Chapter 2 – The Thames and changing environments in the river valley

THE PALAEOHYDROLOGY OF THE THAMES AND ITS FLOODPLAIN

The Late Iron Age and Early Roman Period (AD 1–250)

The palaeohydrology of the Upper Thames is much better known than that of the Middle Thames. The Upper Thames was experiencing major hydrological changes during the first millennium BC caused by clearance and agriculture in the catchment (Robinson and Lambrick 1984; Robinson 1992a). This resulted in a rise in the water table of the floodplain and, by the middle Iron Age, seasonal inundation of lower-lying areas of the floodplain. This process has been studied at Yarnton (Robinson and Hey forthcoming), and is discussed in detail in Lambrick *et al*. forthcoming. Although the extent of flooding increased progressively during the middle Iron Age, some areas of the floodplain escaped its effects. The action of the late Devensian braided streams had left an undulating surface to the gravel of the floodplain, which is now covered with fine alluvium, and in places gravel islands project through the clay. Settlement at Port Meadow, Oxford, for example, was on islands above contemporaneous flood levels (Lambrick and Robinson 1988) and the middle Iron Age settlement at Mingies Ditch, on the floodplain of the Lower Windrush, experienced little flooding until the medieval period.

No investigations have been made of major palaeochannels of the Upper Thames of middle Iron Age date. However, sediments were analysed from the bed of a channel of the Thames which ceased to be active at the end of the Bronze Age at Wallingford Bypass Bridge (Cromarty *et al*. 2006, 133-4). The aquatic insects and molluscs comprised a rich fauna of a well-oxygenated calcareous lowland river in all its aspects. These ranged from lengths with rapidly flowing water over a stony bed to more slowly flowing water over a silt bed, from areas of open water in the centre of a channel to densely vegetated marginal reedswamp. Such a fauna probably occurred throughout much of the length of the Thames while it remained in an unpolluted, unmanaged state and its waters only carried a low level of silt. The minor channels in the multiple channel system of the Upper Thames were not necessarily active throughout the year. At least six gravel causeways of certain or presumed middle Iron Age date were constructed across the minor channels at Yarnton which would probably have prevented any flow along them in summer (Robinson and Hey forthcoming). At Oxford, the rising level of the river drowned a large area of floodplain in the St Aldate's area between the late Bronze Age and the middle Iron Age, creating what was, in effect, a shallow lake perhaps 0.5 km or more wide (Robinson 2003a, 73-8). Such an area of water, which was probably less than 0.5 m deep for much of the year, could not be expected to have remained open for long and rhizomes of *Phragmites australis* (common reed) were found to have grown into organic sediment on its bed. A radiocarbon date of 760-50 BC (HAR-8361) was given by reedswamp peat above the organic silt on the bed. Once the river began to carry a heavy sediment load, silting is likely to have been very rapid amongst the reeds, probably raising much of the area above summer water level.

Much less work has been done on the palaeohydrology of the Middle Thames during the middle Iron Age. At Marsh Lane East, on the Maidenhead, Windsor and Eton flood relief channel, middle Bronze Age ditches which cut humified early Flandrian peat in a palaeochannel were sealed by alluvial clay but the date of alluviation is unknown. At Dorney, an area of Shepperton (Floodplain) Terrace was dissected by palaeochannels filled with fine sediments, and low-lying areas of floodplain were covered with alluvial clay which formed the modern floodplain (Parker and Robinson 2003). The low-lying areas had experienced alluviation for much of the Holocene and it is possible that there had been some Iron Age overbank alluviation although this could not be confirmed. One of the palaeochannels at Dorney had been crossed by a timber bridge in the middle Bronze Age. The central supports of the bridge had been replaced in the Iron Age. The construction of the bridge undoubtedly influenced local sedimentation patterns and by the Iron Age, organic silts and sands with a little gravel were beginning to accumulate on the channel bed. There had previously been periods of almost horizontally bedded sedimentation along the channel margins followed by episodes of erosion, cutting back almost vertically into these sediments. However, although the channel had started to silt up in the Iron Age, a sample from the bed dated to 380-180 cal BC (CAMS-57213) contained the full range of insects and molluscs of clean flowing water noted from Wallingford Bypass Bridge, including the beetle *Stenelmis canaliculata*. The Dorney palaeochannel showed what was probably a typical profile of a channel of the Thames in the Iron Age, being broad and shallow. For the Surrey stretch of the Thames, a distinction can be made between gravel 'islands' and terraces which have settlement archaeology of all periods and were above the highest levels of Holocene alluviation, and those areas with an alluvial covering, from which settlement archaeology tends to be absent. This suggests the alluvium-covered floodplain was vulnerable to flooding throughout much of the Holocene.

Thus, by the start of our period, *c* AD 1, the water table was rising in the Upper Thames and the lower areas of the floodplain were experiencing seasonal inundation with alluviation. However, much of the floodplain was still above flood levels. The river was divided into an anastomosing system of channels (parallel channels with sinuous cross-links) with rapids and pools of clean, well-oxygenated water. In the Middle Thames there was flooding, possibly with alluviation, on the lowest areas of the floodplain. The river system itself was of similar character to the Upper Thames. Sea level possibly had a limited influence on the hydrology of the Middle Thames, but the Goring Gap provides a base level for the Upper Thames, which is isolated from its effects (Robinson and Lambrick 1984).

It is not possible at present to distinguish palaeohydrological events of the last few decades of the Iron Age from those of the early Roman period, so they will be considered together. Evidence for a continuing rise in the water table of the Upper Thames was given by a 'recurrence surface' for peat preservation in the upper fills of the Iron Age ditches at Mingies Ditch (Allen and Robinson 1993, 119). The settlement enclosure ditches extended below the water table when they had been dug in the middle Iron Age. Initially, waterlogged sediments accumulated in the ditch bottom but soon sedimentation reached the top of the water table and mineral sediments accumulated until the sides of the ditch stabilised. The presence of a layer of peat above these sediments suggested that the water table had risen to at least this level. The extent of flooding on the floodplain also continued to increase in the Upper Thames Valley. Clay alluviation sealed an early Roman ploughsoil at Drayton (Barclay *et al.* 2003). An attempt, initially successful, was made to protect an early Roman cultivated field on a high area of floodplain at Yarnton (Robinson and Hey forthcoming). A boundary ditch was dug parallel to a palaeochannel and the upcast from it used to create an embankment. The ditch cut through a partly-silted Neolithic or Bronze Age ring ditch. The bottom of the Roman ditch contained shells of flowing-water molluscs and the part of the ring ditch adjacent to the palaeochannel became filled with alluvial clay. In contrast, the part of the ring ditch protected by the embankment became filled with ploughsoil.

The heavier sediment load in the water of the Upper Thames which resulted in the onset of overbank alluviation was also reflected by a change in sedimentation in palaeochannels. The sediments that accumulated in a major palaeochannel at Yarnton from the late Bronze Age to the Iron Age had a substantial organic content (Robinson and Hey forthcoming). There was a transition during the Roman period to sediments with a higher clay content. The sediments gave an OSL date of 310 BC-AD 290 (OSL-957b, at 95% confidence) from the base and radiocarbon dates of AD 140-420 (OxA-7362) and AD 250-550 (OxA-7361).

Alluviation was probably widespread on the floodplain of the Upper Thames during the early Roman period although it is not possible to date the sediments closely. For example, at Farmoor, around 0.5 m of the alluvial sequence is Roman (Lambrick and Robinson 1979, 125) but it has not been further dated whereas at Drayton, an early Roman ditch was found interstratified within the alluvial sequence (Barclay *et al.* 2003, 110). However, on present evidence, there seems to have been less alluviation on the floodplain above Lechlade than below during the Roman period.

The ditch systems associated with Roman settlements on the gravels of the Upper Thames tend to be more extensive than those of the Iron Age settlements and some of them possibly had a drainage function beyond the removal of rainwater puddles. Biological evidence from a 2nd century settlement on an island of 1st terrace at Claydon Pike suggested drier conditions than in the preceding period (Robinson 2007). It was thought that this could have resulted from the provision of ditches leading down to the floodplain. The only evidence for Roman modification to the river system was found on the floodplain of the Lower Windrush at Mingies Ditch, where much of the flow of one of the minor streams of the river had been channelled into a ditch (Allen and Robinson 1979, 117). The purpose of this was uncertain.

Much less evidence is available from the Middle Thames. Sedimentation continued in a palaeochannel at Dorney and a deposit dated to 110 BC-AD 80 (CAMS-57215) was the last to contain a significant fauna of elmid beetles, including *Stenelmis canaliculata* (Parker and Robinson 2003). It is possible that the decline in this group of beetles was the result of local factors as flow in the channel declined, but the increasing sediment load of the Thames and a muddier bed would also have proved hostile to them. The Roman town of Staines, at an important crossing point on the Thames at its junction with the Colne, was built on a low-lying island of floodplain gravel fringed with alluvial clay. Alluviation continued around the edge of the island throughout the early Roman period (McKinley 2004, 46-7).

The Late Roman Period (AD 250-410)

Seasonal flooding and alluviation probably extended over almost the entire area of the floodplain of the Upper Thames during the late Roman period. The relentless rise in flood levels was well illustrated by the developments on the Roman field at Yarnton with the flood embankment (Robinson and Hey forthcoming). Layers of alluvium spilled in through a gateway in the embankment. Alluvium sealed all the earlier Roman ploughsoils on the higher areas of floodplain at Yarnton.

A study of molluscs from Roman alluvial sediment on several sites on the Upper Thames floodplain, including Drayton and Farmoor, has shown that shallow standing water probably lingered on large areas of the floodplain from winter into spring (Robinson 1988). In addition to shells of aquatic species which had been derived from the river, there were numerous shells of the amphibious or 'slum' aquatic species *Lymnaea truncatula* and *Anisus leucostoma*. Modern studies of the molluscan fauna of the floodplain showed that these species were breeding in pools of water on the floodplain and once the pools dried out in summer, they retreated into cracks in the clay only to emerge on rainy nights. The absence of fully terrestrial snails of damp ground from Roman floodplain sediment where there was pasture suggested that at the height of summer, conditions on the surface could become hot and dry.

At Yarnton, substantial bodies of alluvial clay were deposited in all the palaeochannels. They probably became reduced to a series of pools in summer and only carried a flow of water during the winter. This alluviation would also have had a substantial influence on the drainage pattern of the floodplain. Low-lying parts would have tended to be levelled up to a height more similar to that of the remainder. A considerable quantity of alluvial clay was deposited in the St Aldate's area of Oxford, filling much of the drowned floodplain. During the winter floods, sedimentation would probably have been greatest where dead stems of reeds provided some impediment to water movement, flow becoming concentrated in open areas of deeper water. This created seasonally-flooded islands and began to define as areas of permanent water what were to become the Trill Mill Stream, the Blackfriars Mill Stream and the Shire Lake Channel (Robinson 2003a, 74-9). There was limited evidence from some sites in the Cotswold Water Park area above Lechlade for increasing wetness of low-lying areas (Robinson 2007). At Bowmoor, Whelford, late Roman peat developed above some early Roman ditches. It is likely that some of the alluvium on the floodplain in this part of the region is late Roman but direct evidence is lacking.

Flood levels increased at Dorney on the Middle Thames during the late Roman period (Robinson forthcoming a). Early Roman features around the edge of an island of gravel terrace gave no evidence of flooding whereas the late Roman features contained shells of flowing-water molluscs. Some alluviation was occurring. During the middle to late Roman period, flow ceased in the palaeochannel. It is unclear whether this was the result of natural processes or of direct human intervention. The abandoned channel was left as a pond-like feature in which peaty silts rapidly accumulated, a date of AD 250-440 (CAMS-57215) being obtained on them. The area of alluviation also became more extensive at Staines in the late Roman period (McKinley 2004, 51. 61). Winter flooding was probably a problem in part of the built-up area of the town.

The palaeohydrology of the two regions during the Roman period can be summarised as follows. In the Upper Thames below Lechlade, the extent of seasonal inundation increased until the entire area of the floodplain was experiencing alluviation. Floodwaters were slow to drain. Substantial sedimentation also occurred in channels of the river and some became narrowed or filled. The Thames Valley above Lechlade also experienced a rise in water table but alluviation was probably not as extensive. In the Middle Thames, the extent of flooding and alluviation increased during the Roman period and there was simplification of the channel system as a result of silting.

The Early Saxon Period (AD 410–650)

The Saxon palaeohydrology of the two regions can be divided into two stages. In the early Saxon period, there was a reduction in alluviation. This trend was reversed in the mid and late Saxon periods. At least initially, late Saxon flooding was not as extensive in the Upper Thames Valley as it had been in the Roman period. However, flood levels eventually became at least as high as in the Roman period, although this possibly did not occur until after AD 1000. In the Thames Valley above Lechlade, alluviation was more extensive than in the Roman period, although it is likely that much, if not all, of this alluvium is post-Saxon in date.

Magnetic dating of clay alluvium on the floodplain of the Upper Thames at Drayton suggested an average rate of accumulation of about 0.5 mm per annum from about AD 1 to AD 400 (Robinson 1992b, 201; Barclay *et al*. 2003, 170). This slowed down to a rate of 0.2 mm, or less, from about AD 400 until AD 800, suggesting a substantial decline in plough-induced erosion of the slopes of the catchment. It was not possible to show whether alluviation had entirely ceased during the early Saxon period. Similar evidence for a post-Roman slowdown in sedimentation was given by the sequence from a palaeochannel at Yarnton. An organic layer above a Roman mineral layer gave an OSL date of AD 540-900 (OSL-957c) and a radiocarbon date of AD 550-760 (OxA-7363) (Robinson 2004b). The alluvial sequence on the floodplain adjacent to the palaeochannel showed a layer of manganese staining which was continuous with the organic layer. This horizon is interpreted as an episode of soil development which occurred as a result of the stabilisation of the surface. Other evidence for the early Saxon hydrology of the Middle and Upper Thames is scarce. However, the preservation of organic material in the bottom of shallow Roman wells on the 1st terrace shows that the water table remained high to the present day. If there had been episodes when the water table fell for long, the organic remains would have decayed.

The Mid to Late Saxon Period (AD 650-1000)

In both the Upper and Middle Thames, the channel regime remained one of silting and simplification. However, Saxon documentary evidence indicates that there were many water mills on the Thames and its tributaries by AD 1000 (see Chapter 6, below). The obstructions created by the mills would have caused local rises in water table and increased the area vulnerable to flooding. The multiple channel system of the main river would probably have facilitated the construction of mills because it would have been necessary neither to place a barrage across the full flow of the river nor to dig long leats to raise the required head of water. The magnetic dating of the sediment sequence on the floodplain of the Upper Thames at Drayton showed an increase in sedimentation after the end of the early Saxon period (Robinson 1992a, 201; Barclay *et al*. 2003, 170). The rate returned to an average of 0.5 mm per annum between about AD 800 and AD 1100. An OSL date of AD 860-1110 (OSL-957d) was obtained on inorganic alluvial clay which post-dated the early Saxon organic sediments in the palaeochannel at Yarnton (Robinson 2004b, 392). A resumption of alluviation was shown by the deposition of clay over the palaeosol which had developed adjacent to the palaeochannel. Interestingly, there was a resumption of cultivation on a high island of floodplain at Yarnton during the late Saxon period, which suggests that flooding was less extensive than in the late Roman period.

Sedimentation had also resumed in the St Aldate's area of Oxford by the late Saxon period (Robinson 2003a, 75-81). Wattle fences were placed to revet the banks of islands of clay alluvium, so creating more definite edges to the broad channels of the Thames. The date range for these structures centred around AD 880. It is possible that this work was related to the construction and maintenance of the river crossing south from Oxford, including a middle Saxon timber bridge, an oak pile from which gave a radiocarbon date of cal AD 660-900. Alluvium accumulated against and above the wattle fences, while land reclamation was occurring alongside St Aldate's from the mid 10th century onwards by the dumping of sediment.

Much late Saxon / early medieval alluviation occurred over the entire area of the floodplain in the Upper Thames Valley, which has been interpreted as reflecting a return to widespread cultivation of the slopes of the catchment (Robinson 1992b; Robinson and Lambrick 1984). In the Thames Valley above Lechlade, alluviation was occurring on the highest areas of the floodplain which had experienced no Roman alluviation, for example sealing late Roman features at Claydon Pike (Robinson 2007). However, it is likely that this alluviation only reached its greatest extent post AD1000.

Some evidence is available from the Lower Kennet Valley (Butterworth and Lobb 1992). A minor channel of the river had various wooden structures of mid Saxon date that were probably related to the trapping of fish. In the late Saxon period, a timber structure, which was possibly used for water control, was inserted into the stream (see Chapter 6, below). There was a rapid flow in the channel and elmid beetles such as *Limnius volckmari* and *Normandia nitens* were well represented (Robinson 1992c). There were changing conditions on a low area of the floodplain, possibly as a result of stream management raising the water level. Molluscan evidence suggested wet grassland giving way to mudflats, followed by the establishment of reedswamp (Evans 1992, 143; Evans *et al*. 1992). Peat development eventually occurred. Alluvium possibly of late Saxon date filled the tops of 4th-century Roman features which in turn cut a plough-soil containing pottery of the 2nd century AD on the Kennet floodplain at Reading Business Park (Robinson, in Moore and Jennings 1992, 5). At Dorney, in the Middle Thames, the abandoned channel became a pond-like feature in which peaty sediments rapidly accumulated (Parker and Robinson 2003). There was certainly some medieval alluviation on the floodplain, but it has not yet been possible to determine whether this was underway before AD 1000. Likewise, alluviation continued at Staines in the post-Roman period although the sediments are not closely dated (McKinley 2004, 11).

THE VEGETATION AND ENVIRONMENT OF THE THAMES TERRACES AND FLOODPLAIN

The overall impression of the Upper Thames Valley at the end of the middle Iron Age is of a productive agricultural landscape (see Lambrick forthcoming for detailed discussion of the evidence). Any areas of scrub with rough grazing or waste were probably restricted to tributary valleys, clay slopes between terraces and geologies beyond the gravel terraces. The arable areas tended to be on the higher terraces but some grassland was also present on them. The floodplain was grassland, the lower areas experiencing seasonal flooding. As the floods became more extensive, so the pasture experienced damage from overgrazing while wet. The degree to which the gravel terraces were divided by hedges is uncertain. It is possible that the floodplain and terraces were very open expanses indeed. Some woodland was presumably present on the clay hinterland. The landscape of the Middle Thames probably showed some similarities but was not necessarily being farmed as intensively. There was possibly some heathland which had been created by earlier occupation. It is plausible that there was rough grassland and scrub between the areas of more organised landscape around settlements.

The Late Iron Age and Early Roman Period (AD 1–250)

Environmental change occurring in the Upper Thames Valley in the late Iron Age and early Roman period was primarily related to alluviation becoming widespread on the floodplain, and to agricultural intensification. This led to floodplain grassland being ploughed up just as it was becoming wetter. At least limited areas of what had been overgrazed floodplain pasture were transformed into hay meadow. Grassland was also ploughed up on the gravel terraces. It is quite possible that this was occurring alongside clearance for pasture on the clay hinterland. The linking of settlements by ditched trackways possibly brought about more division of the landscape with hedges. Small ditched enclosures proliferated around the settlements, probably surrounded by hedges with some standard trees; many were probably horticultural plots, a new type of environment for the area at this time. Beetle evidence suggested a much greater intensification of occupation of the settlements: more accumulations of various categories of decomposing organic material and more buildings. However, although various weed species introduced as a result of increased contact with continental Europe around the time of the Roman conquest became established as part of the flora of the arable fields, the synanthropic insect and rodent pests which became members of the Roman urban fauna did not manage to sustain themselves in the countryside of the Upper Thames Valley. There is much less evidence for the Middle Thames Valley, but with the exception of the hydrological changes, most of the changes described above probably also occurred in this region. The increase in the number of early Roman settlements in the Middle Thames and Lower Kennet Valleys, for example, was probably also a reflection of agricultural intensification.

The Upper Thames Valley

In the Upper Thames Valley, the period from about AD 25 until AD 150 was one of agricultural intensification. Conditions of overgrazed, ill-drained pasture with rush tussocks, seen at the Iron Age settlements at Thornhill Farm and Port Meadow (Lambrick *et al*. forthcoming), developed around a settlement on an island of 1st terrace at Claydon Pike which was occupied from *c* AD 25-125 (Robinson 2007). Scarabaeoid dung beetles, such as *Aphodius granarius*, were particularly abundant and as on the other two sites, the pasture in the vicinity of the settlement had been churned into mud enriched with dung, supporting weeds such as *Chenopodium rubrum* (red goosefoot).

As well as an intensification of grazing on the wetter areas of the floodplain, cultivated fields were being extended onto the high parts of the floodplain. Early Roman arable fields were laid out on the floodplain at Yarnton (Hey (ed.) forthcoming) and Drayton (Barclay *et al*. 2003). It is likely that grassland was also being ploughed up quite extensively on the gravel terraces as part of an increase in cereal production. Land management was rationalised at Gravelly Guy during the Roman period, probably as part of a wider re-organisation of agriculture on the 2nd terrace between the Windrush and Stanton Harcourt. Roman cultivation eventually extended over the area of the Iron Age settlement and the grassland on the 2nd terrace at Gravelly Guy (Lambrick and Allen 2004, 482).

The main cultivated fields on the gravel terraces continued to be large blocks of land without archaeologically-evident subdivisions. Weed seeds from amongst charred cereal-processing assemblages showed slight changes to the arable weed flora at the end of the Iron Age and start of the Roman period. Some additions to the flora were the result of the introduction of Southern European species through increasing trade with the continent. Charred seeds of *Agrostemma githago* (corn cockle) were found in a late Iron Age context at Barton Court Farm, Abingdon (Jones 1986). *A. githago* reached Yarnton by the early Roman period (C Stevens, in Hey (ed.) forthcoming). Other early Roman arrivals included *Scandix pecten-veneris* (shepherd's needle) and *Caucalis platycarpos* (small bur-parsley) from waterlogged deposits at the Faccenda Chicken Farm near Alchester (Giorgi and Robinson 1984). These weeds are annual plants adapted to a climatic regime in which summer drought creates bare ground for colonisation by the next generation. Under British conditions, they are dependent upon cultivation to create the open conditions needed for their seedlings to escape competition from other plants and, in the case of *A. githago* and *S. pecten-veneris*, their seeds being inadvertently harvested and sown with the crop. *A. githago* and *S. pecten-veneris* persisted as weeds in Britain until improved seed cleaning techniques in the 19th century began their decline and they have now almost been eliminated by the use of herbicides. *C. platycarpos* has never managed to become permanently established. Another annual weed which makes its appearance in the region in the early Roman period is *Anthemis cotula* (stinking mayweed). Unlike the species mentioned above, it has a more versatile ecology under British conditions and also became established on nutrient-rich disturbed ground in settlements and is therefore commonly found in waterlogged deposits on occupation sites.

Some changes in charred weed seeds amongst cereal-processing assemblages have been related to changing conditions in the arable fields. A steady rise in seeds of *Vicia* and *Lathyrus* spp. (vetches, tares etc) as a proportion of all weed seeds from the early Iron Age to the Roman period was recorded at Ashville, Abingdon (Jones 1978). Three species were involved, *Vicia tetrasperma* (smooth tare), *V. sativa* (common vetch) and *Lathyrus nissolia* (grass vetchling). The increase was regarded as a consequence of declining soil nitrogen levels due to insufficient manuring or periods of fallow to allow the fields to retain their fertility. Vetches and tares, being legumes, have a symbiotic association with nitrogen-fixing bacteria in nodules on their roots, enabling them to exploit atmospheric nitrogen. There was also a substantial rise in the proportion of seeds of *Vicia* and *Lathyrus* spp. in the early Roman period at Yarnton. This occurred alongside a decline in the proportion of seeds of Polygono-Chenopodietalia weeds, such as *Chenopodium album* (fat hen). C. Stevens (pers. comm) put forward the alternative explanation that this change was a result of an increase in the proportion of land sown in autumn. However, there was no increase in the number of seeds of *Galium aparine* (goosegrass) compared with the Iron Age samples, even though this weed is very much associated with autumn-sown crops.

In other aspects, the late Iron Age and early Roman arable weed assemblages were similar to those of the middle Iron Age. Not surprisingly, given that cultivation was extending to the edge of the flooded area of the floodplain, there was a continued presence of seeds of wet-ground plants, such as *Eleocharis palustris*. Other weeds appropriate to the soils of the gravel terraces, such as *Atriplex* sp. (orache), *Rumex* sp. (dock) and *Tripleurospermum inodorum* (scentless mayweed), maintained their status as arable weeds.

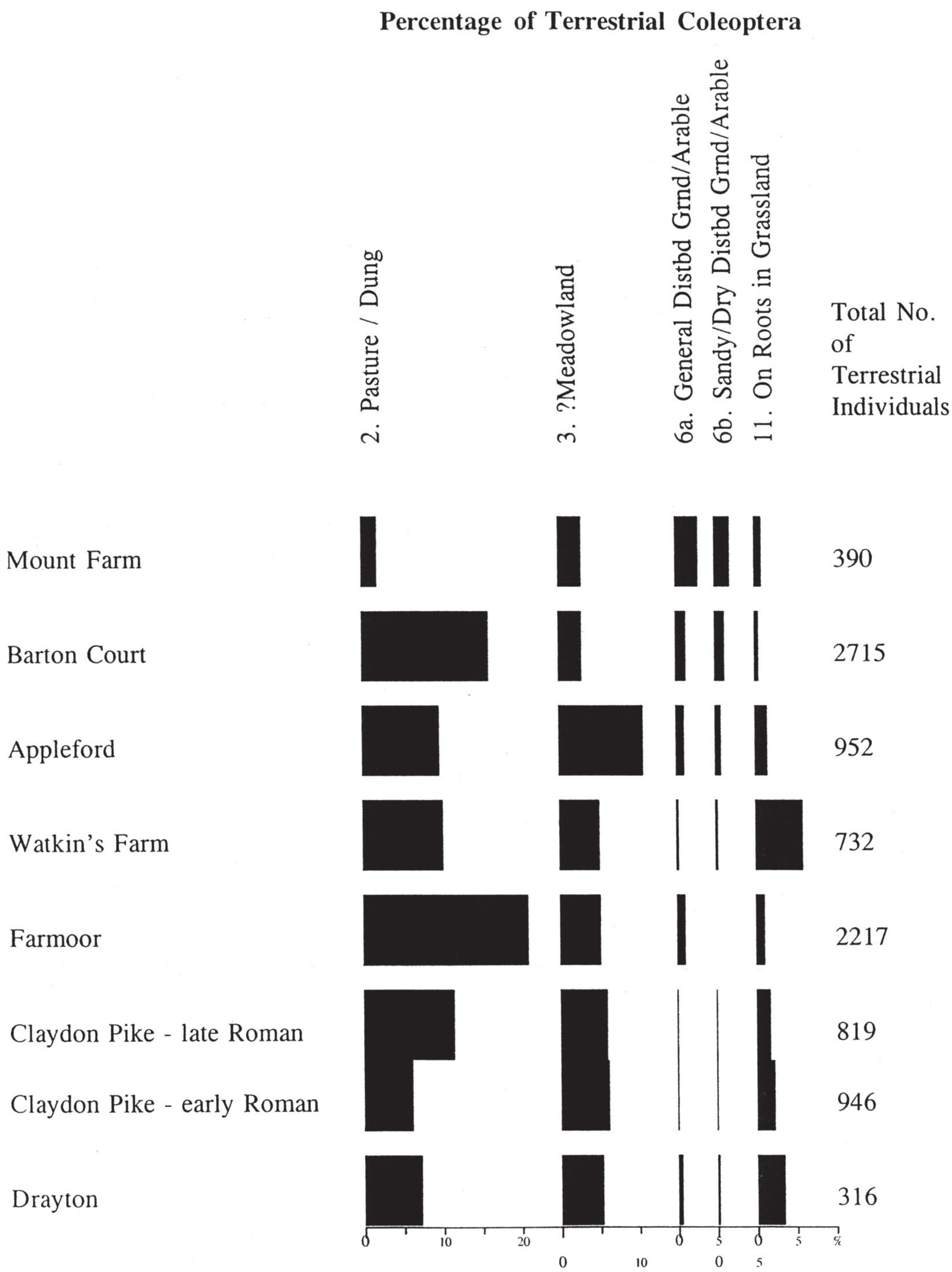
One new category of vegetation to make its appearance in the Upper Thames Valley in the early Roman period was hay meadow. It is very likely that areas of grassland were sometimes left ungrazed in the region during the Iron Age. However, a very distinctive type of species-rich grassland results if grazing animals are excluded in the spring, a crop of hay is taken in the summer and grazing of the late summer and early autumn re-growth follows. A major re-organisation of the layout of the settlement at Claydon Pike occurred in the early 2nd century AD. A wide range of palaeo-environmental evidence was available from both the settlement and some of the outlying ditches (Robinson 2007). The main environment suggested by the pollen, waterlogged macroscopic plant remains and insects was hay meadow. The seeds included *Ranunculus acris* (meadow buttercup), *Rhinanthus minor* (yellow rattle), *Leucanthemum vulgare* (ox-eye daisy) and *Centaurea nigra* (knap-weed). The pollen included *Rhinanthus* sp. and there was a much higher percentage of *Plantago lanceolata* (ribwort plantain) pollen from this phase of the site than the previous pastureland phase. Scarabaeoid dung beetles had fallen from 19.5% of the terrestrial Coleoptera in the previous phase to being absent from the outlying ditches with the reduction in grazing pressure. Clover and vetch-feeding weevils of the genera *Apion* and *Sitona*, which are favoured by hay meadow conditions, comprised 13% of the terrestrial Coleoptera.

The meadowland could have belonged to either *Alopecurus pratensis – Sanguisorba officinalis* flood meadow (MG4) or *Cynosurus cristatus – Centaurea nigra* meadow (MG5) (Rodwell 1992). MG4 is the characteristic community of the few remaining traditionally-managed alluvial hay meadows in the Upper Thames Valley whereas MG5 is the meadow-land community which develops where there is less winter waterlogging. However, with only a shallow covering of alluvium on the floodplain in the early Roman period, either community would have been plausible. Both have vegetation of tall grasses inter-spersed with a colourful display of flowers in early summer.

Hay meadow was probably not a very wide-spread type of vegetation on the Thames floodplain during the early Roman period. Evidence from an early Roman trackway ditch suggested that the hay meadow at Claydon Pike extended at least as far as Thornhill Farm (Robinson 2004a, 144). A water-logged deposit of what is now realised to have been cut hay was found in a 2nd-century pit on the 1st terrace at Farmoor (Lambrick and Robinson 1988, 60).

Although there is no evidence that the gravel terraces were divided into small fields during the early Roman period, rural settlements in the Upper Thames Valley tended to have more extensive ditched enclosure systems associated with them than their Iron Age predecessors. These often took the form of rectilinear fields or paddocks adjoining ditched trackways which linked the settlements. Waterlogged remains from these ditches often include thorny twigs of *Crataegus* sp. (hawthorn) and *Prunus* cf. *spinosa* (sloe) along with stones of these two shrubs. There have been a few examples where the twigs showed cut ends from where they had previously been cut back. It is likely that these remains were from thorn hedges alongside the ditches. It is also possible that standard trees grew in the hedgerows. The reorganised settlement of the early 2nd century at Claydon Pike had many ditched boundaries. While the pollen from this phase of the site suggested a largely open landscape, apart from some distant oak woodland, the macroscopic plant remains such as leaf fragments and seeds and the phytophagous beetles such as *Leperisinus varius* and Chalcoides sp. suggested the close proximity of osiers and ash trees. These are best interpreted as hedgerow trees.

Seeds of a wide range of horticultural crops, including both culinary herbs and orchard trees, were found from this phase of Claydon Pike. While a detailed consideration of Roman horticultural crops in given in Chapter 6, it is likely that they were grown locally and therefore that horticultural plants represented a major aspect of the settlement environment. Some of the ditched enclosures could have been orchards with standard fruit trees growing in grass. It is not possible to determine which of the seeds from the waterlogged deposits were of weeds which grew in the herb and vegetable plots but they probably included some of the annuals of nutrient-rich ground, such as *Stellaria media* (chickweed), *Polygonum persicaria* (redshank), *Chenopodium album* (fat hen) and *Urtica urens* (small nettle).



Species groups expressed as a percentage of the total terrestrial Coleoptera (ie aquatics excluded). Not all the terrestrial Coleoptera have been classified into groups.

Fig. 2.1 Roman Upper Thames Valley grassland and arable Coleoptera

The nutrient-rich, disturbed and neglected ground habitats of the early Roman settlements of the Upper Thames Valley supported the same range of vegetation found in the middle Iron Age. *Sambucus nigra* (elder) seems to have had a greater presence on them and there was the addition of *Conium maculatum* (hemlock) to the settlement flora. The reason for the expansion of *C. maculatum*, a tall biennial of damp, nutrient-rich ground, is difficult to explain. It was present in the late Bronze Age at the waterfront settlements at Runnymede Bridge (Greig 1991, 259) on the Middle Thames and at Wallingford on the Upper Thames (Robinson 2006a). However, it does not seem to have managed to colonise ordinary middle Iron Age settlement sites. *C. maculatum* made a very early Roman appearance at the town of Alchester, with seeds being present in the annex ditch of the conquest fort (Robinson 2000, 64) and thereafter it was present on many early Roman sites in the region, including Appleford (Robinson 1980, 93) and Claydon Pike (Robinson 2007).

Early Roman rural settlements in the Upper Thames Valley produce insect evidence which suggests a much greater intensity of occupation than on their Iron Age predecessors. Claydon Pike demonstrated this change well (ibid.). The abundance of *Anobium punctatum* (woodworm beetle) rose from about 0.3% of the terrestrial Coleoptera in the 1st century AD 'native' phase to over 1.4% in the 'Romanised' phase which began in the early 2nd century. The various synanthropic beetles such as *Ptinus fur* which occur in indoor habitats and in accumulations of organic material such as old straw and haystacks were absent from the 1st-century phase but comprised 1.5% of the Coleoptera from the 2nd-century phase. It is likely that the abundance of woodworm and other synanthropic beetles reached very much higher levels in the Roman towns of the Thames Valley but waterlogged deposits have not been investigated from within the towns.

The synanthropic beetles found in the early Roman settlements included occasional examples of *Stegobium paniceum* (bread beetle), a minor stored-products pest which feeds on a wide range of farinaceous materials. It was present in an early Roman waterhole at Appleford, on the floodplain terrace (Robinson 1980, 94) and had been a rare member of the British insect fauna since at least the Bronze Age (Robinson 1991, 324). This beetle does occur in grain residues but is not seen as a serious pest of stored grain. While the pit storage of grain which was practised in the Iron Age would not have been conducive to grain beetles, because of the build up of carbon dioxide which keeps the grain dormant, the above-ground storage of grain in granaries, as practised by the Romans, would have provided ideal conditions in which these pests could flourish. Several exotic species of grain beetle were introduced to Britain in the early Roman period and there is certainly evidence of very severe infestations elsewhere in Britain at this time, for example York (Kenward and Williams 1979). One of these beetles, *Sitophilus granarius* (grain weevil), was in the region at the start of the Roman period, an example being identified from the early sediments in the ditches of the conquest fortress annex at Alchester (Robinson forthcoming g). It had presumably been inadvertently introduced in the grain supply for the army from the continent. This pest was then spread by the advancing Roman army, reaching the legionary fortresses at Exeter (Straker *et al.* 1984), York (Kenward and Williams 1979) and Carlisle (Robinson 2002b) before the end of the 1st century AD. However, these serious grain pests did not become established on the rural settlements of the Thames Valley. This suggests that surplus grain was sent to the towns not long after harvest. If the grain that was needed on the settlements was stored in the spikelet form (in the case of spelt wheat, the main wheat crop in the region during the Roman period, this would mean with the grains enclosed by the tough glumes) and only dehusked immediately prior to grinding, it would certainly have been less vulnerable to pest attack. Perhaps the dehusked grain was only stored in large quantities at large villas, in the towns and at military establishments.

Granaries would also have been vulnerable to rodents. Although *Mus musculus* (house mouse) was present in the Wessex region, it does not seem to have reached the Upper Thames Valley in the Roman period. It is possible that the variety of *M. musculus* present in Britain in the Roman period did not have a genome as appropriate for competition under British conditions as the variety now present (S. Davis, pers. comm.). *Rattus rattus* (black rat) was not present in the region during the Roman period. Some damage would undoubtedly have been done by *Apodermus* sp. (field or wood mouse) but it is not as well adapted as a commensal as house mouse or black rat.

Insufficient late Iron Age to early Roman bones of wild vertebrates have been found to suggest any changes since the middle Iron Age (Lambrick *et al*. forthcoming). Deer continued to be present in bone assemblages but are very rare, while occasional finds of bones of wild duck and wild goose attest to the wetlands of the Thames Valley.

The Middle Thames Valley

Only limited evidence is available for the Middle Thames Valley. The pollen, insect and waterlogged macroscopic plant remains from the Dorney palaeochannel sequence, however, give useful results (Parker and Robinson 2003). A rise in cereal pollen and the presence of waterlogged glumes of *Triticum spelta* and a seed of *Agrostemma githago* (corn cockle) in a sample dated to 110 cal BC-cal AD 80, pointed to an increase in cereal cultivation. This was consistent with the evidence from charred cereal remains

Fig. 2.2 (1) Modern (l) and Roman (r) seed of Coriandrum sativum *(coriander) from Farmoor; (2) Roman seeds of (l to r)* Brassica nigra *(black mustard),* Brassica rapa *ssp.* sylvestris *(wild turnip) and* Brassica *sp. cultivar (eg cabbage) from Claydon Pike; (3) Roman leaf of* Buxus sempervirens *(box) from Farmoor; (4) modern (r) and Roman (l) example of the dung beetle* Aphodius contaminatus *from Farmoor. Scales in mm*

from nearby settlements which suggested that large-scale cereal-processing, or at least the use of chaff as fuel, only began in the Roman period. A decline in the proportion of scarabaeoid dung beetles and a rise in the proportion of weevils from the genera *Apion* and *Sitona* raise the possibility that some of the grassland on the site was being cut for hay.

Macroscopic plant and invertebrate remains were examined from a Middle Thames site on the gravel terrace above any likely Holocene flood levels at Thorpe Lea Nurseries (Robinson forthcoming b). The settlement appears to have spanned the entire Roman period but waterlogged evidence came from a mid-Roman waterhole. Again, conditions around the site appear to have been open. A few tree and wood-dependent beetles were present (in addition to woodworm beetles) but they were mostly species which could have emerged from wood brought to the site. The waterhole did, however, contain many prickly shoots of *Ulex* sp. (gorse) and some frond fragments of *Pteridium aquilinum* (bracken). While this material had undoubtedly been imported, the modern soil of parts of the site was sufficiently acidic for them to colonise. It is possible that some of the more acid areas of the gravel terrace supported heathland with gorse scrub, although gorse would also have grown on Bagshot Heath. The Coleoptera and the macroscopic plant remains did not give any strong indication for the proximity of pastureland, scarabaeoid dung beetles only comprising 4.5% of the terrestrial Coleoptera. Even though charred cereals were relatively sparse, the waterhole contained much waterlogged crop-processing debris. The charred and waterlogged weed seed assemblages suggested a 'Romanised' arable weed flora amongst the cereals, including *Agrostemma githago* (corn cockle) and *Anthemis cotula* (stinking mayweed). Perhaps surprisingly, apart from a few seeds of *Rumex acetosella* agg. (sheep's sorrel), no seeds of acidophilous arable were found. The pH of the gravel terrace at Thorpe Lea Nurseries was variable and one area had a covering of calcareous brickearth. It is possible that cultivation tended to be concentrated on the more fertile areas of the gravels. One potential cereal pest was present, the beetle *Zabrus tenebrioides*, which is now very rare in Britain. Under the warmer summer conditions of continental Europe, the larvae devour young cereal shoots and also climb the plants to feed on the grains. The waterlogged weed seeds confirmed by the insects indicated the waste and disturbed ground, as might be expected around a Roman settlement. Seeds of *Urtica dioica* (stinging nettle) were abundant while nettle-feeding beetles, such as *Brachypterus urticae* and *Apion urticarium*, were present along with the nettle-feeding bug *Heterogaster urticae*. Other waste ground plants included *Malus sylvestris* (common mallow), represented by seeds in company with the mallow-feeding weevil *Apion malvae*. A wide range of beetles of settlement refuse and indoor habitats was present, at the abundance which might be expected on a rural Roman settlement with timber buildings (Robinson 1991, 280-1). They included beetles of very foul organic material such as *Megasternum obscurum*, old straw and hay such as *Xylodromus concinnus* and *Typhaea stercorea*, and organic material inside buildings such as *Ptinus fur* and *Mycetophagus quadriguttatus*. Evidence for timber buildings was provided by *Anobium punctatum* (woodworm beetle) and *Lyctus linearis* (powder post beetle). Work on the environmental archaeology of a second early Roman settlement on the Middle Thames gravels at Heathrow Terminal 5 is still under way but some results are available from insect analysis (Robinson in Framework Archaeology 2005). The results so far are somewhat similar to Thorpe Lea Nurseries except that a higher proportion of scarabaeoid dung beetles suggests more pastureland.

The Late Roman Period (AD 250-AD 410)

There were no sudden changes to the environment of either the Upper or the Middle Thames that can be said to have marked the start of the late Roman period. Seasonal flooding and alluviation probably extended over almost the entire area of the floodplain of the Upper Thames by the late Roman period (see above). This inevitably caused the abandonment of the areas of floodplain cultivation at Drayton (Barclay *et al.* 2003) and Yarnton (Robinson and Hey forthcoming). It is likely that the floodplain was all given over to grassland in the late Roman period. Molluscan evidence suggested that there was pasture on the floodplain at Farmoor (Robinson 1988) but some areas would have been cut for hay and indeed a large hay scythe was found at the site (Lambrick and Robinson 1979). The late Roman period saw alluviation at its greatest extent and exploitation at its most intensive in the Thames Valley until after the Norman conquest. The loss of any remaining floodplain arable had probably been compensated for by an increase in cultivation of the clay hinterland. The grassland of the floodplain was primarily pasture, but an increasing area of it was being managed as seasonal hay meadow. The gravel terraces themselves probably presented a landscape of very large fields, each of several hundred hectares or more, divided by the natural water courses which cross the gravel terraces and the ditched trackways which linked settlements. The majority of these fields on the higher terraces would have been cultivated for cereals but the floodplain terrace would probably have supported much pasture. Some late Roman changes to the environment were the result of local development which did not fall into any wider pattern. For example, the early to mid Roman establishment at Claydon Pike which concentrated on the management of floodplain hay meadow was replaced in the early 4th century AD by a small villa which was perhaps primarily concerned with the grazing of domestic animals. It is possible that the areas of the higher gravel terraces with more acidic soils in the Middle Thames Valley were pasture tending towards heathland. There was little or no woodland on the gravel terraces although, as in the early Roman period, there was some evidence of hedgerow trees. Woodland was, however, certainly present in the hinterland. The settlements themselves had the same range of habitats as in the early Roman period: hedged horticultural plots and paddocks, weedy disturbed ground, various categories of decaying organic material, timber buildings and indoor habitats. The only significant change seems to have been a greater intensity of occupation.

There were some changes to the late Roman carbonised weed seed assemblages in comparison to those of the early Roman period, but these seem to have been related to changes in the areas under cultivation rather than changes in the ecology of the arable fields on the gravel terraces themselves. For example, at Yarnton there was a substantial increase in the percentage of seeds of *Anthemis cotula* (stinking mayweed) from less than 2% of the weed seeds in the early Roman period to over 8% of the weed seeds in the late Roman period. This weed is favoured by heavy loam and clay soils which are calcareous (Kay 1971). It is not a plant of waterlogged soils and indeed seed numbers of plants of marshy habitats, such as Cyperaceae (sedges, spike rush etc) did not increase. It is thought this was a result of cultivation spreading onto or becoming more extensive on the Oxford Clay. Many late Roman assemblages of charred cereal weeds, including those from Yarnton, show a presence of seeds of wet-ground species suggesting that cultivation extended to the edge of the floodplain or into wet hollows on the clay. Most late Roman sites in the Upper Thames Valley with waterlogged deposits have evidence from scarabaeoid dung beetles that the grazing of domestic animals continued to be important.

By comparing the relative percentages of five species groupings of Coleoptera between sites in the Upper Thames Valley it proved possible to show the importance of pastureland and gain some information about meadowland and arable (Robinson 1983). The groups used out of those given in Robinson (1991, 278-81) were: 2. Pasture/Dung, 3.? Meadowland, 6a. General Disturbed Ground/ Arable, 6b. Sandy/Dry Disturbed Ground/Arable and 11. On Roots in Grassland. The results for these groups for the mid-late Roman sites in the original study plus some additional sites are given in Figure 2.1. Mount Farm and Barton Court were well-drained sites on higher gravel terraces, the other sites were lower-lying, being situated on the floodplain terrace or floodplain edge.

The two driest sites, Mount Farm and Barton Court, had the highest values for the Carabidae of Species Group 6 which favour arable habitats: *Agonum dorsale*, *Harpalus rufipes* and various species of *Amara*, especially *A. apricaria* and *A. bifrons*. These beetles are not exclusive to arable and also occur on weedy open ground. However, there was botanical evidence for the involvement of these sites in cereal cultivation and the soils of these sites were well-suited to arable cultivation. Beetles that feed on weeds were also present at these sites, for example *Phyllotreta atra*, *P. nigripes* and *Ceuthorhynchidius erysimi*, which feed on Cruciferae (wild mustard, shepherd's purse etc) and *Chaetocnema concinnal*, which feed on Polygonaceae, especially *Polygonum aviculare* agg. (knotgrass). These two sites gave the lowest values for Species Group 11, chafers and elaterids with larvae that feed on the roots of grassland herbs and Species Group 3, weevils from the genera *Apion* and *Sitona* that are favoured by meadowland conditions. At Mount Farm, the percentage of the scarabaeoid dung beetles of Species Group 2, which suggest the pasturing of domestic animals, was very low. However, at the Barton Court Farm Roman villa (Robinson 1986), Species Group 2 comprised over 16% of the terrestrial Coleoptera, suggesting that, in addition to arable farming, there was also a concentration of domestic animals on the site. The most numerous species were *Aphodius contaminatus* and *A. granarius*, but another 16 species of *Geotrupes*, *Colobopterus*, *Aphodius* and *Onthophagus* were present.

Watkins Farm, Farmoor and late Roman Claydon Pike had quite high values for Species Group 2, ranging from around 10% at Watkins Farm up to 21% at Farmoor, suggesting pasture to have been important at these sites. *A. contaminatus* and *A. granarius* tended to be the most numerous members of the group, sometimes in company with *A. sphacelatus*. These sites were adjacent to the floodplain which, as noted above, had become grassland by the late Roman period. Not all these sites had a strong presence of Species Group 11, chafers and elaterids with larvae that feed on the roots of grassland plants. However, other phytophagous grassland insects were quite well represented, for example the homopteran bug *Aphrodes bicinctus* and the plantain-feeding weevil *Mecinus pyraster*. It is possible that winter waterlogging of the floodplain soil resulted in the low values for Species Group 11. None of the sites had sufficiently high values for Species Group 3 for the occurrence of hay meadow to be confirmed from insect evidence alone, although there was botanical evidence from late Roman Claydon Pike, for example (below), that hay meadow continued to grow on the floodplain. The relatively high value for Species Group 3 from Watkins Farm was argued as resulting from neglected ungrazed grass on the settlement (Robinson 1990, 70). The botanical evidence from Drayton suggested the vegetation of the site to have been a type of flood pasture which included some tall-growing plants which do grow in meadowland, such as *Filipendula ulmaria* (meadowsweet) and

Leucanthemum vulgare (ox-eye daisy), along with *Caltha palustris* (kingcup), which characterise this category of pasture (Lambrick and Robinson 1988, 71).

This study suggested that the settlements on the higher ground terraces tended to have more arable land whereas the lower-lying sites, especially those adjacent to the floodplain, tended to concentrate on grassland.

The majority of the late Roman cultivated fields were probably used for cereals but other crops were also grown (see below). Some of these would have had their own distinctive weed flora. Flax-processing remains were found in a well at Barton Court Farm villa (Robinson 1986, fiche 9: D11-12). They included the pods of *Camelina alyssum* (gold of pleasure), a weed which is very closely associated with flax cultivation and was developed into an oil crop in its own right in continental Europe. It gives striking clusters of yellow flowers amongst the expanse of blue flowers of the flax field. Another weed represented by its seeds in the deposit was *Agrostemma githago* (corn cockle). Although a cornfield weed, it was formerly also a weed of flax fields, and its seeds can be found in great abundance amongst waterlogged flax remains.

Pollen analyses have been undertaken on late Roman archaeological deposits on several settlement sites including Farmoor (Dimbleby in Lambrick and Robinson 1979), Barton Court Farm (Dimbleby in Robinson 1986), Mount Farm (Greig in Lambrick forthcoming) and Claydon Pike (Turner in Robinson 2007). The results confirmed the Upper Thames Valley to have been an open agricultural landscape with both arable and pasture. Trees such as oak and ash were present but any large areas of woodland were distant. However, as was suggested for the early Roman period, it is possible that there were standard trees in thorn hedges. While the thorny shrubs were hardly represented in the pollen record, being insect-pollinated, *Crataegus* sp. (hawthorn) and *Prunus spinosa* (sloe) were well-represented amongst the macroscopic remains.

Other shrubs or small trees were also present. Perhaps unsurprisingly, there was evidence from capsules of *Salix* sp. (sallow or willow) and examples of the willow-feeding beetle *Chalcoides* sp. that these shrubs grew alongside a pond at Mount Farm. More interestingly, leaves of *Salix viminalis* (osier) or *S.* x *viminalis* (hybrid osier) were found in a late Roman ditch at Watkins Farm, Northmoor (Robinson 1990). It is possible that osiers had been planted along the watercourse. Willow trees, either growing to their full height or pollarded, are now a prominent feature of the Thames. However, there is no evidence for the presence of either of the large tree species of willow, *Salix fragilis* (crack willow) and *S. alba* (white willow) in the Upper or Middle Thames before the medieval period. Thus the valley bottom would have had a rather different appearance from what is now seen as its typical aspect.

While there was no evidence for woodland on the gravel terraces or floodplain of the Upper Thames, the proportion of oak amongst the charcoal on settlement sites suggests that most sites had woodland amongst their catchment rather than just being dependent upon hedgerow trees. It is usually not possible to gain any information on the location of the woodland. At the Barton Court Farm villa, however, it proved possible to gain an unusual insight on a piece of woodland exploited by the villa. Moss had been packed between the lining stones of a deep well when it was constructed in the late 3rd century AD. The mosses, reported on by J. Dixon, were all woodland species. The most abundant, *Hylocomium brevirostre*, occurs in deep shade on calcareous soil and is at present uncommon. Many other biological remains had been transported with the moss from the woodland floor including pollen, oak leaf spangle galls caused by the gall wasp *Neurotenus*, seeds and the woodland snail *Azeca goodalli*. An 'old woodland' bryophyte flora suggested that the woodland was of ancient origin but a high value of hazel pollen and a low value for pollen of woodland trees showed that there had been human interference with the woodland. Perhaps it was an oak hazel coppice and the gall-infested oaks had not reached flowering size. The wood may have been situated on coral limestone 4-5 km to the north of the site, as is the present woodland of Bagley, which has a somewhat similar fauna and flora to that suggested by the remains amongst the moss.

The late Roman settlements of the Upper Thames Valley retained the various habitats of weedy neglected and nutrient-rich soil with the same range of weeds that were present on the early Roman settlements. There seems to have been a greater intensity of occupation than previously, leading to a greater range of synanthropic insects. For example at Farmoor, *Ptinus fur* had been joined by *Stegobium panicum*, *Tipnus unicolor*, *Mycetophagus quadriguttatus*, *Typhaea stercorea* and *Tenebrio molitor*. All live in material such as old straw, grain residues, stable debris etc. However, serious insect pests of stored grain continued to be absent from rural settlements in the Thames Valley.

Bones of wild vertebrates are more common on Roman sites than on Iron Age sites but this was probably due to social factors rather than environmental change. Throughout the Roman period, there is a slight presence of bones and antler fragments of roe and red deer but they are never sufficiently abundant to suggest the close proximity of woodland, in contrast, for example, to the villa of Shakenoak, on the Limestone at the foot of the Cotswolds. Exploitation of scrub or woodland at Shakenoak was strongly marked by a higher proportion of deer bones (Cram 1978). The scattering of other species recovered from Roman sites is insufficient either to give a detailed environmental picture or a good impression of the range of species present. For example, the other wild mammals and birds from the Barton Court Farm villa (Wilson 1986; Bramwell *et al*. 1986) were:

mole	wild goose
water vole	duck *cf.* mallard
field vole	duck *cf.* garganey
bank vole	golden plover
hare	buzzard
	sparrow hawk
	kestrel
	rook/crow
	jackdaw

Interestingly, a bank vole mandible was found cemented to the sternum of a part skeleton of a buzzard, possibly part of the crop contents of the bird's last meal.

There is little evidence for the environment of the Middle Thames in the late Roman period. The pollen, waterlogged seed and insect sequence from the Thames palaeochannel at Dorney suggested that a greater proportion of the grassland alongside the palaeochannel was hay meadow than during the early Roman period (Parker and Robinson 2003). The proportion of scarabaeoid dung beetles declined until they were less abundant than the weevils from the genera *Apion* and *Sitona*. Further evidence indicative of hay meadow conditions was given by seeds of *Primula veris* (cowslip), *Rhinanthus* sp. (yellow rattle), *Centaurea* cf. *nigra* (knapweed) and *Leucanthemum vulgare* (ox-eye daisy) as well as pollen of *Centaurea scabiosa* (greater knapweed). With the apparent increase in the extent of flooding in the late Roman period, it is likely that some of the lower-lying areas of arable on the site were abandoned. Cultivation was still possible on the floodplain of the Kennet at Reading Business Park in the mid to late Roman period (Robinson in Moore and Jennings 1992, 5)

A preliminary investigation of insects from late Roman pits and waterholes on the Middle Thames gravels at Heathrow Terminal 5 (Robinson in Framework Archaeology 2005) shows that there were few wood- and tree-dependent Coleoptera, suggesting a very open landscape. However, there was an example of the rare beetle *Platystethus albinus*, which has been recorded from isolated elderly trees as well as old woodland. Chafer and elaterid beetles which feed on the roots of grassland plants, such as *Athous hirtus*, and other phytophagous beetles, for example *Gymnetron labile*, which feeds on *Plantago lanceolata* (ribwort plantain), were sufficiently abundant to show the presence of grassland. However, although there was some evidence for grazing given by scarabaeoid dung beetles, particularly *Aphodius* spp., there was also evidence of nearby cultivated or sparsely weedy disturbed ground from the carabid beetles *Agonum dorsale* and *Harpalus rufipes*. As seems usual for Roman settlements, there was strong evidence from *Anobium punctatum* (woodworm beetle) and other synanthropic Coleoptera for the presence of buildings.

The Early Saxon Period (AD 410-650)

The end of Roman rule in AD 410 was not marked by sudden environmental changes. Indeed it is possible that the landscape of both regions remained largely unchanged from the Roman period for several decades. In the Upper Thames Valley, there was no large-scale abandonment of land on the floodplain and gravel terraces to scrub followed by woodland regeneration. A pollen sequence from the Oxey Mead palaeochannel at Yarnton (Greig 2004) which extended from the Roman period throughout the Saxon period gave no evidence for woodland vegetation. The macroscopic plant remains did not even suggest the local development of scrub (Robinson 2004b, 395). The Coleoptera showed a decline in scarabaeoid dung beetles to half their previous level, suggesting a reduction in grazing presence, but the terrestrial part of the insect fauna remained characteristic of open conditions with grassland. To what extent the Roman agricultural system survived into the 5th century at Yarnton remains unknown. If the Roman fields and pastures were entirely abandoned, rough grassland with areas of thorn scrub would have covered them within 40 years. This would not necessarily have been detected by pollen analysis because thorn scrub such as sloe and hawthorn are entomophilous (insect pollinated). However, some oak/ash woodland with hazel would have begun to succeed the scrub in less than 80 years. This should have been detected by the pollen analysis and some evidence would have been expected from the insects. Two pollen sequences away from the river gravels which span the transition from the Roman to the early Saxon period, the Oxford Science Park, Littlemore and Sidlings Copse near Beckley, show no evidence for early Saxon woodland regeneration (Parker in J Moore 2001, 213-15; Day 1991). There is some evidence of agricultural continuity from the Roman period to the Saxon period on the 2nd terrace at Barton Court Farm with the persistence of the flax weed *Camelina alyssum* (gold of pleasure). Capsules of this weed were found in a 4th-century Roman well on the site and were also identified from a well which contained Saxon pottery of the early to mid 5th century (Robinson 1986, fiche 9E5). Members of the genus *Camelina* are entirely dependent on flax cultivation for their persistence in England but *C. sativa* was the gold of pleasure most usually seen in recent times. For example Stace (1997, 266-7) notes that *C. alyssum* has been recorded as a casual (that is, an introduced plant that has not become permanently established), but very rarely, if ever, occurs nowadays, whereas *C. sativa* is still of frequent occurrence and was formerly common in arable fields. The remains at Barton Court Farm had been preserved by waterlogging so there was not the danger that they were residual in the Saxon context, as might have been the case with carbonised material. It is therefore thought likely that the persistence of *C. alyssum* at Barton Court Farm was the result of continuity of flax cultivation from the Roman to Saxon periods.

Pollen from the early Saxon well at Barton Court Farm (Greig 1986) suggested an open, relatively unwooded landscape, although there was a rise in tree and shrub pollen from 4.5% in the Roman period to 10% of the total, suggesting some expansion of woodland or scrub. In contrast, the insects showed the reverse trend, with an absence of wood- and tree-dependent Coleoptera. The intensity of grazing had perhaps fallen, with a decline in scarabaeoid dung beetles to 8% of the terrestrial Coleoptera. Somewhat similar evidence was given by waterlogged remains from a 5th- to 6th-century well on the floodplain terrace at Bishop's Court, adjacent to the Roman town of Dorchester (Robinson 1981, 269-70) and two early Saxon wells at Mount Farm, Berinsfield (Robinson and Wilson 1987, 59).

Cereals were certainly being cultivated on these early Saxon sites although the charred evidence from them is very sparse. *Galium aparine* (goosegrass) was present amongst the carbonised seeds from Sutton Courtenay (Robinson forthcoming c), which when growing as a cereal weed tends to be associated with autumn-sown crops. At Yarnton there was a distinct element of species of wet or heavy calcareous soil, including *Eleocharis* sp. (spike rush) and *Anthemis cotula* (stinking mayweed) in addition to seeds of dry-ground species, suggesting that even at this early date cultivation was not just restricted to the well-drained soil of the 2nd terrace but had extended onto the Oxford Clay on the edge of the floodplain. The occurrence of seeds of perennial weeds such as *Rumex* sp. (dock) and biennial field-edge or wayside plants, such as *Malva sylvestris* (common mallow), raised the possibility of light cultivation, the ploughing up of grassland or periods of fallow.

Seeds from the various plants of disturbed and waste ground that grew around the Roman settlements were also present in the waterlogged deposits on the early Saxon settlements. However, the numbers of *Anobium punctatum* (woodworm beetle) fell, while synanthropic beetles were reduced to occasional examples of *Ptinus fur*. This would suggest that the settlement had neither the scale of timber buildings nor the range of indoor habitats that were to be found on the Roman settlements in the regions.

On the Middle Thames, sedimentation in the palaeochannel at Dorney probably continued after the end of the Roman period (Parker and Robinson 2003). Conditions remained open with the floodplain probably remaining grassland.

The overall impression of the early Saxon environment of the Upper Thames Valley is that little, if any, land on the floodplain or gravel terraces was abandoned after the end of the Roman period but that the landscape was being exploited less intensively. It is possible that there was a substantial reduction in the area under cultivation but that there was sufficient grazing from domestic animals to maintain open conditions. Woodland regeneration did occur over some Roman sites beyond the gravels in the Cotswolds and the abandonment of agricultural land there was probably the cause of the reduction in alluviation on the floodplain of the Upper Thames Valley (see above; Robinson and Lambrick 1984). The insect evidence suggested that the intensity of occupation of rural settlements was much less than in the Roman period. It is likely that there had been a substantial decline in human population.

The Mid to Late Saxon Period (AD 650-1000)

The mid Saxon period saw the beginning of a re-intensification of the agricultural exploitation of the Thames Valley, which, by AD 1000, had possibly resulted in the area under cultivation approaching that of the Roman period. This resulted in alluviation of the floodplain in the Upper Thames Valley also reaching its former extent. Increasingly, floodplain grassland was being managed as hay meadow. Unsurprisingly, as population levels rose, so there was insect evidence for an increased intensity of occupation of settlements. At Oxford, wet areas of the floodplain were being reclaimed for suburbs of the town. However, it was not until after AD 1000 that the various developments reached their full extent.

Evidence from Yarnton suggested that an agricultural recovery was underway in the mid Saxon period. There was a resumption of cultivation on one of the islands of a high area of floodplain where late Roman alluviation had forced the abandonment of cultivation, a spill of gravelly ploughsoil into an adjacent palaeochannel overlying the Roman alluvium. Presumably flood levels were slightly lower than in the late Roman period but the significance of this evidence is that there must have been pressure to bring grassland into cultivation. The charred weed seeds from the middle to late Saxon phases of the Yarnton settlement suggested a full plough-arable flora. They included *Rumex acetosella* (sheep's sorrel), which is typical of the circumneutral soil of the 2nd terrace, while *Galium aparine* (goosegrass) suggested that some crops continued to be autumn-sown. By the late Saxon period, there was an increasing dominance of annual species at the expense of less plough-tolerant biennial and perennial weeds. These annual weeds either survive ploughing as seeds in the ground, for example *Chenopodium album* (fat hen), or are harvested with the crop, not completely removed by cleaning and are then re-sown, for example *Agrostemma githago* (corn cockle). This trend was possibly the result of the introduction of mouldboard ploughing or the frequent ploughing of fallow. Some of the more numerous weed seeds were of *Vicia/Lathyrus* spp. (vetch or tare) which was perhaps a reflection of declining soil fertility. Pottery scatters detected by fieldwalking suggested manuring of the fields in an attempt to retain soil nutrient levels while the charred seeds included *Hyoscyamus niger* (henbane), a plant of middens whose seeds had perhaps been introduced to the arable fields in manure.

Some of the weeds identified from Yarnton have associations with particular crops. Seeds of *Spergula arvensis* variety Linicolae (spurrey), which is a very characteristic weed of flax cultivation, were found in a well and a palaeochannel in company with flax remains. Pollen of *Centaurea cyanus* (cornflower) was identified from a palaeochannel along with pollen of *Secale cereale* (rye). *C. cyanus* is a weed very much dependent upon cereal cultivation, especially rye, with its seeds showing similar properties to those of *Agrostemma githago* (corn cockle), being difficult to clean from the crop and thus sown with the seedcorn. Interestingly, it does not seem to have reached Britain until after the end of the Roman period.

Insects from one of the palaeochannels at Yarnton did not suggest any changes to the terrestrial landscape, with grazing apparently continuing. However, the upper part of the organic sequence in the Oxey Mead palaeochannel, which radiocarbon dating showed as beginning AD 650-850, gave insect evidence for a change in the character of the floodplain grassland. The scarabaeoid dung beetles which feed on the droppings of larger herbivores, in this instance domestic animals feeding on the grassland, fell to about half their previous abundance. In contrast, weevils that feed on various clovers (*Trifolium* spp.) and vetches (*Vicia* and *Lathyrus* spp.) and are much favoured by hay meadow conditions (Robinson 1983) more than doubled. Such a development strongly suggested a change in the use of the grassland at Oxey Mead from pasture to hay meadow. Indeed, the southern part of Oxey Mead has retained until the present day its traditional management which gives its distinctive flora of *Alopecurus pratensis* – *Sanguisorba officinalis* flood meadow. The northern part, adjacent to the palaeochannel, survived as hay meadow until the 1930s.

Several other floodplain sites in the Upper Thames Valley showed a transition from pasture to hay meadow which probably occurred in the late Saxon period (Robinson 1988). At both Farmoor and Drayton, there is a change in the mollusc assemblages from the alluvial sequences, with the appearance of *Trichia hispida*, *Vallonia pulchella* and *Carychium* sp. These snails are unable to survive in the harsh, exposed summer conditions of floodplain whereas they thrive with the lack of trampling and the shelter provided by the taller vegetation of hay meadows. Many other floodplain sites in the Upper Thames Valley have a superficial layer of alluvium with the shells characteristic of hay meadow, but these deposits could be entirely early medieval in date rather than sedimentation which began in the late Saxon period.

The St Aldate's area of Oxford provided the opportunity to look at the changing environment of the floodplain as it was reclaimed for settlement. During the Iron Age, the Trill Mill Stream supported tall emergent vegetation along its edge which graded into marshy pasture (Robinson 2003b, 365-73). By the mid Saxon period, there was no longer reedswamp vegetation on the pasture but instead there were seeds of plants of disturbed ground such as *Chenopodium album* (fat hen) and *Polygonum persicaria* (redshank) along with evidence for flax processing. During the late Saxon period, a combination of seasonal flooding and the deposition of organic refuse created an environment of nutrient-rich mud which supported vegetation of *Ranunculus sceleratus* (celery-leaved crowfoot), *Rorippa* cf. *palustris* (marsh yellow cress) and *Rumex maritimus* (golden dock). There was evidence that a gully was discharging sewage onto the site. Synanthropic beetles provided good evidence for the proximity of buildings and human habitation. The woodworm beetles *Anobium punctatum* and *Lyctus linearis* were well represented. Various other beetles of indoor habitats such as *Ptinus fur* and *Typhaea stercorea* were present. At the end of the Saxon period, the site was reclaimed above ordinary flood levels by the dumping of soil. The early medieval flora was of well-drained nutrient-rich soil and seeds of the wet-ground plants, such as *Ranunculus sceleratus*, were absent. Various other sites alongside St Aldate's showed somewhat similar sequences. Evidence for the late Saxon environment of the Middle Thames is lacking.

A particularly impressive range of wild mammals, birds and fish were identified from a late Saxon settlement in the Middle Thames Valley at Wraysbury (Coy in Astill and Lobb 1989, 111-24):

mole	mallard	common eel
common shrew	buzzard	herring-type
red deer	goshawk	brown trout
roe deer	partridge	salmon
beaver	woodcock	pike
field vole	golden plover	chubb
water vole	lapwing	rudd or bleak
field/wood mouse	corncrake	cf. bream
harvest mouse	wood pigeon	barbel
house mouse	dove or domestic pigeon	gudgeon
black rat	crow or rook	burbot
	robin	perch
	blackbird	flat fish
	thrush-type	
	house sparrow	
	wren	

While many of these creatures had been captured and brought to the site for consumption, and a few, for example the herring (a marine fish) had been imported from a distance, most were probably of local origin. They suggested the site to have had a very mixed catchment, with woodland, large open areas of grassland and arable and clean river water. Two of the species, beaver (*Castor fiber*) and burbot (*Lota lota*) are now extinct in Britain. Beaver survived into the Saxon period in the Kennet Valley (Coy in Astill and Lobb 1989, 116), and wooded islands amongst the channels of the Colne near its confluence with the Thames would have made another refuge for this large rodent. The burbot is a freshwater member of the cod family which formerly occurred in the Great Ouse and some other rivers further north on the east coast of England. It is likely that there would also have been suitable conditions for burbot in the Saxon Thames.