewage and the flies also provide evidence of conditions in the pit. Cesspits often contain fruit stones, fruit pips and chewed fish bones as evidence of foods which were certainly consumed. Cesspits, although found in the Roman period, become more common in the medieval and post-medieval periods. Rubbish pits are also a good source of evidence because they often contain burnt cereal grains and seeds which are preserved because they are charred. This type of rubbish may contain accidentally spilled grains burnt in the cooking hearth and then cleaned away into a pit with other rubbish such as meat bones which can provide evidence of diet. These two different groups of remains and the type of preservation assist in the interpretation of features.

**Leicester:** As in the Roman period sites from both inside and outside the town walls have been sampled. Inside the town excavations in the north east quarter at the Shires (Buckley and Lucas forthcoming) and Causeway Lane (Connor and Buckley 1999) can be compared with the sites in the southern suburb at Bonners Lane, Oxford St, York Rd and Bowling Green Yard (Finn *et al* forthcoming). In the early medieval period of the 12th-13th centuries at Causeway Lane abundant remains from numerous cesspits and rubbish pits show that there was intense occupation at this time. The range of fruits extended from those found in Roman samples to include grape, blackberry, damson, plum, apple and pear, and vegetables included pea, bean and leek (Moffett 1993, Monckton 1999). The cereals changed from the hulled wheat of the Roman times to free-threshing wheat, which included not only bread wheat which is used today, but also rivet wheat. Meat from the domestic animals, which were butchered more uniformly during the period, was consumed (Gidney 1991-3, 1999), fowl were consumed as were their eggs, from the evidence of eggshell mainly of domestic fowl (Boyer 1999). Other foods included abundant fish with more large sea fish than in the Roman period showing the fishing of deeper waters with improved technology (Nicholson 1992, 1999). Oysters from the Shires of medieval date were fewer and smaller, they were found to be from deeper waters and more managed populations than in the Roman period (Monckton 1993). Analysis of residues on pottery from Causeway Lane showed that ruminant fat was used in lamps, dripping dishes contained pig or boar fat and jugs had little residue suggesting they were used for aqueous liquids (Evershed 1999). At the sites in the suburb at this time charred cereals from domestic rubbish were also found including at Oxford St germinated barley which may have been malted barley for brewing. A waterlogged well there contained leather offcuts and seeds of weld which is a dye plant, suggesting the trades being carried out in the area (Finn *et al* forthcoming).

In the Late medieval period there is less domestic evidence from Causeway Lane in the north east of the town. Evidence from rubbish pits at the Shires for of larger sheep kept for wool before being used for meat, and calves used as veal. Early slaughter of calves is used in managing cows to produce milk and this suggests the development of dairy production (Gidney 2000, Albarella 1997). In contrast in the suburb at Bonners Lane there is abundant domestic rubbish and even evidence of pigs being kept in back yards. This was apparently not always successful as several whole pig skeletons were found in a pit and they are thought to have died of disease (Baxter 1998). Abundant burnt cereal grains and legumes may be the remains of food for animals as well as people. Pig keeping was also suggested at Oxford Street from the find of neonatal piglets (Browning 1997); and a sample with charred cereal grains and numerous seeds of stinking mayweed which was recorded as a very troublesome weed of claylands (Greig 1991). Samples from York Road also recovered abundant domestic evidence with the cereals wheat, barley, rye and oats, some legumes and abundant fruit remains found in a cesspit there (Finn *et al* forthcoming).

The best preserved waterlogged evidence for the environment in part of medieval Leicester was found during excavations at an Augustinian Friary, near the west gate of the town (Mellor and Pearce 1981). Ditches contained remains of waterside vegetation from a wide range of plant remains with evidence of flooding from the water snails in the deposits (O'Connor 1998). The relative cleanliness of the site was shown by the type of insect remains found. Insect evidence also showed the cultivation of legumes and possibly the storage of cereal grain on the site (Girling

1981). A wide range of food remains included meat, oysters and some large fish (Mellor and Pearce 1981) provide a comparison with the secular areas of the town investigated more recently.

**Nottingham:** Charred plant remains, found at Nottingham Castle in a burnt deposit from a 12-13th century ditch at the Hospital site, included free-threshing wheat with rachis material of both bread wheat and rivet wheat. The deposit contained quite abundant grains, chaff and weed seeds and may consist of cereal cleaning waste but may have been derived from burnt thatch (Gnarnaratnam et al forthcoming).

**Derbyshire:** An excavation at Full Street, Derby recovered seeds of medieval date (Hall 1975). Excavations at the Magistrates Court by Archaeological Investigations Ltd. have produced medieval cereal remains of good potential for future analysis. Excavation of pits at Chesterfield recovered some cereal remains including free-threshing wheat with weed seeds (Monckton 1999).

**Northampton:** Excavations at St Peters Street Northampton recovered charred plant remains from a drying oven with cereals including two-row barley and oats with weed seeds and a pit from house 10 contained fruit remains of sloe, bramble and elder with wheat grains and stinking mayweed seeds. Animal bone, fish bones, shellfish were found and evidence from snails and insects investigated. Pits on the site were interpreted as tanning pits (Williams 1979).

**Lincoln:** Three sites in Lincoln are noted as producing plant remains by Murphy (1998). Charred plant remains from 11th-13th century deposits at Flaxengate included free-threshing wheat of both bread wheat and rivet wheat types, while both six-row and two-row hulled barley were identified. Two-row barley is preferred for malting, since its grains are of uniform size. Germinated grains of both barley and oats were noted and it is possible that malting residues were represented. The oats included both common oat and sand oat with rye and vetch as crops (Moffett 1996). Two other Lincoln sites included preserved waterlogged plant remains, Dane's Terrace and Waterside, where cultivated plants included celery, columbine, fig, strawberry, flax/linseed, apple, sweet gale (used for flavouring ale) cherry, plum/bullace, raspberry and grape (Moffett 1993, Greig 1989). Using information from animal bones from the town and hinterland, approaches to the study of providing the town with food have been suggested by O'Connor (1983). A detailed programme of analysis of animal bone from Lincoln has been carried out (Dobney et al 1996). The trends noted include the killing of older sheep which were kept for wool before being used as meat and the use of calves for veal as part of increased dairy production from the late medieval period onwards as noted at Leicester (Albarella 1997).

A wide range evidence for foods, living conditions and activities has been recovered from the towns of Leicester and Lincoln, although more data is required to expand the picture already obtained to other parts of these towns. Comparable data is needed from other towns and small towns in the region. Evidence is lacking from monastic sites, castles, and high status sites. Northamptonshire has produced good evidence for the rural economy and evidence from villages and rural sites is now being collected in the rest of the region as a future priority because the exploitation of the different landscapes of the region requires investigation. Data is needed from towns and their hinterlands in order to study provisioning of the towns and trading relationships with their surroundings and further afield. Information from economic history studies (Dyer 1989) provides the background for data from rural and urban sites and comparisons are needed to integrate the information particularly on farming, crops, produce and diet. Consideration of the evidence in conjunction with documentary records is an important area of study for this period.

## POST-MEDIEVAL

**Summary:** Information from this period is mainly from Lincoln and Leicester where animal bones from urban excavations show changes and improvements to animal husbandry. There is more evidence for trades using animal products, and the horse as transport and traction becomes more evident. Some samples of plant remains show more variety of useful garden plants and the use of cesspits for the disposal of sewage continues as found in Leicester and Nottingham. Silted

channels with bridges, mills and fishweirs are a source of environmental evidence for this period which are under investigation in the Trent Valley.

Areas of future research include documenting the introduction of new world crops and studying deposits from garden sites, which can produce data for authentic replanting (Murphy and Scaife 1991, Murphy 1998). A recent project at Lyveden New Bield, Northamptonshire has sampled the Tudor sediment of the moat which contains pollen including that of roses and pinks which provides evidence of the garden plants and then of the abandonment of the garden.

Animal bone has been studied from Lincoln for the late medieval to post medieval period (Dobney *et al* 1996) and evidence for improvement of breeds has been found in the larger sheep in 16th century Lincoln. The trend towards killing older sheep after they had been kept for wool continued from the late medieval period in Lincoln and in Leicester as did the use of calves for veal (Albarella 1997). There is evidence from Lincoln that there had been some changes in pig breeds and pig husbandry by the 17th century and that pigs were killed for meat at an earlier age (Dobney *et al* 1996). This was thought to be because of improved stock of faster growing larger sized animals which reached a higher weight when younger so the animals could be slaughtered earlier (Albarella 1997). This was the main improvement in pig husbandry until the introduction of new breeds in the 18th century.

In Nottingham a cesspit was excavated at High Pavement (Alvey 1973) and a well at Castle Gate (Alvey and McCormick 1978). No evidence is known from Derby at present. In Northampton tanning pits have been investigated by chemical analysis to provide evidence for the leather industry there (Shaw 1996).

**Post-medieval Leicester:** Activity in the suburb increases into the post-medieval period, cesspits at Bonners Lane and the Bowling Green Yard contained very numerous fruit pips of figs and blackberry together with sloe, apple and grape. This shows the continued use of cesspits for sewage disposal. Rubbish pits contained such abundant charred cereal grains that they must have been waste or accidental loss from some commercial use either for sale as grain or perhaps in other products (Finn *et al* forthcoming). Evidence from bone from the site shows the processing of animal skins adding to the evidence for tanners or tawyers trading activity in the suburb (Baxter 1998). In the north east of the town at this time evidence from a rubbish pit at Causeway Lane showed that an improved breed of pig with a dished profile of the skull frontal was being introduced (Gidney 1999, 2000). This possibly represents a cross with a pig of Asian origin and is probably of 18th century date. A few large rubbish pits and a well at the Shires contained charred grains of cereals from domestic rubbish and seeds of additional plants such as dill, hops, asparagus and marigold which possibly grown as garden plants (Moffett 1993). The fewer larger pits and stone lined well may suggest fewer larger properties in the area at this time with large gardens and at least one such residence is known on High Street from the 16th century (Courtney 2000). After this the north east quarter was recorded as an area of trees on maps of the 18th century and did not become populated again until Victorian times.

Other Leicestershire sites include the town of Mountsorrel where a deposit of sheep foot bones, similar to those at Bonners Lane, was found at a site where leather working and saddlery are known to have been carried out (Lucas 1987). Evidence for the post-medieval horse trade was found at Market Harborough where a pit containing horse bones included bones with the pathology of draught animals, slaughtered and skinned for hides; cattle horn cores were found as waste from the horners trade (Baxter 1996).

## MODERN

Investigation of modern deposits is rarely carried out as part of archaeological projects but is sometimes carried out as ecological research. One example is a study of sediments from Groby Pool Leicestershire to compare evidence for woodland and land use with documentary evidence.

This shows that the pollen record mirrors the history of the mixed oak woodland of the area over the last 200 years (David and Roberts 1990). This type of work provides a firm basis for recording less well documented areas in earlier times as well as more recently. It also has great potential to reveal the history of land use and record changes in the landscape. Another study of lake deposits at Creswell, Derbyshire (Jenkinson and Gilbertson 1984) has recorded vegetation up to recent times and also includes a study of the present ecology of the site. This is a useful comparison with the very early deposits from the area and is an important contribution to the preservation and management of the site.

Sampling for plant remains and animal bones from post-medieval to more recent deposits has the potential to reveal the introduction and use of foods and other traded material, particularly New World introductions, imported into the country and their spread to the region. Studies of animal bones can show the changes in animal husbandry and the introduction of improved breeds of animals; it can also show the animals used for traction and transport as horses replaced the large cattle of earlier times. There is also the potential to reveal diet, living conditions and status of historically recorded households or settlements of both rich and poorer people. Study of skeletal material has great potential to reveal history of disease and social conditions of groups of people. Other areas of study include the history of pollution by metals and other materials which may be deposited in sediments.

## **CONCLUSIONS FROM RESOURCE ASSESSMENT**

Charred remains of crop plants and domestic animal bones are as much an artifact of material culture as pottery and therefore should be recovered and recorded for excavated sites as part of preservation by record of sites which are to be destroyed. Information about the ancient environment is crucial to the study of archaeology, and recovery of information from natural deposits which are to be destroyed is also essential.

Publications should include sufficient data to back-up conclusions and archive reports should be made more easily available to allow local and regional comparisons. Data is accumulating in the region but it is only by comparing information over time and from different areas that change and development can be investigated. Therefore more detailed information is required from the region, although the work done already can be used to target future investigations in order to answer questions raised about the region within the main themes suggested above. This assessment has shown the main gaps in the evidence which are listed below and should suitable deposits be encountered information from them should be maximised, other subjects with scarce data are mentioned in the agenda for each period.

### **Main gaps in the evidence**

The resource assessment has shown the gaps in the evidence of plant and animal remains to be as follows (table E2). However these can only be examined in the context of information from other periods.

Lack of published early prehistoric pollen profiles as noted by Greig (1996).

Evidence for early clearings and their use from pollen analysis and insect remains.

Neolithic settlements, evidence of crops, wild resources and animal husbandry.

Land use evidence of pasture, cultivation and woodland, dated evidence needed from wider area.

Bronze Age crop remains, for comparison with later remains as evidence development of agriculture.

Evidence from Iron Age Hillforts and extensive settlements.

Evidence from Iron Age to Roman transition.

Roman small towns, evidence of status, economy and function lacking.

Saxon evidence of crops and animal husbandry.

Medieval rural evidence of agricultural production and use of fields.

Evidence from medieval towns.

Post medieval plant remains, introduced plants and improved animal husbandry and breeds.

**EMRF SUMMARY: ENVIRONMENTAL ARCHAEOLOGY NOV 24th 2001****Table E2: Numbers of sites with each type of remains**

<b>Period</b>	<b>Total Sites</b>	<b>Mammal bone</b>	<b>Bird bone</b>	<b>Fish</b>	<b>Molluscs</b>	<b>Charred Plants</b>	<b>WL Plants</b>	<b>Pollen</b>	<b>Insect</b>
Palaeo	10	8 (5*)	1	-	-	-	2	5	1
LG	11	2 (1*)	1	-	1 Snails	-	6	6	6
Meso	23	2 (2*)	2	-	1 Snails	-	8	17	8
Neo-EBA	39	8	-	-	2 Snails	16 (3*)	9	15	6
BA	31	8	-	-	1 Snails	15 (4*)	12	18	11
LBA-EIA	16	5	1	1	-	4	5	5	5
IA	42	15 (6*)	1	1	2 Snails	27 (14*)	10	12	9
LIA-RB	17	4	-	-	-	16 (5*)	5	5	2
Roman	33	11	1	-	-	22 (16*)	12	8	6
Roman urban	12	12 (7*)	4	4*	2 Oysters	10 (2*)	5 (3*)	2	2 (m)
E. Saxon	6	3	-	-	-	6 (3*)	1	1	1
L.Saxon	16	5 (3*)	1	-	-	12 (7*)	4	4	3
Med	21	9 (5*)	-	2	-	17 (9*)	4	4	2
Med urban	17	12 (7*)	6	6*	1 Oysters	11 (9*)	8 (3*)	4	4 (m)
Post-Med.	12	8 (5*)	1	2	1 Oysters	4 (3*)	1	1	1

Key: Numbers in brackets \* = number of sites with good assemblages from table E1.

LG = Lateglacial palaeochannels.

Meso = Mesolithic, and includes Mesolithic-Neolithic waterlogged deposits.

Neo = Neolithic, and includes Neolithic to Early Bronze Age sites.

Of the 321 sites listed by period for the region (table E1) a total of 160 sites have been sampled and recovered charred plant remains which have been analysed or assessed, 70 sites are peats or palaeochannels with waterlogged material present, 14 sites have Palaeolithic-Mesolithic bones. The remaining sites have produced only bones from excavations which are mentioned in the text, or have other analysis (e.g. residues), some sites are listed which are in progress or need more information.

(NB. Animal bone has been recovered from many excavations but only selected sites are included here).

## **Conclusions contd.**

### **Problems**

Publication and/or accessibility of information, particularly 'grey literature'.  
Lack of environmental materials recorded on Sites and Monuments Records  
Methods/Guidelines needed for region so information is comparable  
A review of the evidence from animal bone for the region is urgently required.  
Need for a review of the environmental evidence from Lincolnshire  
Need for collation of information  
Need for integrated synthesis.

### **Suggestion for basic methods of sampling for future sites:**

- a) Waterlogged deposits should be sampled for pollen, plant macrofossils, insect remains and dated by AMS of seeds of land plants as a minimum.
- b) Bulk sampling for charred plant remains as routine, a range of samples is needed.
- c) Recovery of animal bone assemblages by appropriate sampling.

### **Methods under-used in the past which are applicable for future investigations:**

1. Investigations of buried soils by sediment analysis, micromorphology (see Limbrey in Hughes 2000).
2. Boundary and field ditches can be investigated for dating evidence and land use from waterlogged remains (see Rackham forthcoming).
3. Stable isotope analysis of human bone to investigate diet and lifestyle as at Staythorpe (Davis 2000).

### **General problems**

Access to unpublished work, particularly developer reports, needed.  
Environmental information needed on SMRs.  
Co-ordination and synthesis of information from the river valleys urgently needed.  
Publication of data important, summaries useless without data to back up conclusions.  
Resist the temptation to reduce sample size and quantity because of competitive tendering.  
Need to use comparable methods for sampling excavations so regional comparisons can be made.

## **POTENTIAL OF THE REGION**

The landscapes of the region include the Peak District, the river floodplains, claylands, the Fens and the Coastal area of Lincolnshire and the wide range of different geologies allows the investigation of different types of economic exploitation, farming and settlement history. The Peak District where evidence of Palaeolithic activity and environment has been in the cave sites at Creswell, while palaeochannels and peats have provided evidence of the early wooded environment with clearings and the beginnings of cereal cultivation in the Neolithic. All the main river valleys in the region and many tributaries have been found to produce a wealth of evidence from waterlogged deposits from palaeochannels discovered during quarrying, development and surveys usually connected with threats of development. These deposits have great potential to provide evidence of the general and more local environment, each sampling site providing a snapshot of the environment which can be dated and which can build into a general picture of landscape and landuse. Mapping and dating river channels contributes to the evolution of the river systems and landscape and dating alluviation often relates to human activities such as woodland clearance and cultivation. This information is being used to investigate the different types of woodland and clearing dates, evidence for land used as pasture and cereal cultivation contributing to information about the environment of the occupied landscape and impact of man.

The claylands of south of the region have an increasing amount of evidence for settlement on the drift geology from prehistoric times onwards and the study of a range of settlement types is possible to compare with other parts of the region and places outside the region. This will elucidate

aspects of the development of farming and the rural economy. In Roman and later times Leicester and Lincoln have provided good urban evidence, both with the potential for further investigation and more evidence from the other towns is needed. If this could be related to rural evidence sources of supply of food and other materials to the towns may be suggested. Northamptonshire has good rural data with waterlogged evidence and has potential to study the Roman villa environment and economy, while in the medieval period there is abundant evidence of the medieval rural economy which has the potential to be related to documentary evidence in some places. Derbyshire has particular potential for information about early as well as later mineral exploitation from evidence from sediments to add to that from the sites. The Lincolnshire fens and river valleys have good waterlogged remains have great potential to study the relative importance of pastoral and arable from prehistoric to more recent times, particularly for methods of animal husbandry. Future work should be directed to filling gaps in the evidence and building on the existing body of data in order to preserve the evidence by record. Integration of the information from different studies is needed to maximize the evidence from sites which will be destroyed by development, and to inform the preservation of sites in the ground.

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## Appendix 1 Key:

Key: site\* = sites in the Regional Review of Plant Macrofossils (de Moulins and Murphy 2001), reference # = from Environmental Archaeology Bibliography on English Heritage website, wr = reference from Review of Wood and Charcoal (Murphy 2001), AML = Ancient Monuments Laboratory Report English Heritage, TLAHS = Transactions of the Leicestershire Archaeological and Historical Society, DAJ = Derbyshire Archaeological Journal, Thoroton = Transactions of the Thoroton Society of Nottinghamshire, Northants Arch = Northamptonshire Archaeology, Wild = wild animal bone, Bone = domestic animal bone, Ch.pl. = charred plant remains, Chc/Oth = Charcoal / other remains, P-Ch = palaeochannel, w = waterlogged, settle = settlement, cem = cemetery, fld syst = field system, r-h = roundhouse, BM = burnt mound, + = present, ++ = moderate amount, +++ = abundant, LAU = Leicestershire Archaeological Unit closed 1995, ULAS = University of Leicester Archaeological Services, BUFAU = Birmingham University Field Archaeology Unit, T&P = Trent and Peak Archaeology Unit, Assmt = assessment of remains, unpubd = unpublished, forth = forthcoming.

(Angela Monckton 23.11.2001)



## RESEARCH AGENDA BY PERIOD: ENVIRONMENTAL ARCHAEOLOGY

### Palaeolithic topics:

- The region has great potential to build on an existing body of data from a variety of different areas and deposits.
- Creswell, Derbyshire is important for research, interdisciplinary studies, and potential for public interest with visitor centre and admission to cave sites, SSSI important for conservation of the sites and surroundings, and for study of environmental change and human activity.
- Palaeochannels of the main rivers have great potential for the study of environmental change; co-ordination and publication needed.
- Potential for information about beginnings of modern river systems from palaeochannel studies.
- Investigation of unusual deposits of good potential, such as those at Glaston and Brooksby a priority.
- Stray finds of mammoth bones and tusks could be mapped, curated and dated.
- Literature of other disciplines important, Botanical, Zoological, Geological etc. need for references to be made known to archaeologists and environmental archaeologists.

### Mesolithic topics

- Correlation of the changing environment with changes in technology needed, any opportunities to date organic remains found with lithics must not be missed.
- Analysis and dating of pollen profiles showing early clearings needed for more of the region.
- Great potential of stable isotope analysis for any finds of human bone, or any already in archive, to obtain a more representative sample of results.
- Recovery of any charred material from in situ contexts a priority for dating remains and as evidence of fire.
- Potential of palaeochannels for dated evidence of this period.
- Potential of headwaters and small catchments to provide evidence.

### Early Neolithic Priorities

- Pollen evidence for clearings, cereal cultivation and land use needed from well-dated deposits.
- Analysis of insect remains needed from dated deposits to investigate the importance of grazing.
- Analysis of buried soils a priority.
- Recovery of animal bones a priority for the region.
- Recovery of Neolithic cereals and weeds should be maximised by using large samples and studied in relation to research on weeds and cultivation methods.
- Recovery of dated charred plant remains of this period is a priority to answer questions about the spread of cereal crops and use of gathered resources. A range of large samples is recommended (50 litres) to maximise recovery; more radiocarbon dates are required.
- Analysis of the samples from Aston is in archive and should be published.
- Investigation of any settlements a priority.

### Bronze Age Priorities

- Dated evidence of new crops needed over the region; in particular further investigation of regional variation in date of introduction of spelt wheat is needed.
- Analysis of any samples of charred plant remains needed as a baseline to compare with later samples in the study of arable expansion (see LBA/IA section).
- Recovery of evidence of hedges for control of animals.
- Evidence of the 1159 BC catastrophe/volcanic event (Baillie 1995).
- Evidence for landuse from study of a range of remains necessary, insect remains, plant macrofossils as well as pollen should be analysed.

### Neolithic-Early Bronze Age Agenda summary.

1. Environment and landuse, dated pollen evidence needed.
- Clearings, duration, size and use.
  - Woodland clearance, does date vary in region?

## 2. Prehistoric Farming: Arable and pastoral

- Beginnings of cereal cultivation, dates of first cereal pollen - does this vary in region or nationally?
- Spread of crops, dated charred crop remains, regional variation or comparison with other regions.
- Investigation of information from weeds of the crops.
- Importance of cereals in relation to gathered food, any change over time, differences in region or site types.
- Balance of meat and plant foods, (stable isotope analysis of human bone used in Cotswold tombs to look at importance of plant food in the diet. see in Fairbairn 2000).
- Evidence for exploitation of domestic animals.
- Evidence for pasture.

### Neolithic-Early Bronze Age, Gaps in the evidence:

Evidence from settlements

Good groups of plant remains

Animal bone assemblages

Synthesis of dated landscape and landuse information.

Unpublished work a problem.

### Late Bronze Age/Iron Age Themes

- Are there differences in dates of woodland clearance and what woodland remained?
- Landscape/Landuse: More information from dated palaeochannels and waterlogged deposits providing evidence of the general and more local environment is required. These deposits provide a snapshot at the sampling site which can build into a general picture at the time. Single widely spaced sample sites are usually taken from palaeochannels and more complete information could be obtained if more sample sites are used. Dating more samples can give better resolution. Seeds of land plants should be selected for AMS dating.
- Information from river valleys needs co-ordination, more publishing and synthesis)
- Dating alluviation and mapping and dating river channels (cf Trent valley project).
- Dating sites of this period is problematic in the Iron Age because they fall in a flat area of the radiocarbon calibration curve so needs careful consideration. Multiple samples with known stratigraphic relationships should be assayed and the results calibrated by statistical analysis (see Bayliss 1999). Other methods should be considered.
- Important to look for regional diversity in expansion of agriculture and in the relative importance of animals and crops. Are there differences on different soils? (M. van der Veen pers. comm.) The region includes the fens of Lincolnshire and the floodplain of the Trent, heavy clays and upland geologies to compare. Some differences appearing already and great potential for further work particularly on charred cereal remains and arable weeds in relation to other evidence from sites.
- Study of Development of farming in different parts of the region.

### Iron Age and Roman transition

- First evidence of introduction and/or production of new crops (spelt wheat, bread wheat, rye, oats, pulses and the herbs and fruits which come with the Romans.
- Evidence of high status (slaughter of young pigs or other animals, hunting, fruits exotics) or of impoverishment of sites. Could provide important evidence of IA/Roman transition.

### Gaps in evidence and Topics to investigate LBA-IA

Recovery of animal bone assemblages a priority.

Pollen and waterlogged remains of this date associated with sites a priority.

Large settlement sites outside Northamptonshire sampled for comparison.

Analysis of remains and dating from boundary ditches of field systems needed.

Evidence from hillforts lacking because of old excavations, any opportunities to sample or analyse old samples from archive would be useful.

#### Roman topics

- Evidence of arable farming methods from charred plant remains needed. There is an increase in disposal of spelt wheat chaff and introduction of corn driers both of which indicate changes in cereal production and bulk processing. Analysis of remains can provide evidence of function of corndriers which can have a number of purposes.
- Evidence of arable expansion is required from pollen bearing deposits to add to the evidence from more abundant cereal remains from sites for agricultural expansion.
- The evidence for the use of fodder should be examined, e.g. hay from Causeway Lane, Leicester, and Stanwick, Northamptonshire.
- Analysis of weed floras and study of weed ecology may produce evidence of extensification of agriculture and may help to indicate the source of cereals.
- There is an increase in the variety of food available, some imports and some introduced plant foods and flavourings and these are found in the towns and some of the larger settlements.
- Supply of crops and meat to the towns could be investigated by comparison with Rural sites.
- Villa estates have potential where sampled to provide evidence of economy, perhaps to supply other places.
- All the environmental evidence from a site must be considered together and in relation to other evidence from sites to make any conclusions about site economy.

#### Roman; Gaps in the evidence:

Lack of environmental evidence from SMALL TOWNS

Lack of sites with sampling in Derbys

Studies of the villa and rural economy needed.

Trade routes for fish and oysters needed

Evidence of IA/Roman Transition

Evidence for End Roman to Saxon

#### Anglo-Saxon topics

- Timing of change from spelt to free-threshing wheat.
- Evidence for hiatus in cultivation or not. Any evidence of frost ring-event of 540AD (Baillie 1995) detailed pollen diagrams are showing this as a significant environmental event.
- Introduction of crop rotation.
- Agricultural expansion.
- Timing of the introduction of rye wheat, dating evidence needed.
- Animal husbandry, changes and development.
- Exploitation of woodland.

#### Medieval themes

- One of the main objectives for the period is to study the relationship of towns to the countryside in order to establish how towns were provisioned.
- Development of farming and the introduction and spread of new crops such as rye wheat. Rye and oats also increased in occurrence in this period. Weed seeds found with the cereals can show the more intense cultivation of clay soils and some leguminous seeds found with the cereals may suggest crop rotation was being practiced.
- The increase in size of some domesticated animals by the Late Medieval period as well as changes in animal husbandry to include dairy products (Albarella 1997).
- Diet and living conditions: A wide range of foods and other evidence recovered from the towns has provided such information for Leicester and Lincoln although more data is required to expand the picture already obtained to other areas of these towns. Evidence is needed from small towns, monastic sites, castles, and most particularly from rural sites for most of the region.

Medieval topics:

- The introduction and distribution of rye wheat.
- Crop rotation and field systems
- Changes in animal husbandry (meat, wool, dairy)
- Butchery and trades using animal products (horn, bone, hides, tanning)
- Supply to towns, food and other products.
- Sea fish technology and trade
- Freshwater fish production and supply
- Urban diet and living conditions
- Woodland management
- Environmental evidence of land use

Post-medieval to Modern topics:

- Changes in animal husbandry
- Introduction of improved breeds of animals
- Trades in animal products
- Animals used for traction and transport, change from use of large cattle to horses.
- Introduction of new plants as crops or garden plants (particularly New World introductions)
- Possible changes in diet and living conditions
- Recovery of evidence from rural sites, which is lacking at present.
- Evidence from higher status sites status in the region is needed to compare with those in other regions.
- Living conditions and diet of workers in trades and industries

## **Appendix 2: PROPOSED THEMATIC RESEARCH AGENDA**

**ENVIRONMENT:** Change, human impact and landuse.

The resources for the study of environmental change, natural or anthropogenic, are ancient deposits in caves and fissures, and waterlogged deposits of palaeochannels of main rivers and headwaters, bogs and mires which contain plant and animal remains preserved in anaerobic conditions.

Analysis of the flora and fauna including land snails and small mammals, from deposits provides evidence about the environment in the past. Analysis of sediments by micromorphology and other methods, chemical analysis of phosphates and other minerals, contributes to the evidence of the environment and landuse. Sometimes it is argued that natural deposits such as bogs and old river channels are not archaeological, however, there has been human impact on the landscape since at least Mesolithic times so these deposits are often not entirely natural. The study of vegetation and other changes from such deposits provides evidence of the environment and activities of people in the past. Even where deposits are considered natural from the end of the last glaciation and before, these show the environment inhabited by people at times in the past, revealing the climate, vegetation and animal resources available, which determined the lifestyles of the people.

The earliest deposits from caves and fissures in open country can contain animal bones and remains of microfauna, such as small mammals and land snails, which are good environmental indicators. Coprolites may be found which may contain pollen as well as other plant and animal remains. Charred remains may provide material for dating and evidence of the use of fires. Such deposits can provide rare early evidence and if found the data should be maximised by strategies of fine sieving, using 0.5mm meshes, for complete recovery of material, analysis of animal and plant remains, and use of appropriate scientific dating methods.

The palaeochannels of the major rivers tend to become silted at times of change and destabilisation of soils. They have been found to represent the major changes at the end of the last glaciation when melt waters formed and changed land drainage routes and study of these provides evidence about the origin of the modern river systems and about the environment inhabited at the time. Woodland clearance from the Early Neolithic period onwards was another phase of destabilisation of soils, caused mainly by the activities of man, and palaeochannels from this time show the changes in the woodland which seems to have occurred at different times in different areas. Later, increases in cultivation also gave rise to silting of channels and alluviation. These events may be traced by dating the channels in conjunction with a study of the preserved pollen, plant macrofossils, insects and other remains to provide evidence of environmental changes in various parts of the region. The investigation of the timing of such changes over the region is a priority.

Evidence of landuse is also required and waterlogged deposits have the potential to reveal the extent and type of woodland, use of land as pasture and the presence of cultivated land and type of crops cultivated. This information from pollen, plant macrofossils and insect remains should be collected as a minimum in order to build a picture of the inhabited landscape and exploitation of the land. Other remains, such as diatoms, can show hydrological conditions and the evidence should be maximised wherever possible. Study of landsnails can contribute to evidence for the local environment as can the analysis of soil phosphates. Buried soils should be studied by such methods as soil micromorphology, when found from sites and monuments, because they can provide a history of the previous land use. Information about the environment of sites and their surroundings is required in order to interpret activities on sites and deposits with the potential to provide such evidence are a priority for study.

Evidence of the effects of large-scale environmental events or catastrophes noted in the dendrochronological record at 1159 BC and 540 AD for example, may be discovered by detailed analysis of pollen profiles.

More information is required from dated palaeochannels and waterlogged deposits to provide evidence of the general and more local environment. These deposits provide a snapshot at the sampling site which can build into a general picture at the time. Single widely spaced sample sites are usually taken from palaeochannels and more complete information could be obtained if more sample sites are used. For example mid channel and edge of channel samples can give different types of information on, for example, water conditions and land use from the study of insect remains; samples from valley bottom and sides can provide evidence of different types of woodland and clearing dates from pollen analysis. Dating more samples can give better resolution. Seeds of land plants should be selected for radiocarbon dating by the AMS method. Other materials should be considered for dating where appropriate. Information from the major rivers and tributaries with dating evidence needs co-ordination, publication and synthesis. Dating alluviation, mapping and dating river channels required for the region for all periods including medieval and post-medieval in order to reconstruct information about past landscapes.

#### DEVELOPMENT OF FARMING: pastoral and arable

The first evidence of pastoral farming may be found in the identification of animal bones of domestic animals, and from pollen diagrams of woodland affected by the possible collection of fodder and clearings possibly used as pasture. Hence early pollen profiles should be recorded in detail to examine duration of clearings, and should appropriate deposits be found, sampling for insect remains should be carried out to examine for evidence of pasture. Early pollen profiles should also be examined for evidence of cereal pollen to find the earliest evidence of cultivation and also look at this within the region for variability, and for comparisons with other regions.

The nature of early cultivation is being questioned so recovery of dated charred cereals is important. The weeds which occur with the cereals may indicate if short term cultivation or more continual garden-type cultivation was carried out which may contribute to the debate about temporary or permanent settlements. Identification of early crops and their weeds is a priority so sampling should be carried out to maximise their recovery. A range of samples of 50 litres in size is recommended. The relative abundance of cereals and gathered fruits and nuts should be considered on different types of sites and parts of the region from dated remains, this may help to establish where early cereals were being grown. The importance of pastoral farming should be investigated and evidence for the seasonal use of lowland pasture considered. There is a shortage of evidence from early settlements nationally so full investigation should be carried out including environmental sampling if the opportunity arises.

In the Bronze Age the importance of pastoral farming in the fens has been described and possible differences in the methods used in the main river valleys suggested by Pryor (1998). This should be investigated in the region from remains in waterlogged ditches and palaeochannels which can provide evidence of land used as pasture. Hedges may have been important as boundaries to contain animals, and plant remains from these may survive in earlier features in more of the region. Study of animal bones, where they survive, provides information about the proportions of animals kept and the possibility of investigating their trade or exchange could be considered. It has been suggested that arable farming is relatively less important during this period and this should be investigated in the region in relation to other areas of the country. The possibility of garden type cultivation could be investigated if any good weed assemblages were recovered from this period. The first occurrences of spelt and groups of charred plant remains should be recorded as a baseline to investigate the development of arable farming in the succeeding periods.

In the Iron Age the spelt becomes more common and the quantity of charred cereals found increases, the occurrence and timing of this should be traced in the different parts of the region. Evidence for new crops and weeds and crop husbandry may be investigated by the study of charred plant assemblages. The evidence of agricultural expansion may be found in pollen profiles at this date. This expansion may represent the development of more balanced mixed farming in parts of the region, although some settlements are probably mainly pastoral. Cereals are usually present on

these sites and the possibilities of small scale production or trade could be investigated if the pattern of evidence for the region could be established. Pastoral farming may be evident from pollen and insect data, and from animal bones which have shown that the proportions of the different domestic animals may vary in different areas perhaps related to the type of land. Also the interdependence of pastoral and arable should be considered because animals are important for ploughing and manure while crops may provide winter fodder as well as food for people. This may affect the extent of over wintering animals and slaughter patterns. The use of wild and woodland resources should be considered and the extent of surviving woodland requires investigation. Comparative data is needed for the region to establish the types of economy on different geologies and different settlement types so similar sampling methods for the recovery of plant and animal remains should be used. There is a lack of evidence from the hillforts in particular.

In the Roman period evidence for new methods of farming and increased production should be investigated by comparable sampling of rural and urban sites in the region for charred plant remains. The transition from the Iron Age is a priority for investigation when the opportunity occurs. Increased production of cereals may be detected in the disposal of more chaff and a difference in the use of chaff as a fuel for processing cereals in corn driers; recovery of charred plant remains from such features is necessary to provide evidence of the type of cereal processing or of malting carried out. Chaff may also have other uses, or have been traded, which should be investigated. The incidence of arable weeds should be recorded and crop husbandry investigated in comparison with other areas of the country (cf van der Veen 1992). Villas and the rural economy needs investigation in much of the region to compare with evidence from Northamptonshire and to compare with the plant resources found in the towns. The spread of new crops and foods could be investigated. The production of fodder and use of pasture is important and pastoral farming needs consideration in terms of continuity or change from previously. With a few exceptions, there is a general lack of good groups of animal bones from rural sites and their recovery is a priority. Investigations to find out if larger animals for traction correlate with with evidence from plant remains for cultivation of heavy soils may be worthwhile. Evidence for the scale of production may be seen in the quantity of animal bones found in urban deposits which may indicate methods of animal husbandry used in the countryside. The importance of secondary animal products should be considered. There is a lack of environmental sampling of the small towns in the region and these sites require investigation for evidence of agricultural activities.

At the start of the Saxon period the possibility of continued use of spelt in different parts of the region requires investigation, as does other evidence from the transition period. The timing of the change to free-threshing wheat, probably bread wheat, is of interest as is a comparison of animal husbandry with the Roman period. More evidence is needed to show if a decrease in evidence from settlements and agriculture occurs to the same extent over the region and when revival occurs. Good evidence from Northamptonshire exists for comparison with the rest of the region. At the end of the period there is the introduction of rivet wheat as a crop and the timing of the introduction and spread of this new crop during the medieval period warrants investigation.

The medieval period has many documentary records of field systems and production of crops and animal products but recovery of remains from sites to show the actual crops grown and animals kept is patchy for the region. It is a priority to study the remains in the light of the documentary records and information from economic history. Northamptonshire again has good rural evidence of arable and pastoral farming with evidence suggesting the improvement in animal husbandry and the use of crop rotation. Evidence for the spread of new crops, such as rivet wheat and fodder vetch, should be investigated as well as the increase in rye cultivation in some areas, and any evidence for the cultivation of the mixed crops maslin and dredge. Analysis of charred plant assemblages can provide evidence of the cereals and processing particularly when recovered from kilns or ovens. More evidence of the rural economy in the region is needed for comparison to chart the developments before the Black Death and to record any subsequent changes. Changes in this period include not only improved animal husbandry, but also the increase in the wool trade and the resultant effects on the countryside and recovery of rural animal bone assemblages is required for

more of the region. Investigation of provisioning the towns is a priority for this and the succeeding period. In the post-medieval period these changes continue with the development of dairy produce and change to the use of horses for traction, and there is also the first evidence of improved animal breeds. Animal bones of improved breeds are rare finds because few post-medieval deposits have been excavated and recorded so recovery of well dated animal bone assemblages from this period is a priority. The medieval to post-medieval period also includes the development of market gardens to supply the towns. The whole period has the potential to study the evidence in relation to documentary evidence about crop yields, animal produce and known field systems to elucidate the timing and spread of developments in the region. When the number of known settlements is considered few have been sampled and there is a lack of evidence from rural medieval settlements for much of the region, post-medieval deposits have rarely been sampled, there is a shortage of samples from monastic sites, castles and other higher status sites.

#### LIVING CONDITIONS: rural and urban

If investigated over time the changes in technology and variety of foods and other produce can be seen and compared between for example, rural and urban sites, to contribute to investigations of status, economy and social organisation. Remains can also indicate trades and activities on sites and some indications of the health of the people can be obtained. Hence as well as providing evidence of environment and food production analysis of samples can assist in showing how people lived in the past.

#### Food and diet

Food is not only essential but is of some interest to everyone and the change in food procurement and production accompany the major changes in technology. The earliest evidence is from butchery marks on animal bones while there is little evidence for consumption of plant-derived foods. Human bone can be analysed for stable isotopes to show the type of diet; carnivorous, omnivorous or vegetarian and such studies have great potential to reveal differences between different groups of people at different times. The evidence for a terrestrial carnivorous diet of a Mesolithic individual at Staythorpe, Nottinghamshire, is one of few studies nationally. Such studies could contribute to establishing the relative importance of meat and plant derived foods in the Neolithic and Bronze Age diet if human bones are available for analysis. This work has great potential, particularly for these earlier periods where other evidence is rare.

In the prehistoric period evidence for the foods available can be found from the plant and animal remains on sites which should be recovered routinely, particularly when well preserved assemblages are encountered. The proportions of domestic animal bones and their contributions to the diet depending on the size of animal can be estimated. Hunted animals may have been used to a greater or lesser extent to supplement or add variety to the diet. The crops and gathered plant foods can be identified from charred, mineralised or waterlogged remains but their contribution to the diet is difficult to assess. Introduction of new crops can however be recorded, and the increasing importance of cultivation seen in a range of evidence including structures for storage of grain. More attempts at assessing the food produced could be made by applying results from experimental data, such as that from Butser Experimental Farm, while ethnographic evidence may assist in suggesting how animal and plant derived foods were used over the seasons of the year.

Before the Roman period there is little evidence for the way food was prepared although there has been some speculation about recipes. Roman recipes are known from writers at the time which allows some interpretation of the way foods were prepared in this country from the range of resources known to be available. Evidence of greater variety of foods at the end of the Iron Age has been found on some sites and more evidence should be sought when sites of this period are found to add to the picture of possible influence of trade and contacts. There is an expanding amount of evidence for cereals, fruits, vegetables, herbs and flavourings from the Roman towns and



a few villa sites, however study of more sites is required as the evidence is patchy in the region. In addition some of the evidence is difficult to find, such as that for vegetables which are used before they set seed and would rarely be burnt, they may occasionally be found in waterlogged deposits, hence extensive sampling is needed to find them. Animal bones provide good evidence of the types of meat consumed and the range of domestic fowl and their eggs, and the wild species consumed. Oysters were brought to the towns and their study can provide evidence of their sources. Evidence is growing for the consumption of both freshwater and marine fish found by sieving deposits in Leicester and Lincoln but this evidence is needed from these and other towns, and from a wider range of site types. Beer may be inferred where evidence of malting is found from the evidence of germinated cereal grains. Imported foods such as wine, olive oil and fish sauce are known from their containers. Of the small towns only Dragonby has been investigated by sampling and a priority is to investigate the evidence for diet for more of the small towns to find out how life in them compared to the larger towns.

From the Saxon period onwards there is great scope to study the changes in foods available and their preparation and use in relation to written accounts and documentary evidence. Recovery of the range of plant and animal remains from dated deposits is particularly important for the Saxon period where evidence is rare. In the medieval period some evidence is available to show the foods available in the villages, although surprisingly few village excavations have been carried out and sampled with the exception of the work in Northamptonshire. More village contexts require sampling in future. More evidence is available for the towns of Leicester and Lincoln to show a wider variety of foods than known at present from the villages. In the towns meat from the domestic animals and a variety of fowl and wild species was consumed. A wider variety of marine fish from deeper waters is found in this period in Leicester thought to reflect improved fishing technology, oysters were also consumed. Freshwater fish is also known from the towns from the rivers and probably from fishponds, the supply of which requires further investigation. Cereals, pulses, some vegetables, herbs and food flavourings, fruits and nuts are known but as in the Roman deposits a range of samples is required to recover the evidence. The variety of foods increases in the post-medieval period with the introduction of plants into the country. Although this is known from documentary evidence the spread of the use of new foods to the general population is not well known and more sampling of deposits of this date may answer this question. More investigation of urban deposits is required to compare with village sites. There is a lack of evidence from monastic sites and higher status sites which have the potential for a greater variety of remains if wells, cesspits and latrine deposits are found and sampled as in other regions.

## Health and status

Approaches to investigation of the health of people include study of human bones for pathological conditions and indications of diet and lifestyle. Cesspits have been found to contain eggs of parasites of the human gut indicating worm infestations of the people. Evidence of status is difficult to assess from food remains but a varied diet with imported foods and good cuts of meat can contribute to the evidence for a higher status lifestyle, particularly when considered in the context of other finds and site type. Sampling well dated deposits associated with settlements and buildings known from documents is a priority for the investigation of lifestyle and status of the poor as well as the rich.

## ACTIVITIES, domestic and trade

A range of activities may be reflected in samples and some examples are included here.

Domestic occupation can be typified by samples interpreted as waste from food preparation of cereals and from food waste such as meat bones. Sampling a range of contexts can show the difference of domestic and other activities on prehistoric and later sites. Activities such as crop

processing and butchery may be found by examining groups of remains and analysis of samples can show the type of activity and the areas where they were carried out.

Crop processing and malting may be found from the evidence provided by charred cereal remains. There is no evidence for malting earlier than the Roman period in the region, however some corn driers from this period, and ovens or kilns of medieval date have been interpreted as malting kilns from the presence of germinated grains. Other crop related activities, the difference in the cereals used and methods of processing can also be investigated from charred plant remains. The recovery and analysis of such remains is a priority because these features have a number of functions and their purpose cannot be assumed without evidence from the remains in them. Other cereal related activities may be investigated such as marketing, milling and baking particularly in the medieval period onwards. The location of such activities in relation to the settlements, and particularly the towns, can provide evidence about the supply of cereals.

Butchery methods and type of meat consumed can be found by analysis of animal bone assemblages and study of cut marks on bones. The changes over time can be seen in the differences between Roman and medieval assemblages for example. The areas of settlements where these activities took place can be found from the waste. Examples of scavengers such as ravens and kites in urban contexts in Leicester add to this information. The complete recovery of good assemblages of animal bones by sieving large bulk samples is a priority when such material is found.

Rubbish disposal varied over time on different settlement types from scatters of waste, deposits or dumps in pits and ditches, middens and manuring spreads, to purpose built cesspits and finally to communal dumps and removal by vehicle. Identification of flies and insects from cesspits can indicate conditions of the pits and treatment with lime may have been carried out to deal with the problems they caused. Rubbish pits may contain small mammal bones as evidence of rodent pests and environmental indicators. The rubbish itself provides much of the information about life in the past and the methods of disposal and change over time are of interest as they reflect the organisation and conditions of the settlement. A range of bulk samples is required from such deposits as well as appropriate analysis for other remains.

Trades can be found from analysis of the waste such as antler or bone working off-cuts, and horn cores from horn working. Tanning and animal skin preparation for other purposes can be found from the waste bones from the skins and cut marks of skinning on the bones. Hence analysis of bone assemblages provides evidence of such activities and sieving large bulk samples for the complete and consistent recovery of the large and small bones is necessary to provide this information. Analysis of organic residues can be considered when tanning pits are suspected. Evidence for flax retting has been found at West Cotton from plant remains in waterlogged deposits and should be considered as a possibility elsewhere. Other trades such as dying may also be found from plant remains but have not been found in this region to date.

Evidence about fish consumption can be found from the remains of freshwater and marine fish remains in pits of Roman and medieval date found even at inland sites such as at Leicester. The changes in the fish consumed can indicate changes in fishing technology. The presence of freshwater fish shows some were from rivers and fish traps are known from the Trent, for example, where they have been investigated regarding their position using analysis of caddisflies to show the water flow. The culture of fish in fishponds requires more investigation as few have been studied.

Woodland management was important for the supply of fuel and timber from prehistoric times. Evidence for the wood used as fuel can be found by analysis of charcoal on occupation sites and associated with metal working. New approaches to charcoal analysis need to be found for the interpretation of this information (Murphy 2001a). Timber may be found as burnt posts but when found as waterlogged wood can provide dating evidence by dendrochronology and information about woodworking as well as contribute to information about woodland management. Collection and

synthesis of such information is required for the region because dated wood from palaeochannels can contribute to dating channel evolution as well as providing evidence about woodland in the region.

Pasturing, fodder production and woodland pannage are all important aspects of animal husbandry and evidence could be found for these activities from studies of landuse from evidence described earlier.

Gardening may be suggested from the finds of seeds of possible garden plants which may have been ornamental flowers or have uses as food flavorings or herbs. A few examples have been found from Roman Leicester and Lincoln, with more variety in such plants being found in the medieval and post-medieval periods but only as occasional seeds. Pollen of a few possible garden plants and grape vine has been recovered from a well in post-medieval Leicester. An interesting project by the National Trust at Lyveden New Bield in Northamptonshire has recovered pollen including that of roses and pinks from the moat sediments of the Tudor garden. Such information adds to the evidence for reconstruction of gardens and would be of interest from more sites. There is a lack of samples from monastic sites which may provide evidence of herbs and other plants. Sampling such deposits would be of great interest.

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