Is there anybody there?
An Archaeology of Empty Places in the Mesolithic Neolithic Transition of England

by

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Abstract

The nature of the mechanisms surrounding the transition to a Neolithic way of life is still much debated in archaeology. Despite the vast volume of research undertaken, we still do not have definitive proof whether or not this cultural change occurred due to the colonisation of these islands. Within the period, there are areas of Britain that appear to be apparently empty. Is it possible that a closer examination of these areas could help to solve this debate? Historic changes in the theoretical approaches archaeologists apply to their data have involved the embrace of more scientific enquiry, followed by a move away from it; favouring a more social approach. Is it possible that by using a multi-disciplinary approach we may achieve a more complete understanding of this period?

This study concentrates on the Mesolithic-Neolithic transition of the British Isles. Drawing on palynological evidence from published sources, the apparent 'empty' areas are examined for palaeoecological evidence for past activity. In order to minimise the effects of investigator bias, all communities will be considered equally, regardless of whether they are considered to be Mesolithic or Neolithic in nature.

I conclude that by examining the palynological evidence from areas that are either apparently empty, and from those with a more secure and established archaeological record, we are able to identify potential new sites and areas with previously unrecognised archaeological activity.

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Chapter One

From the Tree of Knowledge – Literary Review

> The tree of knowledge grew fast by, knowledge of good bought dear by knowing ill
>
> Milton

Introduction

The process, or indeed processes, by which indigenous Mesolithic hunter-gatherer-fishers lay down their harpoons and spears and instead picked up the ard and raised their cattle, has been debated in Archaeology for many years. Improvements in excavation techniques and post-excavation methodologies have added to, rather than answered these debates. Much, but by no means all, of these debates have centred on the subsistence strategies of these prehistoric communities, to provide evidence to support, or refute, ideas of colonisation, shifts in ideology by whatever mechanism, resource scarcity, climatic events and the socio-political development of the communities under investigation. Although it could be said that the shift from a hunter-gatherer lifestyle to one based on husbandry was arguably one of the greatest subsistence shifts in human history (Nehlich *et al*, 2009: 1791), subsistence was not the only aspect of life with changes with the onset of the Neolithic. The process of Neolithisation also includes the appearance of polished stone tools, the creation of large monuments and the development, albeit relatively suddenly, of ceramic pots. There is supposed evidence of the contemporary appearance over a very wide area of a wide range of novelties that relate to almost every aspect of life, and are in contrast to the former Mesolithic culture (Sheridan, 2007: 466).

Recently, critical approaches have questioned the extent to which the difference between what we label the late Mesolithic and early Neolithic are actually 'real' in any sense of the word. It is possible that they are more artefacts of the research methodologies applied to them rather than products of different lifeways or cultures (Hind, 2004: 35). Despite the critical theoretical considerations surrounding the issue, the three age system is proving itself to be resistant and resilient to direct change or functional modification and as such investigations, at least at the discussion level, are trapped within its definitions.

A key issue in the debate of the embrace of Neolithic culture, concerns the issue of colonisation. One of the problems that encapsulate the debate is the largely unacknowledged assumptions that lie behind the characterisation of the Neolithic (Bradley, 2003). In Mesolithic studies, research is focussed on the relationship between material culture and landscape, while for the Neolithic, the concentration changes to the relationship between architecture and landscape (MacFadyen, 2008: 121). Although to some extent, this issue has been addressed in more recent literature, with arguments and ideas against the Neolithic being a purely economic phenomena and instead focussing on a shift in belief systems providing the engine for change (for example, Jones, 1999), it still forms the backbone of our understanding of the Neolithic. Originally, with the study of prehistoric archaeology growing up under the shadow of Nationalism, arguments on the nature of Neolithisation tended to develop with people from either side of the Mesolithic-Neolithic divide being classed as either them or us (Richards, 2003: 135). Although the three age system predated any socialist evolutionist programme, it was already informed by the idea of progress which was generally interpreted as being from worse to better (Hind, 2004: 35). This being the case, together with the fact that we are no longer practicing a hunter-gatherer way of life, the indigenous hunter-gatherer population has often been seen in a more negative light than the more highly developed and organised agriculturalists that followed.

One of the main aspects of the debate surrounds the issue of whether this was a homogeneous or heterogeneous process. Regardless of whether the Neolithic package appeared on these islands by a process of colonisation or acculturation, it is possible that there were several concurrent European sources of contact, although there is no certainty that these contacts were long-lived (Bradley, 2003). This is perhaps best evidenced by the regional diversity that can be seen in the archaeological record. There has been a considerable interest recently in the evidence that regional diversity provides, and the conclusions that can be drawn from it (see for example, Crombe and Vanmontford, 2007 and Sturt, 2006). This aspect will be discussed in greater detail below, but the unmistakable differences (such as architectural differences) both between north and south, and east and west, could suggest that these communities came to be Neolithic due to the influence of different continental groups. In fact, it has been suggested that there is more evidence of contact between these groups and the continent than within the different regions within these islands (see Bradley, 2003). However, this evidence is largely based on the comparison of secure, well-known Neolithic packages that are often separated spatially by areas and regions that lack obvious evidence for the period under investigation. Whether these areas are genuinely 'empty' spaces in the landscape and what, if any, additional information they can provide is discussed further below. Although the regional diversity witnessed in artefacts is capable of providing evidence to support the idea of different continental sources, it also could be used in the argument for continuity, where the indigenous populations adopt independently different ways of life. This could occur for any number of reasons including being externally triggered by climatic fluctuations, or internally developed by human agency (Gronenborn, 2007). For example, there is a sharp change in the evidence for social organisation and resource exploitation of the late Mesolithic of Northern England. This coincides with the eustatic rise in sea level which could have led to a rise in population density. This could suggest that the Mesolithic communities at this time and place were ripe to embrace a Neolithic way of life (Donahue and Lovis, 2006:256).

Colonisation/acculturation/continuity

One of the main strands of the debate surrounding the Mesolithic-Neolithic transition has concerned the issue of colonisation. Historically the idea of *ex oriente lux* was popular and to some degree, this has influenced the way archaeologists have researched the process of Neolithisation, with arguments for and against colonisation being a major trigger. Unfortunately, the debate has been dominated by a highly polarised dichotomy between just two scenarios, neither of which are necessarily plausible (Robb and Miracle, 2007). The question is whether the indigenous population of Britain was overwhelmed by an incoming continental economic and social system and perhaps population, of which they were largely unaware, or whether the process of Neolithisation elaborated or resolved a process of change that was already in place during the Mesolithic (Thomas, 2008: 62).

There are arguments both for and against and, unfortunately, evidence can be found that to some degree substantiates all arguments. Ethnographic evidence from modern-day hunter gatherer communities demonstrate that the forager mode of thought is resistant and resilient to contact with agriculturalists and pastoralists (Barnard, 2007: 15) and even though in much of the more recent literature, the concept of colonisation is out of vogue, there are still attempts to verify that this was the driving force behind the transition, along with evidence in support of their argument. In Sheridan's paper "From Picardie to Pickering and Pencraig Hill" (2007), she postulates that the appearance of the carinated bowl Neolithic package is best explained in terms of the arrival of small farming groups from the continent. In many ways she presents a convincing paper, citing evidence ranging from the contemporary appearance over a wide area of these islands of a genuine package of novelties and the consistency of this material culture to the contrasts in the distribution of Mesolithic and Neolithic settlement patterns and the absence of evidence for the kind of gradual shift to agriculture as seen continentally (Sheridan, 2007: 466). Although convincing, her arguments are not without problems. Much of these will be discussed further below, but as an example, there is evidence in northwest England for both Mesolithic and Neolithic settlements matching up both spatially and temporally (for example, Bonsall *et al*, 1994: 96). Some of her evidence is further corroborated by other archaeologists. For example Rowley-Conwy argues that there is no evidence for the subsistence economy of Mesolithic foragers and states further that the shift to agriculture was probably both sudden and traumatic (Rowley-Conwy, 2004: 83). However, there is plenty of palynological evidence that a gradual shift to agriculture was occurring throughout the late Mesolithic. This will be discussed in more detail below. There is also evident continuity of upland activities across long time periods linking not only early and late Mesolithic, but also the Mesolithic to the Neolithic (Spikins, 1999: 13).

It is not just within the British Isles that these arguments reign on. Although the continental evidence is in many ways more complete, this issue is still debated. In some cases, molecular genetics have been used to corroborate a particular hypothesis. In these cases they have often justified the expected outcome by choosing to rely on single items, focussing on cereals where possible, as markers of the spread of the Neolithic to maximise their data set (Richards, 2003: 137). This application leads to an advance rate of 1km/year – much quicker than it originally spread in the near East, suggesting diffusion rather than colonisation. Many archaeologists widely agree that the process of Neolithisation was heterogeneous and that there is no evidence for large-scale, continent wide immigration (Richards, 2003: 143). Combe and Vanmontfort (2007) argue that evidence from the Scheldt Basin, Belgium points to indigenous Mesolithic groups became Neolithic by a process of acculturation. Although they acknowledge that there are potential problems with their conclusions, specifically due to the lack of evidence for the final Mesolithic within their study area, they argue that the fact that the Neolithic settlement of the area occurs first in clusters, coupled with the fact that there is no evidence for the external culture group, points to an interpretation of acculturation (Combe and Vanmontfort, 2007: 270). Conversely, Nehlich *et al* (2009), from their work at Hessen, Germany, conclude that the evidence of the large and diverse pottery assemblages appearing in a short period, most probably suggests immigrant activity (Nehlich *et al*, 2009: 1792), and therefore a level of colonisation.

It has been said that Neolithisation in these islands was influenced by continental prototypes (see Thomas, 2008: 58) and that although contact can be demonstrated, change was resisted until approximately 4000BC (Thomas, 2008: 65). Unfortunately this is not always backed up by the evidence. Again in northern England there is evidence of cultural change occurring for many generations prior to 4000BC and when the accuracy of the radio-carbon dates are taken into account, the shift to a Neolithic cultural package cannot be seen as either sudden or wholesale although it appears to be a more archaeologically visible shift than the cultural changes occurring throughout the Mesolithic period. This being the case, it is unlikely that either colonisation or acculturation can fully explain the appearance of the Neolithic in these islands and in looking to solve the dilemma; we may be narrowing our potential interpretations. Unfortunately the issue is almost guaranteed to appear in most examinations of the period, regardless of whether the question of colonisation had been explicitly addressed.

Monumentality

An aspect of the Neolithic that is largely particular to these islands is the appearance of large monumental structures. Public intensification can be seen to have taken place at the beginning of the Neolithic with the creation of these public monuments, specifically in the forecourts of chambered tombs (Evans, 2003: 32). Although there are a limited number of continental examples, it appears that it was only here that they were adopted on such a large scale, with this monumentality occurring from the very start of the Neolithic. Bradley (2003) has argued that the differences in form from different regions of these monuments suggest several sources of Neolithisation and, yet, it is possible that these practices have their roots in the indigenous culture. Given the supposed more mobile existence of communities prior to the Neolithic, it is likely that excarnation had an extremely long history and although the placement of these bones within a monument is likely to be a Neolithic innovation, it is probable that the treatment of human remains prior to deposition had been part of the culture for a long time (Smith and Brickley, 2009: 62). Human remains have been found on a number of shell middens, predominantly phalanges, and skull and vertebra fragments which suggests that human bodies were laid out on middens for excarnation then the major bones removed (Cobb, 2005:71). There have been suggestions that shell middens, rather than being purely places for practical disposal of refuge, were the precursors of monuments (Thomas, 2008: 67) being deliberate constructions that tied communities to places. However many are hidden in caves and behind rock outcroppings (Warren, 2005:122) so it is likely that not all of these middens had the same function or significance. The fact that they were large, permanent features on the landscape, were repeatedly returned to and contain evidence of successive deposition is reflective of the way in which Neolithic monuments were created and used (Cummings, 2006: 76). If, as is suggested by the evidence, bodies were excarnated on the shell middens, they were likely to have become transformative and symbolic locales (Cobb, 2005: 74). Although the bones at shell middens such as Oronsay can be interpreted in terms of excarnation, parallels can be drawn between the representation of humans and animals on the middens, with the same parts of the body frequently represented (Warren, 2005: 147), which could suggest that their deposition is more symbolic than a functional excarnation. In areas of Europe there seems to have been an outbreak of shell midden formation shortly before the first appearance of fully Neolithic communities (Mellars, 2004: 175). Most dates for human bone fall into the late 5th and early 4th millennia cal BC and as such could be transistional (Warren, 2007: 2). The 150m long midden at Nether Kinneil, Forth Valley, Scotland, is dated to the Neolithic (Saville, 2004:11) which is suggestive of a possible monumental continuation. Chris Tilley, in his Phenomenology of Landscape (1994), rarely mentions non-monumental places, largely ignores the role of animals and crops from within the Neolithic world and dismisses the potential value of environmental evidence. Although he believes that the Mesolithic communities altered their world with paths and clearings, it is only with the 'culturally embedded horizon' of Neolithic tombs and their settings that the landscape became visibly encultured. As discussed above, he is re-affirming the cliché of Mesolithic foragers being tied to the natural world while their Neolithic agricultural successors are interpreted as being more cultural (Hind, 2004: 39). As has been demonstrated, there is evidence from many of the middens for the deposition of disarticulated human remains and possible evidence for ritual activity. This being the case, the large-scale appearance of burial mounds, instead of providing evidence for continental contact, is more closely affiliated with the argument towards continuity.

The limitations of the three age system

Current chronological divisions and the constraints these place on archaeological research may have more to do with the differences between the practices of archaeology than the current archaeological evidence (King, 2003: 2). In their paper, Robb and Miracle (2007) attempt to open the debate to a theoretical area which is free from the "encumbering conceptual baggage" surrounding the issue of colonisation, and can be viewed instead as a real ethnographic landscape. Using ethnographic examples from native North America, they demonstrate how distorting classifying communities as either Mesolithic or Neolithic can be. It appears to be an excellent theoretical standpoint for future studies into the period. Many sites are pigeon-holed as being either Mesolithic or Neolithic due to the absence or presence of particular items of material culture. There is much evidence for periodic woodland clearance occurring throughout the Mesolithic (Innes and Blackford, 2003: 185) and yet when this is discovered, a non-anthropogenic cause is often sought. On the other hand, the discovery of evidence of woodland clearance dated to the Neolithic promotes interpretations of early farming and sedentary settlement activity. This Mesolithic woodland clearance, at least specifically in the upland areas of northern England, can be found occurring right through from the very earliest Mesolithic to the middle of the Neolithic (Simmons and Innes, 1986: 386). Julian Thomas points out that one of the most visible artefacts of the transition is the disappearance of micro-lithic technology and the appearance of pottery and new lithic forms (Thomas, 2008:75). Yet in the northwest of England there are numerous sites where microliths occur alongside what is traditionally thought of as Neolithic technology (see for example, Cherry and Cherry, 2002:7). These data are often overlooked or ignored and yet without the pre-conceptions surrounding what is Mesolithic and what is Neolithic, they could be included in discussions regarding what social and economic changes were occurring at that time in our prehistory, without lending bias to the argument.

Dating

A major problem with the evidence surrounding the Mesolithic Neolithic transition concerns dating and proving whether or not communities are contemporaneous. For example, difficulties in dating the Mesolithic sites from the Scheldt basin meant that the adjacent Neolithic sites might not be contemporaneous, which would have implications on the analysis of the data (Combe and Vanmontfort, 2007: 271). Also, the lithic material from the Ditton Brook 1 site suggest a much earlier date than has been demonstrated by radiocarbon dating, with a strong blade element together with microliths but with less obvious Mesolithic characteristics (Cowell and Phillpot, 2000: 24). Closer to home, in chronological if not cultural terms, the late Mesolithic cultures of the northwest were contemporaneous with the early Neolithic sites of east Yorkshire (Cherry and Cherry, 2002: 14). This may suggest a local adaptation of a Neolithic way of life with evidence on the Eskmeals coastal foreground of Mesolithic hearths and stake-holes in linear clusters, which continued in use well into the Neolithic (Bonsall *et al*, 1994: 96). Although a similar pattern is demonstrated at many sites, it is not always the case that continuity can be indicated. The evidence from the St. Bees area of northwest England shows that while all sites with Mesolithic occupation evidence also show sporadic Neolithic re-use, there is no significant re-occupation until the early Bronze Age

(Cherry and Cherry, 1983: 12). Lack of continuity is also evidenced at the Cleveland Hills with the Mesolithic activity concentrated on the upland moors, and the Neolithic evidence on the lowland areas (Vyner, 1994: 29).

Much recent work on the nature of the Mesolithic Neolithic transition has centred on the evidence of human diet, either directly using stable isotopes, or indirectly by means of midden material. As has already been mentioned, the issue of colonisation too creeps into this research. Bradley argues (2003) that the direct evidence for human diet my well indicate a greater dependence on meat during the earlier Neolithic, but that these mobile economies based on the exploitation of animals grew out of hunter-gathering and that the collection of wild foods during the Neolithic provides evidence of a continuation of a Mesolithic way of life. Indirect evidence gleaned from faunal remains in archaeological assemblages can also be used to suggest indigenous adaptation. From the faunal evidence from the early Mesolithic site of Faraday Road, Rick Schulting points out that the hunter-gatherer subsistence is structured in the same way as later husbandry, with evidence for the dominance of juvenile pigs (Schulting, 2008). From more distant archaeological assemblages, charred grain appears more frequently in central Europe than in Britain, yet in terms of the scale and permanence of cultivation and clearances, the two areas are very similar. Bogaard and Jones (2007), suggest that the differences could indicate acculturation. This is a possibility. However, a variety of taphonomic factors could influence the survival of charred grain, including the treatment of the grain prior to its deposition in the archaeological record. This leads us to consider subsistence.

<u>Subsistence</u>

There have been considerable investigations regarding the subsistence strategies of the people of our period. These strategies, however, are bound up with wider cultural and social issues including status, gender and identity (Schulting, 2008: 90). Ecological and climatic modelling has demonstrated a major climatic event at the start of the Neolithic which, depending on the model you favour, could have created either drier conditions with an increase in the annual temperature range (Bonsall *et al*, 1994) or a cooler climate which would have been most keenly appreciated in coastal areas; where the cooling of the sea water would have altered the lifecycle of marine life, and brought increased storminess (Cooney, 2007: 547). Either of these outcomes, and without being environmentally deterministic, may have contributed to producing a mind-set that was ready to embrace new innovations such as agriculture. If we accept that the beginnings of agriculture on these islands was neither on a grand scale nor marked a complete cessation of hunting, gathering and fishing, it is reasonable to accept that any major climatic event could trigger a diversification in subsistence strategies due to alterations in the availability of wild resources. That said, there are many instances of cereal cultivation prior to the elm decline (Edwards & Hirons, 1984: 72).

Ethnographic investigations have demonstrated that evidence of greater complexity including, but not exclusively, more complex technologies; intensified subsistence strategy; greater sedentism; greater territoriality; increased (or some) dependence on stored foods; and larger amounts and wider networks of exchange are always either adaptational or transformational events (Keeley, 1988: 374). Population pressure, as an adaptational response, has become an unpopular explanation yet population pressure influences storage which influences sedentism, or the converse, so to discount resource availability and therefore population pressure as a potential mechanism for the adoption of Neolithic behaviour seems folly. All explanations need to be considered, regardless of their popularity.

It is often found that the occurrence of cereal grain in British examples had low densities per metre, which is often interpreted as demonstrating that it played a minor economic role, and yet the same is found with the LBK in Europe (Bogaard and Jones, 2007:361). There are also taphonomic problems with assessing the volume of pollen grains in samples. Cereal pollen grain, being relatively large, is subjected to more filtering before it is deposited; just having a reed bed nearby for example, could effectively lower the number of pollen grains present to negligible values, giving rise to an interpretation based on the absence of agriculture. Weed taxa should also be taken into consideration. The presence of cereals typically give rise to certain weeds which when taken into consideration when a small amount of cereal pollen is found, can demonstrate the presence of cereals more clearly. In their study, Bogaard and Jones did assess the weed taxa, and the results indicated that although there are differences in treatment, types and consequently deposition and recovery of evidence of cereals, there is little difference in the volumes between the British and central European samples.

One of the possible indicators for the adoption of agriculture comes from evidence of woodland clearance, usually by fire. However, small-scale, sporadic and temporary episodes of vegetation disturbance are evidenced from the early Mesolithic to the Neolithic in northern England (Simmons and Innes, 1986: 386). This does not lead us to conclude that agricultural activity was taking place from the earliest Mesolithic, rather that woodland clearance does not necessarily indicate adoption of agriculture. The range and quality of edible plants foods, both for humans and ungulates is greater in post fire vegetation (Innes and Blackford, 1986: 386) suggesting that woodland clearance is as much an indicator of hunter-gatherer subsistence strategy as agriculturalist. It does, however, demonstrate a deliberate and reasoned manipulation of the environment in order to facilitate subsistence activity.

Stable Isotopes are now routinely used to infer past human diets (Bogaard et al, 2007: 335). For example, Julian Thomas uses Richards and Hedges stable isotope analysis demonstrating that no human after 5400BP had a marine protein signature, to conclude that the Neolithic is an all or nothing affair (see Thomas, 2003). However it has been suggested that recent studies showing that the Neolithic community ate little marine protein, and that plants have little dietary role, may have many problems including not taking into consideration the possible effect of manuring on plants (Bogaard *et al*, 2007: 336). Also, it is possible that there is a sample bias in the human skeletons used and also possibly some bias in the interpretation of the results (see Milner *et al*, 2004). Many Mesolithic samples come from marine and esturine environments, in fact in the north of England all Mesolithic settlement occurs on sites that experienced esturine conditions in the period (Bonsall *et al*, 1994:92), so it is not very surprising that they demonstrate a strong marine protein signature. Conversely, when the Neolithic bone samples are taken from inland burial grounds, it is logical that they have a very terrestrial signature. For example, the human remains from Whitewell Quarry, which is in an inland location, have demonstrated a terrestrial diet by stable isotope analysis. However, wear patterns on their teeth and a lack of dental caries are indicative of a diet dominated by wild plants (Thomas, 2008: 74). In many of the sites examined, the direct evidence indicates a greater dependence on meat. As these were likely to be mobile communities with economies based on the exploitation of animals, and they probably have their roots in the hunter-gatherer way of life with evidence for the collection of wild food in the Neolithic, they provide some evidence for a continuation of a Mesolithic way of life (see Bradley, 2003). There are also problems with characterising entire populations by the source of their food supply.

Mobility versus Sedentism

A debate that appears in much of the literature relating to the Mesolithic and Neolithic lifestyle and activities centres on mobility versus sedentism. There is a general assumption that the Neolithic equals farming which equals sedentism but this is not necessarily the case. There are modern ethnographic examples where farming does not equal sedentism (see Whittle, 2002). Regardless of the assumptions that are made about the subsistence activity of a group of individuals, evidence of their levels of sedentism can provide information about their social structure. In Britain, the elm decline is often seen as marking the first horizon with the settled agriculturalists (Edwards and Hirons, 1984: 71). This is due to the fact that large-scale woodland clearance is often seen as one of the most viable explanations of the sudden, widespread decline in elm pollen in pollen records. However this remains a problematic explanation as there is evidence for sustained woodland clearance from the earliest Mesolithic without the accompanying decline in elm pollen. This has been concluded from the associations between the arrival of *Alnus* (alder) and the presence of charcoal in pollen diagrams for the Mesolithic period (Hirons and Edwards, 1990: 716). Also, apparent long-lived episodes of vegetation disturbance may not represent a systematic and sustained episode of woodland clearance and maintenance, rather composite features of successive and perhaps non-related disturbance events which cumulate to provide a prolonged input of disturbance indicators in the pollen rain (Simmons and Innes, 1986:396).

As woodland clearance cannot by itself demonstrate either settled or agricultural activity, it needs to be combined with other evidence. There are many types of evidence used to suggest sedentism including cereal stores, molecular genetics, houses, field systems and boundaries; each is problematic on its own. Cereal stores are evident from the early Neolithic (Rowley-Conwy, 2004: 90) and these are often used as evidence of sedentism and yet these could have been used as part of a system of radiating, logistical or seasonal mobility. Hunter-gatherers, too, often structure their mobility by the changing seasons (see Schulting, 2008) from lowland to upland locales, much the same way as the northern pastoralists of today. Molecular genetics have been carried out to test, or perhaps justify, the 'accepted' central role of sedentism, population growth and the resulting resource pressure in early farming communities by 'New' archaeologists (Richards, 2003: 137). Although this was carried out to demonstrate colonisation, it actually provided more evidence for diffusion, and it was flawed due to the assumptions made regarding sedentism.

Except in Scotland, evidence of houses and field systems are short-lived and are confined to a few short centuries at the beginning of the Neolithic (see Bradley 2003). There are problems with the definition of short-lived and "a few short centuries". A few centuries do not make up a short-lived phenomenon – it is many, many generations. To suggest that this behaviour is short-lived seems to be a way of justifying an activity that does not fit into the mould as the Neolithic being a wholesale and uniform culture change. Cultures and cultural behaviour is fluid rather than rigid. Cultures adapt to their environment and to contact with other groups and activities come in and out of vogue, without changing the identity of the culture in question. Evidence in the north west of England at Williamson's Moss indicate structures and settlement dating from 6015 to 5520 BP with additional evidence for renewing of these structures implying use over a number of years, perhaps decades (Bonsall *et al*, 1994: 101). Although this is considerably less than centuries, it does indicate that similar activity was being carried out over generations suggesting a culture or at least cultural behaviour. It is also likely that the evidence for structures and field systems has not survived in many places due to later disturbance (Rowley-Conwy, 2004: 92). Field systems in particular may have problems with preservation as they may have been more ephemeral in nature. There is also likely to have been problems with the recognition of field systems. Rarely there are large-scale excavations taking place and when they are they are often linear, for roads or pipelines. Modern-day population densities also affect the numbers of sites recovered through professional archaeological studies, as many of these are carried out in advance of development work and usually concentrated in big cities. Yet the construction of these cities themselves has often obliterated any evidence (Spikins, 1999: 21).

Linked to field systems are regional boundaries. Donahue and Lovis (2006: 218), suggest that long-distance logistical mobility may be the organising device, with chert and flint lithic raw material as a means, of defining the potential social territories of Mesolithic northern England. This being the case it may offer initial insights into the development of regionally bounded systems of land use. It is a reasonable explanation but as we are yet to identify the residential locales in the region associated with this trade and movement of raw materials, we cannot definitively demonstrate the regional forager mobility system. The distances between the upland and lowland sites are within the mobility distances of North American foragers undertaking a seasonal strategy of long-distance mobility yet the assemblage variability is greater at the lowland sites (Donahue and Lovis, 2006: 253). This could also indicate that they are separate, perhaps related, social groups that have contact through trade. There are cross ridge boundaries found in northeast England with a level of complexity in their structure from as early as the Mesolithic period (Vyner, 1994: 29-36) which may indicate a level of sedentism. To date there are no permanent settlements that have been discovered in association with these boundaries so sedentism cannot be proved, even on a seasonal basis. What is clear however is that time and effort was expanded in the creation of these boundaries which mark or divide a place in the landscape and as such must have had some significance.

<u>Ethnographic Analogy</u>

The use of ethnographic analogy is debated hotly within archaeological circles. Some hold the opinion that regardless of how familiar we are with the data or how objectively we try to look at it; we often have no alternative but to use ethnographic examples to justify our findings. There are of course problems with importing models effective in one period to another (Warren, 2007: 323) but despite this, ethnographic analogy provides an alternative explanation to past activity that comes from outside the investigators own life experiences. As such it is a worthwhile tool; adding colour to a monochrome understanding. It only becomes a problem when its limitations are not acknowledged. By looking at ethnographical work we have a living example of the motivations surrounding the material remains we discover. Rick Schulting's "Slighting the Sea", where he uses stable isotope analysis to demonstrate a sudden shift from marine to terrestrial protein, need not necessarily provide evidence for colonisation as he suggests. By applying ethnographic examples, other conclusions may be drawn including that often people within the same culture group, but with very different statuses, may eat or have access to different foods (see Milner *et al*, 2004). Ethnoarchaeological work shows that material culture is often used knowingly and strategically to enhance identities and maintain boundaries irrespective of contact between populations (Thomas, 2008: 64). This could explain the scenario that is beginning to emerge in the north west of England – where there are clusters of material culture that are classified as Mesolithic and Neolithic occupying the same geographical and temporal horizon. There are no pristine modern hunter gatherer groups. All have contact with non-hunter gatherers albeit sometimes on a very sporadic and small scale. In some cases modern hunter gatherers may use a subsistence strategy other than foraging but despite this, they think in different cultural terms than the agro-pastoralists (Barnard, 2007: 15) and their culture is resilient to the colonisation of ideals. With this ethnographic knowledge we are thus able to suggest viable, reasoned alternatives to the traditional straightforward explanations of the process of Neolithisation.

<u>Landscape</u>

A key branch of interpretive investigations is Landscape archaeology. Landscape thinking in archaeology has caused the emergence of the concept of a ritual landscape (Robb, 1998: 159), but there are many ways that people interact with their landscape. Attitudes towards land are embedded in local knowledge and in long-standing relations between the people and their environment (Barnard, 2007: 12). Ethnographic examples demonstrate that accumulators and foragers see the relationship between themselves and the land in reverse. Landscape is fluid. It changes from season to season and over generations and it is therefore possible that the past populations utilised the fluidity of their environment as part of their own nomadic or semi-nomadic existence. Despite this, some reasonable generalisations are emerging. Much of the northern Mesolithic occupation evidence appears to fall into two distinct landscape zones. On the limestone uplands, Mesolithic foragers were pitching camp, perhaps to control the maximum possible local view (Cherry and Cherry, 2002: 4). Relatively complex cross-ridge boundaries built with a single bank and ditch but with the addition of stone, and defined by streams, slopes or modern-day marshy areas occur from the Mesolithic of north east England (Vyner, 1994: 32), perhaps demonstrating a level of control of the upland region. Within the moorland area of the Cleveland Hills, concentrations of Mesolithic activity is found on the high plateau of the middle moors contrasting with the apparent interest in the lower areas during the Neolithic (Vyner, 1994: 29). These would have been wooded areas during the period and not the moorland we see today. In addition to these pockets of interest in the upland areas, we see an apparent preference for esturine conditions. For example, in northwest England the sites that can be interpreted with some certainty as Mesolithic settlement sites are all on sea-ward facing slopes overlooking stretches of former coastline that experienced predominantly esturine conditions during the period (Bonsall *et al*, 1994: 92). There may be an issue with uneven preservation coming into play here though. In the main, these upland and coastal sites are sparsely occupied today and as such any past activity visible has not been subjected to the same taphonomic disturbances as in other areas. This being the case, it may be that past populations did not utilise the landscape in such a predicable manner. There is evidence that goods were often not transported by what appears to be the most logical routes. For example, chert from the Mesolithic of northern England is transported east-west rather than north-south (Donahue and Lovis, 2006: 250) and yet to do so the Pennine ridge has to be crossed. It could be an indicator of kinship groups or there could be significance in trading across the Pennines.

Palynological Research

Pollen analysis from known archaeological sites can provide a lot of information about the environment and activities of past populations but it is often an under-used resource. Palynological work has found data incompatible with the assumption that Mesolithic foragers were completely subject to the biophysical environment with sporadic, small-scale and episodic pre-elm decline vegetation clearance (Simmons and Innes, 1986: 385-386). However, palaeobotanical work in Europe demonstrate that the attempts at cultivation during the late Mesolithic occur after a period of climatic unrest – the early Holocene event (EHE), a cooling period that punctuated the Holocene climatic optimum (see Gronenbron, 2007). This could mean that the adoption of agriculture occurred as a reaction to a period of uncertainty, perhaps with changes in the behaviour of prey and vegetation, but that it had its roots in behaviours practiced for generations. Using fungal spore analysis to complement pollen and charcoal data to show the presence of dung shows disturbance phases at almost annual time-scales (Innes and Blackford, 2003: 188), demonstrating the possibility that woodland clearance was habitual activity at the time. However, as already mentioned, apparent long-lived episodes of vegetational disturbance may represent composite features with a succession of different, perhaps unrelated, disturbance event combining to provide a prolonged input of disturbance indicators in the pollen rain (Simmons and Innes, 1986: 396). What is clear, however, is that there are many instances of woodland clearance appearing from the earliest Mesolithic and although these may not always be sustained, the pattern is clear enough to demonstrate that the activity was not unusual. For example, the appearance of *Alnus* in combination with increased charcoal associated with the loss of woodland with a 250 year duration in Mesolithic Scotland strongly suggests that the clearance activity was both direct and repeated (Hirons and Edwards, 1990: 716). In addition to this, evidence from the north York Moors demonstrates clearance associated with cereal phases lasting at least 50 years during the Mesolithic (Simmons and Innes, 1996: 614). The presence of cereal-type grain must be present to conclude a level of agricultural activity. It is often combined with the weed-taxa associated with cereal cultivation to strengthen the argument. However, weed pollen types frequently associated with arable land cannot independently indicate agriculture as their presence may merely demonstrate some relatively open ground (Edwards and

Hirons, 1984: 75). There are other indicators that cereal growth was a planned rather than opportunistic activity as the spectra containing the pre-elm decline cereals also feature expansions in the representation of bracken spores and herbaceous pollen as well as fluctuations in the curves for hazel and oak whereas ash is more continuously represented (Edwards and Hirons, 1984: 74). This suggests that the woodland was cleared in order to plant the cereals or at least allow the cereal growth. Geographical Information systems (GIS) can be used in conjunction with pollen analysis in creating an ecological model of past variability (see Spikins, 2000). Its main determining factors are: Abiotic – deriving from the past environment e.g. substrate type and climate, and Biotic – the plant species themselves. This can provide us with information regarding the timing of the arrival of species and how various species compete. Again, on its own it has limitations but when combined with other methods of research it heightens our understanding of the past.

Regional Diversity

The archaeology of the period under investigation is vastly varied from region to region but this fact often remains unacknowledged. Regional diversity is a widespread characteristic of the continental Neolithic and is accepted as such (see Bradley, 2003) whereas in this country for example, Wessex-centred models emphasising the role of animal husbandry are often extended into areas in which they are inappropriate. It has been claimed that the Neolithic presence is not earlier or later in any part of the country (Thomas, 2008: 63) but this is only true due to the way in which the Neolithic is defined – i.e. the wholesale package rather than the presence of an item of material culture. The populations that lived here before the onset of the Neolithic were not a homogeneous culture; variability existed with, for example, different microlith technology from different regions such as Lancashire and Cumbria versus Yorkshire (Cherry and Cherry, 2002: 5) and within regions with the Malham Plataeu and eastern drainages having lithic affinities with the eastern lowlands, whereas the western margins are using local chert which suggests local systems (Donahue and Lovis, 2006: 250). With this in mind, it is unreasonable to expect there to be no variability in the Neolithic unless you are favouring a traditional, violent, colonisation scenario for the mechanism of the Neolithisation of these isles. This is highly unlikely. In the north west of England for example, in chronological if not cultural terms, the late Mesolithic cultures were comtemperaneous with the early Neolithic sites of east Yorkshire (Cherry and Cherry, 2002: 5). In Ireland there is much diversity evident with Neolithic settlement in particular being far from uniform. Pre-Neolithic domesticated animal bones have been found in Ireland along with locally-sourced polished stone axes (Thomas, 2008: 64). These items are both part of the ‘Neolithic package’ adding further evidence to the argument against the wholesale colonisation of indigenous cultures. We have to accept, expect and embrace regional diversity. When we stop trying to squeeze these populations into a ‘one-size (doesn’t quite)-fits-all’ scenario we are provided with a richer, more rounded and archaeologically louder understanding of the lives of past populations.

Empty Places

If we were to create a distribution map for the evidence of the Mesolithic Neolithic transition of these islands there are areas that would appear relatively empty, the north west of England being one of them and, yet, the locations and extent of the occupation sites of prehistoric populations still remain largely unresolved (Cherry and Cherry, 2002: 1). Historically the debate into the nature of the transition has been fuelled by the paucity of the evidence (Thomas, 2008: 59) but still there is a perception that there are ‘empty’ places within the archaeological landscape. The reasons behind these voids remain largely unexplored and yet they could provide a wealth of evidence. The absence of positive archaeology does not necessarily indicate an absence of all evidence, nor does it demonstrate evidence of absence. We just need to adjust the way in which we examine these areas. There are many reasons why these empty places exist. In the north west of England changing sea levels have meant that many site distributions are likely to be below present sea levels (Claire, 2000: 1). Also there are problems with the characterisation of sites. For example, to define assemblages as Neolithic based on their tool-type and polished stone implements would mean that none of the 158 sites surveyed by Cherry and Cherry (2002) can be safely ascribed as Neolithic – a conclusion that is not only unlikely but that is also inaccurate. These Neolithic sites cannot be recognised by applying conventional typologies because they still retain many late Mesolithic characteristics (Cherry and Cherry, 2002: 6). This again demonstrates how the way in which we investigate sites restricts our understanding of the past. We need to move away from looking at 'Mesolithic' or 'Neolithic' cultures and instead concentrate on investigations into populations. What we are looking for is restricting what we are finding. For example, the majority of the evidence for woodland clearance comes from upland locations (Innes and Blackford, 2003: 185). This has led to explanations that the lowland woodlands were too wet to clear by fire and thus beyond the capabilities of the Mesolithic foragers and yet, evidence for clearance of woodland by fire in lowland locales, when looked for, is clearly demonstrated. It appears likely therefore that sustained investigations specifically into the empty places will add considerably to our understanding of the past.

Chapter Two

From Acorns to Oak trees - Environmental Archaeology

Every oak tree started out as a couple of nuts who decided to stand their ground
Anon

Introduction

If we think of the environment in which we live as one agent among many others, then to use the data it provides is not being environmentally deterministic; rather we are giving the constraints and possibilities of the environment due weight in our analysis. In areas where there is a dearth of archaeological evidence, the application, and consideration, of environmental techniques has the chance to open up new lines of enquiry and further enrich our understanding of the past. Although it is possible that scientific enquiry alone cannot add to our understanding of the nature of past communities, when used as a tool that can stand up to rigorous scrutiny, and combined with an interpretive approach, it not only enhances our understanding but can provide the meat to enrich our plates, especially when applied in areas that are lacking positive archaeological features.

Unfortunately much of the earlier environmental archaeological narratives were in many ways deterministic, and as part of the trend of making archaeological investigations more scientific typical of the New Archaeology or processual movements, they often left the humans out of the story. In the recent past, archaeology has 'gone social', but we need to be clear: there are several kinds of sociality (Evans, 2003: 12), not excluding interaction with and within the environment. The reduction of a person's role had led in many ways to an abandonment of environmental data; or where they are used, a marginalisation to supporting rather than creating a scenario. We need to bear in mind that cultural landscapes are after all natural environments; though affected by human activity. As such, their reading *requires* an interdisciplinary approach (Bell and Walker, 1992: 2) rather than just being improved by one. For example, if our conceptual understanding of landscape is purely as an environmental backdrop or a setting in which activities take place, temporality is reduced to a description in terms of seasonality rather than a complex historical condition and, as such, a two dimensional or surface perception of landscape is created (McFadyen, 2008: 122). Such preconceptions in themselves limit the influence of environments and, paradoxically, the sociality of the populations under examination. The environment used to be seen as passive, with humans mapping their activities onto it, and this applied to the food plants and animals as much as the land and weather (Evans, 2003: 1) but as will be demonstrated later, the environment can be seen as being as much a social and culturally inclusive, *active* aspect of human lives that when included in interpretive texts, the whole becomes greater than the sum of its parts.

The best results, and most complete stories, have come from highly focussed geoarchaeological investigations that have employed appropriate techniques and have been intimately linked to multi-disciplinary studies that provide consensus interpretations (Goldberg and MacPhail, 2006: 1). As previously stated, environmental analyses need to be integrated with archaeological texts and interpretations rather than be treated as an add-on (Brennend, 2007: 23). Geoarchaeology provides the ultimate context for all aspects of archaeology from understanding the position of the site in a landscape setting to a comprehension of the context of individual finds and features (Goldberg and MacPhail, 2006: 3). When not limited to discussions regarding resource availability and climatic restrictions, it also provides a smorgasbord of possible explanations, motivations and interactions that can expand our understanding in much the same way as the use of ethnographic analogy. Although the spatial scale and intensity of past land uses are central aims of environmental archaeology (Tipping *et al*, 2009: 140) even now, allowing them to enter, or even perhaps dominate, our interpretive, post-processual explorations can only be a good thing.

Issues of fragmentary Evidence

Surface remains can be viewed at best as providing only a fragmentary and incomplete picture of what is to be found at an archaeological site (Ammerman, 1981: 63) and yet often can make up the majority of the evidence immediately available at a particular landscape setting or region. Accessing the physical remains of past human activity is often difficult as farming communities have preferentially settled on the best drained soils; therefore pollen analyses are bedevilled by distortions induced by either the very poor preservation of pollen or the destruction of secure pollen stratigraphies. This can render interpretations highly problematic or meaningless (Tipping *et al*, 2009: 140). These later settlements may also bias the evidence for Mesolithic settlement and activity; demonstrating perhaps erroneously, an upland-dominated site distribution.

It is not only in lowland zones that earlier activity can be obliterated; in addition to lowland ploughing, grazing pressures are causing erosion within peat uplands (Spikins, 1999: 20) and much land has been lost due to marine inundation as discussed below. So whilst artefacts in peat covered areas may be relatively more visible than in the intermediate zone due to peat erosion, those in the lowland areas may be more visible than in the intermediate zone due to ploughing and arable farming. In effect it is possible that the supposed evidence for a distinct division between upland and lowlands sites may be more a factor of modern land use practices that any distinction in past intensity of activities (Spikins, 1999: 20). Although we need to bear in mind these possible distortions, the fact remains that what we witness in the archaeological record appears to demonstrate a key division in site distributions and activity in discrete landscape zones with, for example, site clusters in northern England evidenced at between 350 and 480m OD. What evidence we do have is often fragmentary and un-stratified and so due to the paucity of the evidence inferences about upland Mesolithic lifeways have to made from the archaeology of Scandinavia and Northern Europe, be taken from palaeoecology (although this may have a positive effect as discussed below), from extrapolation from earlier sites such as Star Carr, and ethnographic parallels from near-recent hunter gatherer groups (Simmons, 1996: 39). Although none of these inferences can be taken as definitive evidence of past human activity, they are as much an indicator of such as evidence perceived as more concrete, such as lithics or pot sherds.

<u>Regionality</u>

Site formation processes in their broadest sense, can and should be integrated regionally to assess concerns of site locations and distributions in addition to any geomorphic filters which may have influenced them (Goldberg and MacPhail, 2006: 2). Distinct contrasts between upland and lowland sites become apparent at the regional scale with what appears to be a physical separation between sites in the two zones, with few sites in the intermediate locations (Spikins, 1999: 11). For example in the central Pennines, upland sites are almost exclusively above about 350m OD and lowland sites below 100m OD. Upland sites are rare above 450m OD. As previously mentioned, there are a number of possible explanations regarding this separation; not excluding a genuine distribution of prehistoric activity. Regardless of the cause, it is only when evidence is viewed on a regional level that such patterns become visible. While at one time the need to survey had to be justified, the concern with regional patterning has continually developed and today survey is among the most fundamental techniques of archaeological enquiry (Burger *et al*, 2004: 409). Unfortunately, and due to a variety of reasons, it is rarely incorporated into traditional excavation and is more often used as a pre-cursor to the perceived more complete archaeological evidence thrown up by excavation.

The nature of pollen cores means that they represent a very local record of woodland composition which is often difficult to relate to large scale regions (Spikins, 1999: 79). At the regional scale, interpretations have focussed on identifying the types of activities which occur in different environments, as well as providing specific explanations for differing distinct local patterns (Spikins, 1999: 11). In excavations, archaeologists have tended to sacrifice area in favour of more thorough recording strategies, producing smaller samples at higher resolution (Burger *et al*, 2004). This means that the bigger picture, and often a wider understanding, is often missed. There are many practical and financial reasons why large, regional-scale surveys are not often carried out, but where they are, we are able to access a whole host of instances of evidence which could provide a fuller awareness and insight into past activity.

<u>Sample and Site Bias</u>

If post-depositional processes have altered the assemblage then the raw data is not directly related to the original environment, and as such, any interpretation can be severely flawed (Bunting and Tipping, 2000: 63) and however powerful and objective the techniques of interpretation used on the pollen data are, if the assemblage is not representative of the environment to be reconstructed, the results could be misleading (Bunting and Tipping, 2000:

64). This being the case, it may be tempting to limit investigations to water-logged, well-stratified deposits to curb the potential damage of post-depositional bias, but the additional data provided by on site palynology mean the potential benefits can out-weigh the risks.

Bunting and Tippping (2000) have developed a test for post-depositional disturbance. In effect, and not exclusively, various factors are to be countable and their numbers must be as follows:

Total land pollen sum	>300;
Total pollen concentration	>3000/cm^3;
Number of main sum taxa	>10;
Percentage of severely deteriorated grains	<35%;
Percentage of indeterminable grains	<30%
Percentage of resistant* taxa	<6%

**Tilia, Caryophyllaceae, chenopodicaeae, asteraceae* (lactuceae), Artemisia type and *brassiciceae*. However as all these are common in agricultural environments this data is not dismissed if this is the only test failed (Bunting and Tipping, 2000: 65). .

In applying this method they suggest that any samples that do not meet the stated numbers and concentrations should be dismissed from any interpretations. This may be a little severe. It may be better to still include the data but to place more emphasis on post-depositional disturbance than would normally be applied. It is not, after all, definitive that samples not meeting the above criteria are a reflection of post-depositional taphonomic factors, and even if this is the explanation for it, many of these processes can be human-induced. Also, even if the concentrations or distributions are not purely, or even partly, down to archaeological activity, their presence adds to the environmental understanding of the past.

Creating an ecological model of past vegetation depends on the predictability of vegetation types according to environmental conditions in the present and a knowledge of the conditions in the past – neither of which is straightforward (Spikins, 2000). Ecologists formally placed vegetation dynamics in the context of long-term changes which were a function of climate with the concept of climax vegetation and stability as long as the climate is constant (Moore, 2000: 132). Climatic differences across the country at a constant elevation had little effect on the 'general nature of woodland types' (although they did affect the undergrowth associated with the different woodland types), the main determinants being the climatic effect of altitudinal differences, and the effect of substrate types (Spikins, 1999: 79). The soil pH, moisture content and texture are important in which key plant species are in any area and bedrock types are a relatively good determinant of soil types on a large scale (Spikins, 2000). As such pedologists would be more concentrated on the parent materials: the surfaces upon which soils were formed and how both have evolved in conjunction with the landscape. Such materials can be buried by subsequent deposition or can be formed on the present day surface (Goldberg and MacPhail, 2006: 2). The types of plant species present at any period in the past are not directly definable by the environment and are rather governed by the rate of spread from refugia and the time since climatic amelioration (Spikins, 2000). They do however remain a good indicator of local environmental conditions especially as indicators of open ground or water-logged conditions.

There may be other explanations surrounding clusters of particular vegetation types including the influence of animal communities, for example, beavers damming, grazing and browsing preserving areas of open forest (Spikins, 2000). There have been arguments regarding the extent to which beavers made an impact on their surroundings sufficient to affect the palaeoenvironmental record and to be possibly confused with humanly-induced change (Coles, 2000: 80). As there are no wild beavers left for us to observe on these islands, it has been suggested that our native beavers may not have behaved in the same way as the North American communities from which inferences are drawn. However, experiments to re-introduce the beaver into France have allowed a more intimate examination of their behaviour from within a climatic zone more similar to ours. They have found that they eat the bark from willow and poplar preferentially and less commonly oak, ash, dogwood, hazel and alder. They avoid box and elder (Coles, 2000: 82). In eating the bark they often kill the tree while it is still standing which could in some cases create a raised mistletoe signature as seen in pollarded coppicing. Beavers are natural coppicers meaning that straight re-growth and already felled and de-barked wood could be available. Their dams attract more wildlife around their ponds and create suitable bridges and walkways over rivers. The beaver pasture (the trees surrounding their dams from which they harvest) attract increased browsers such as deer and elk and are likely to have been good places to hunt (Coles, 2000: 86-87). When their dams are abandoned (or destroyed) they leave behind silt-rich and fertile soil which could be used for agriculture. It is feasible that prehistoric populations took advantage of the resources provided by beaver behaviour and that some of the evidence used to suggest prehistoric clearing may not always have had an anthropogenic cause.

Clearance and firing

Palaeoecological assumptions become embedded in mind and in the literature, and become accepted as a basis for formulating future research strategies and models of past ecological changes; both natural and human induced (Innes *et al*, 2004: 295). Where there is a reduction in arboreal pollen representation associated with increased levels of microscopic charcoal, there is a tendency to infer human clearance of forest through fire, the focus being the Mesolithic Neolithic transition (Moore, 2000: 125) but landscape, people and climate are three variables that are inextricably linked (Bell and Walker, 1992: 1). There are problems associated with the evidence, namely how likely clearance by burning is to have been a deliberate act. In understanding fire ecology it would be misplaced not to consider the climatic component in relation to the incidence and severity of fires, but to say the fires during the Mesolithic were more to do with climate and rapid climate change than human manipulation would result in the label 'environmental determinist' (Moore, 2000: 132). Previously, discussions of adaptations have often been associated with a narrow environmentally deterministic standpoint, thus all cultural changes are viewed as adaptation to environmental change which unfortunately leads to the conclusion that culture is largely predictable by environment (Spikins, 1999: 2). A start to socialising landscape is seen where the physical environment is incorporated into strong hierarchical schemes of politicality and power, where it is wrenched almost forcibly into place. This differs from environmental determinism in that politics, hierarchical power and social attraction play a part in environmental relationships (Evans, 2003: 13) and is more frequently seen in Neolithic investigations. Obviously environmental determinism is not popular in post-processual archaeology but there is a case to be considered rather than dismissed out of hand. It is whether the environmental component is evaluated in isolation or placed within an ecological and cultural context that allows the argument to stand or fall (Moore, 2000: 132). Applying a multi-disciplinary approach would therefore create a more balanced discussion.

Palynological work has produced data incompatible with the assumption that Mesolithic foragers were completely subject to their biophysical environment (Simmons and Innes, 1986: 385) with episodes of vegetation disturbance recognised in pre-elm decline and therefore pre-Neolithic age Britain (Simmons and Innes, 1986: 386). These are often temporary and not particularly large although given the supposed nature of the Mesolithic cultures being relatively small populations that are very mobile, large-scale disturbances would seem out of place. Some, for example Newferry, show a slight depression of elm pollen frequencies at the same time (Edwards and Hirons, 1984: 72). The spectra containing the pre-elm decline cereals also feature expansions in the representation of bracken spores and herbaceous pollen as well as fluctuations in the curves for hazel and oak. As ash is more continuously represented, it suggests woodland clearance (Edwards and Hirons, 1984: 74). Ash prefers lightly shaded, seasonally wet soils or drier parts of fen-carr woods (Birks, 1989: 517) and is therefore more at home in less densely wooded areas.

The elm decline between 5000 and 5500BP did not lead to any significant contraction in the range of elm within the British Isles (Birks, 1989: 511) and as such, if woodland clearance was a contributory factor, it appears that this clearance would not have been occurring primarily at edges, which is in contrast to other evidence as discussed below. Clearance is seen at ALL stages of the Mesolithic in Britain but increasingly between 7000-5000BP. There is also more evidence from upland than lowland landscape zones and often it is associated with charcoal (Simmons and Innes, 1986: 386). In general there is an increase in the frequency of woodland clearance towards the elm decline (Simmons, 1996: 78) which could suggest an environmental marker for the possible transitional nature of the populations at the time. The elm decline is seen as marking the first horizon with the activities of settled agriculturalists but it does not necessarily have a human cause. However, analysed levels coincident with the elm decline produce inferential evidence of woodland clearance and frequently, arable activity (Edwards and Hirons, 1984: 71). The overall geographical pattern and chronological spread of the elm decline does not easily fit any climatic hypothesis. Many sites are coeval with anthropogenic clearance. It could be that elm leaves were collected and used to stall-feed cattle which ultimately would prevent flowering as is ethno-historically demonstrated at the Swiss Neolithic lake village at Weier (Bell and Walker, 1992: 161). Elms also tend to grow on the best soils so it is possible that they were selectively cleared by the first farmers (Bell and Walker, 1992: 162). There are many hypotheses for the cause of the elm decline but however convincing the evidence for these suppositions is, anthropogenic factors fail to take account of the scale of the event.

Regardless of the cause, woodland clearance, particularly by fire, appears to have a long continuous history in prehistoric Britain. This has been demonstrated by an increase in the volume and detail of palynological analysis supplemented by other environmental proxies such as charcoal data. Although most of these are small scale and temporary, some are repetitive and/or severe. The majority are from upland contexts but an increasing proportion are from lowland landscape zones (Innes and Blackford, 2003: 185) which has implications for the natural causes argument. It is generally accepted that the mid to late Mesolithic had higher temperatures and drier conditions than earlier in the era and that it was a period of woodland expansion, therefore precisely the conditions likely to favour increased forest disturbance in addition to an ideal environment for forest fires. This does not mean that human agency can be dismissed as these are also precisely the conditions that would favour human firing (Moore, 2000: 132). Therefore it is the scale as much as the climate that is the context in which to consider human firing of the landscape (Moore. 2000: 133) and evidence for clearances of lowland forestation by these methods tends to point away from it being a natural occurrence.

The precise ecological and archaeological interpretation of temporally and spatially complex fire histories remains problematic and much more research into the meaning of the charcoal signal preserved in various types of sedimentary deposits is still required, despite recent advances. The spatial factor in the interpretation of charcoal evidence remains hindered by uncertainties regarding charcoal taphonomy and by the low spatial resolution of most palaeocharcoal data sets. Micro-charcoal deposits incorporated into terrestrial peat surfaces, particularly small peat mires, may offer a more precise record of local fire history (Innes *et al*, 2004: 296). As has already been mentioned, the evidence that Mesolithic people were actually responsible for these events is unavoidably circumstantial and they are as likely to be due to a possible lightning strike or storm (Innes and Blackford, 2003: 186). Hirons and Edwards' palynological study into the Isle of Rhum, Scotland has found clearance associated with occupation evidence from 8590 ± 95 BP to 7570 ± 50 BP (Hirons and Edwards, 1990: 715). Here associations between the arrival of *Alnus* and charcoal has been taken as evidence of vegetational disturbance carried out by Mesolithic people with evidence of the increase of *graminae* (grasses) colonising newly open wood and shrub land. There is also increased charcoal associated with the loss of woodland over a 250 year duration, perhaps suggesting the reduction was by means of direct and repeated clearance (Hirons and Edwards, 1990: 716). It is obviously problematic to differentiate between human fire activity and natural fires but human firing is likely to have been occurring at more frequent intervals and further topographical features may be indicative of potential edges and patches. The nature of the sampling site becomes the critical context in which to place interpretation and ideally there should be a multiple sampling strategy to identify the regional signal (Moore, 2000: 134). Micro charcoal patterns have even been used to postulate off-site Mesolithic human activity and hence human presence in areas where an archaeological record has yet to be established (Innes *et al*, 2004: 297) and although this can be undoubtedly problematic, it forms a part of this investigation. Peaks in microscopic charcoal may have less significance in interpreting anthropogenic firing than an increase and then continuity in the levels of charcoal. This would be coupled with changes in the pollen spectra representing opening up woodland and increases in herbaceous species, particularly those attractive to collection (Moore, 2000: 134).

Sporopollenin, the main constituent of palynomorph outer walls, is remarkably resistant to damage, and is preserved in a much wider range of contexts than the ideal waterlogged, low pH conditions. However when pollen has been extracted from less than ideal environments interpretation becomes more challenging as they are relatively dry and oxygen rich, and as such biologically active and chemically unstable (Bunting and Tipping, 2000: 63). This can also be offset in part by either using multi-profile analysis (where several profiles from no more than tens of metres apart are subject to pollen and charcoal counting) or fine resolution pollen analysis (FRPA) (the counting of samples with a very low vertical interval often as little as 1mm). Conventional pollen records from long, continuous sequences are the easiest for palynologists to work with for the quality of the pollen preservation (Bunting and Tipping, 2000: 63) and although these give us the most complete picture, they should not be the only ones we use.

Cultural Preconceptions

Of all the possible reasons for human firing, hunting is overwhelmingly favoured in most discussions regarding pre-Neolithic cultures perhaps reflecting the standard subsistence models for European early Holocene hunter gatherers (Mason, 2000: 140). The categories of hunter-gatherer, agriculturalist and pastoralist imply that societies are defined by both their technologies and subsistence strategies. Unfortunately in many prehistoric investigations, the real criterion for the hunter gatherer is not based on the presence of hunting and gathering, but rather on the absence of farming (Hind, 2004: 42) which could be due in part to the fact that one of the main characteristics of the British Mesolithic is the paucity of its evidence, especially when compared to later prehistory (Simmons, 1996: 27). This could provide a little evidence against the continuity arguments as different land-use practices have a marked effect on the visibility of sites (Spikins, 1999: 20). The paucity of distinctive Mesolithic material culture or achievements, with diminutive microliths often seen as an appropriate symbol of the period, can be seen to have led to a search for what might be distinctive about the period and a resultant emphasis on adaptations to environmental changes as a major distinguishing feature (Spikins, 1999: 3). Environmental archaeologists have tended to be conservative in the adoption of the interpretive position, keeping within standard paradigms of science (Evans, 2003: 16) although links with phenomenology were already in place in the Mesolithic of Britain, with movement of small dispersed communities ‘along traditional, wellworn pathways and a return to places that had been used in earlier years or by older generations' (Edmonds, 1999: 488, cited in Evans, 2003: 14). People did not live in a vacuum, but acted on and were acted upon, by a range of different things (Sturt, 2006). Land too is not neutral, but is used in an active way to demonstrate identities, construct metaphors and articulate power. Settlements are positioned so as to be visually expressive and the easiest options in terms of economic production and access are not always taken since social value can be a greater consideration (Evans, 2003: 14-15). It is in an avoidance of these considerations that many traditional environmental studies are let down; providing interpretive archaeologists with a reason to be critical.

Supposing the woodland clearances by fire are human induced, we should be looking at the motivations surrounding the action. A distinction needs to be made between domestication and environmental manipulation, such as cultivation, which can be carried out to encourage undomesticated species (Bell and Walker, 1992: 113). Using fungal spore analysis to complement pollen and charcoal data, and to indicate the presence of dung, Innes and Blackford (2003) test whether post-fire regeneration attracted increased concentrations of large herbivores at North Gill on Glaisdale Moor. The pollen diagrams show disturbance phases at almost annual timescales dated to 6316 ± 55 BP (Innes and Blackford, 2003: 188) which at least suggest it is a deliberate act. The evidence shows increased grazing pressure and huge increases in dung fungus throughout the post-disturbance transitional phases (Innes and Blackford, 2003: 192) which could indicate that, in this case at least, the clearances were carried out to attract prey and is likely to be a facet of a hunter-gatherer lifestyle rather than an activity associated with the transition to agriculture. However, this does not exclude agricultural activity from the explanation. Due to the nature of small-scale clearance, cultivation would be followed by a fallow period, which brings in grazers and promotes wild fruit growing plants. With a low population density, mobile farmers and hunter gatherers get a better subsistence yield through the cooperative use of the land (Bukach, 2004: 158). The fact remains, though, that burning can cause the number of herbivores to visit a site to increase by 3 or 4 times their former level and these ecological effects can last for 10 to 15 years which creates a need for repeated cycles of burning (Bell and Walker, 1992: 154) and is more likely to have been of use to populations who practice hunting for at least part of their subsistence strategy. In order to improve palaeoecological interpretations it may be necessary to undertake greater consideration of ethnographic parallels for land use practices in addition to detailed consideration of the specific resources that may have been managed by Mesolithic peoples (Mason, 2000: 140), rather than relying on the majority of previous models where the only potential foodstuff discussed in relation to landscape burning is hazelnuts.

That the importance of hazel features more strongly in the upland landscape zones rather than the oak-lime of the lowlands (Simmons, 1996: 13) may indicate that the assumed importance of hazel could be a feature of potential sample biases. However, a pragmatic consequence of the interpretive approach is that every facet of material remains – what we call the archaeological record – is of direct relevance to past human lives. Conventionally neutral remains such as soil textures and pollen grains can have been purposefully created and actively used as such by ancient communities and have been of as much significance in their lives as landscapes, the animals and the vegetation that gave rise to them (Evans, 2003: 17). This at first may seem to be a little too far reaching but it is possible, for example, that hazel bushes could have been encouraged for the visibility of their pollen as a means of creating identity in a land and its people: coppicing and use of the long rods were a consequence of this (Evans, 2003: 18) as was any potential harvest and increase in the pollen signature evident today. Heavy lime woodland typical of lowland zones means little undergrowth therefore less subsistence for humans and prey animals. At the terminal late Mesolithic, the mid-uplands developed oak and birch forests with abundant resources but that unfortunately encouraged increased water-logging which led to peat formation encroaching on this (Spikins, 1999: 100). This could suggest that the uplands became more important to late Mesolithic populations and could also explain the rationale behind lowland clearances. The idea that humans influenced the Holocene spread and/or increase of hazel has little ecological evidence in its support (Birks, 1989: 508). They are more likely to have spread by water currents from the west European coastal fringes where hazel was abundant prior to

9500BP (Birks, 1989: 511) and tests have shown that they can float for at least 30 days in fresh or salt water and still retain their viability (Birks, 1989: 511).

By inference, clearances are often apparently viewed as analogous with those of later periods, placing Mesolithic populations in an implicitly pre-agricultural role. Emphasis is thus given to plant taxa that are felt to fulfil a potentially pre-agricultural role, largely annual small-seeded plants. But there is a potential role as a Mesolithic staple of bracken rhizomes (which have a widely acknowledged positive response to fire), bulrushes and the common reed (which has good evidence of burning from the early Mesolithic site of Star Carr) (Mason, 2000: 140). There are also berry bearing low shrubs which ethnographic evidence from North America shows increased productivity after burning (Mason, 2000: 141). Acorns are often ignored. They are a commonly and sometimes abundantly available resource with potential as an energy staple which is storable for a long time (Mason, 2000: 141); although the varieties native to Britain require a level of processing in order to make them edible. Burning removes the build-up of undergrowth and dead vegetation reducing the chances of potentially destructive high-intensity fires. It reduces competition for nutrients, ground-water etc. and destroys pests. It also facilitates the gathering of acorns from the ground (Mason, 2000: 142).

In their work in the North York Moors, Simmons and Innes (1996) found evidence that shows a cereal episode of 50 years at around 5300BP (Simmons and Innes, 1996: 614). Birch declines suddenly halfway through the phase but the otherwise sudden increase in birch and hazel suggest increased flowering caused by increased light. There is also an increase in bracken, heather and other ferns and charcoal which indicates that fire was implicated in the maintenance of this opening (Simmons and Innes, 1996: 617). However, as basic forest cover diminishes in an area, the catchment zone increases in size. More extra-local pollen is then recorded therefore some events are likely to be under-recorded in that their visibility post-dates their presence (Simmons, 1996: 44). Ethnographically Native Americans were able to effectively increase their resources with minimal effort by manipulating the edges and patches within a forest through the use of fire. This was probably seasonal behaviour and may have become more intensive in scale over time (Moore, 2000: 133). Where woodland clearance can be demonstrated it has much in common with Mesolithic sites in that spatially, edges are favoured especially overlooking valleys, off crests or on the edges of lakes (Simmons, 1996: 78). They also tend to be found on south-facing slopes and at river heads (Spikins, 1999: 13). Differing erosion rates, particularly at upland locations, will have an effect on the recovery at sites. Effectively, the optimal recovery location for sites according to erosion patterns should be at plateau edges, in south facing slopes – especially at valley heads – and in locations with a wide area of view (Spikins, 1999: 25) and therefore it is not necessarily Mesolithic preference that creates these site distributions, rather the accessibility of archaeology. If it was in fact the populations and activity of the Mesolithic peoples that created these distributions, such apparent site preferences could be due to the fact that the setting or locale is not neutral. People chose where they do things, partly as a means of controlling a situation, partly to be easy in association with particular kinds of behaviour, and partly as a prescript of tradition (Evans, 2003: 29). The idea that outside of clearances, these islands were densely forested cannot be definitively proven as Frans Vera (2000) debunks the widespread idea that the 'wildwoods' of Britian and Europe were a dense, continuous canopy and suggests instead they may have been similar in structure to wood pasture and parkland (Whitehouse and Smith, 2004: 199). However underneath most types of moorland vegetation there are podsolic soils typical of coniferous or boreal forests (Simmons, 1996: 3) and it is the exception to find an upland which is not substantially covered with close-canopy woodland at some point before 5000BP (Simmons, 1996: 12)

Where there is a subsequent restoration of woodland pollen frequencies after evidence of woodland clearance, this is typically seen as forest regeneration and human abandonment (Moore, 2000: 126). Woodland regeneration is demonstrated when high values of open ground indicators such as herbs, bracken and heather are joined by woody shrubs like *Rubus* (blackberry), *Prunus* (blackthorn), *Sorbus* (rowen, whitebeam etc.) and Rosaceae (rose). As they decline dominance of the spectra is taken over by shade-intolerant tree species such as *Betula* (birch), *Corylus* (hazel) and ash. The high forest then regenerates with oak and lime especially but renewed woodland may provide a habitat for more ash and alder than had previously occurred (Simmons, 1996: 107). Increased firing brought about changes in early

Holocene soil which allowed the development of woodland succession therefore rather than destroying primeval forest, they may have been instrumental in creating it (Moore, 2000: 133). Incidental indicators of burning include *Rumex acetasella* (sheep sorrel) as an early pioneer and Melampyrum (cow wheat) (Simmons, 1996: 110).

In Britain, broad-leaf deciduous woodlands are generally regarded as lacking susceptibility to fire and the removal of lowland woodlands during the Neolithic is seen as accomplished through the use of stone axes (Moore, 2000: 126). Mesolithic woodland disturbances are seen as being caused by human manipulation in the upland zones with little or no lowland Mesolithic disturbances due to woodland composition not being flammable. This belief may have some basis in fact, but it is certainly influenced by spatial biases towards the uplands as pollen sampling sites (Moore, 2000: 133). As there are no natural British woodlands surviving, system dynamics can only be postulated (Moore, 2000: 126). The moorlands of upland Britain present a wilderness unexpected in so densely settled a country (Simmons, 1996: 1). The underlying assumption that this landscapes characteristics is a state of 'natural beauty' with the inference that it was basically the upland climate which produced the lack of trees (Simmons, 1996: 3) but human societies are implicated in at least some phases of the removal. During the Mesolithic a permanent recession of the forest took place in some upland landscape zones – the treeline being lowered from a maximum of 700m to around 300m OD. In general the coastal and/or lowland sites show much less evidence of disturbance than the moorlands or heaths (Bell and Walker, 1992: 157) but again this could be more due to sample bias rather than an archaeological fact. The fact that this burning and clearance cannot be observed in Scandinavia suggests distinctive insular environmental relationships and economic strategies (Bell and Walker, 1992: 158) and as such could lend support to the argument towards continuity. As already mentioned the apparent long-lived episodes of disturbance may actually represent separate disturbance events combined. These could be due to human, animal or natural events (Simmons and Innes, 1986: 396)

On the beginnings of Agriculture

Cereal pollen cannot always be taken to demonstrate agricultural behaviour. Soyland Moor in the central Pennines demonstrates cereal pollen at 4160 ± 40 BC though without an inferred agricultural horizon (Edwards and Hirons, 1984: 75). Cereal pollen is not widely dispersed so, as here, profiles close together may have cereal in one and not in the other (Simmons, 1996: 157) therefore there can be a possible absence of cereals during a disturbance phase that does not necessarily indicate an absence of cereals in the past. In some instances cereals may be under-represented. There are problems with the filtration of larger pollen grains (i.e. cereals) by woodland or by lakeside carr (Simmons, 1996: 43), but problems in the reliability of the representation of pollen from all plants are something we must always be aware of. Pollen grains from different plants or plant groups have varying wall thickness and patterning, which although useful and necessary in making them identifiable, also makes them vary in their susceptibility to different decay processes (Bunting and Tipping, 2000: 63).

Weed pollen types frequently associated with arable land (e.g. *Rumex, acetosella, Chenopodiceae, Polygonum*) may merely indicate some relatively open ground (Edwards and Hirons, 1984: 75) and as such may have an alternative subsistence strategy associated with them. Around hunter gatherer camps there may have been ‘gardens’ of favoured species growing naturally from seeds germinated from dumped food and faeces (Bell and Walker, 1992: 114)

Environmental Perception and Influence

Most environmental considerations in the past have seen the environment as either permissive: allowing several options or choices, or determining: creating them (Evans, 2003: 2). To evaluate the effects of environmental variables on human groups or individuals, we need to involve a consideration of human environmental perception alongside an examination of more easily accessible modern analogies in order to fully, or more completely, assess the range of human reactions to specific environmental stimuli (Bell and Walker, 1992: 8). This escapes the brand of environmental determinism as there are a variety of responses available and is more appropriately considered to be possibilistic in that environments may limit but not necessarily cause human behaviour. Neither animal behaviour nor human behaviour takes place in isolated worlds of nature or culture, animal or human. Interaction is partly ecological; animals and humans adjusting their behaviour in relation to competition or cooperation with other species, but it is also expressive; about social influence and power (Evans, 2003: 3). Most Mesolithic researchers tend to interpret adaptations as an adjustment to both environment and social changes therefore a rise in social complexity can be seen as an adaptation; but to factors such as increasing population stress or demand for certain goods rather than directly to a specific environmental change (Spikins, 1999: 2). Environmental change may create either the opportunity or necessity for change in human behaviour but does not necessarily determine a precise trajectory or indeed timescale (Bell and Walker, 1992: 9). We should therefore be unafraid to mention environmental change, even linked with patterns of changes in cultural behaviour, and instead be explicit in the standpoint and reasoning behind our explanations and narratives.

The spread of lime (*Tilia cordata*) or linden to northern England must have involved fertile seed production and successful establishment. This suggests that between 6000 and 5500BP, July and August mean temperatures may have been 2-3ºC higher than today (Birks, 1989: 517). In current climate conditions lime does not produce fertile seed in this geographical area. Undergrowth species are a more reliable indicator of short time-scale climate change as they are more mobile than tree species, and as such show less of a time lag in expansion after climatic change not only because they can mature more quickly and produce seeds after a single season, but also that their seeds are lighter and more easily dispersed (Spikins, 1999: 81). Unfortunately they are often under-represented in pollen analyses as trees are considered the dominant species.

The delay in the adoption of agriculture from the rapid spread in central Europe to peripheral areas may be because in maritime areas ecotonal environments offered a viable alternative, rich enough locally to support a semi-sedentary lifestyle (Bell and Walker, 1992: 159). Sites are established where they can be seen or otherwise sensed and where these perceptions last. Often this is on marginal land, and so the abundance of archaeology on such land may be considered as an active policy in which visuality was being managed (Evans, 2003: 72). This can be seen at upland ridges and in marine environments. Coastal space changes with the daily rise and falls of the tide therefore it is not just one area i.e. coastal or 'wetland' (Sturt, 2006) – rather a suite of potential habitats, environments and indeed larders, which are both transient and transformative in nature. Wetlands have seen continual activity from the Mesolithic through to the Iron Age but we still need to characterise the nature of the practices carried out in such areas and to establish whether their use and/or meaning changed through time (Brennand, 2007: 33). Maritime archaeology's point of engagement with the environment forces a more sensitised approach to space, temporality and change than terrestrial (Sturt, 2006) what Lefebvre termed the trialectics of space – conception, perception and experience. Tidal flat or lagoonal landscape zones are areas in which marine and estuarine facies alternate with freshwater facies (Tooley, 1974: 20). Perimarine landscape zones are where the rate and character of biogenic sedimentation is affected indirectly by changes in sea-level therefore freshwater lake muds intercalate terrestrial peats and can be shown to be related to relatively high and low sea levels respectively (Tooley, 1974: 20).

Reconstructions of coastline during the Mesolithic show a 25% land loss due to marine inundation in places with mean tide levels from ca -20m to ca -2m by 5000BP. The forests of the Flandrian II would have reached to within 10m of the high tide mark (Simmons, 1996: 23-24). Rising sea levels are responsible for submerging what might exist of previous evidence for marine exploitation; the precise timing of any following diversification is difficult to define (Spikins, 1999: 3). It is not only the evidence for marine exploitation that has been possibly obliterated, many other practices, whether subsistence based or not, could also have been lost to these events. This can free up potential interpretive explanations however as the differences between then and now mean there is no temptation to make a direct link between how space manifests itself today and in the past (Sturt, 2006). The Lytham VI marine transgression equalled as much as +3m OD (Tooley, 1974: 34) which would have undoubtedly created a level of resource hunger albeit not necessarily a dominant one. It is an unfavourable relationship between the population and the least available critical resources that constitute population pressure such as terrestrial resources for hides in a marine territory.

Population density alone is not a measure of population pressure (Keeley, 1988: 376) but even in places where there is little evidence of any major change in social complexity; population changes are commonly associated with the adoption of agriculture (Spikins, 1999: 3). From Lytham VI and the fluctuations of sea level from which it derives, there is evidence from a range of terrestrial environments of significant climatic shifts (Tolley, 1074: 37) so although these effects may have been more apparent in coastal zones, they would have impacted everywhere. The shallowly shelving nature of some coastal landscapes means that even a slight change makes a big impact (Sturt, 2006).

It is difficult to leave these environmental factors out of any explanation for increased intensity or social changes as they would have had a direct effect on the populations at the time, but patterns of human settlement and land use must be seen at least in part as a result of social mediations rather than as a mapping of the environment for food, defence and communications (Evans, 2003: 93). As in all aspects of environmental data, it is important not to throw the baby out with the bath water. Although environmentally deterministic research sells short the complex social, political and cultural life of the populations under investigation, ignoring environmental considerations and concentrating wholly on an interpretive narrative excludes an aspect of their life which in many ways would have been dominant. This is not because they are 'less-developed' hunter-gatherers, but because they are reasoned, strategical and adaptative people. The environment has an impact on all cultures. Our house styles, clothing, food and the way in which we dispose of our dead are all influenced in some way by the environment and climate in which we live - as we would not discount the environment and climate as aspects of our own culture and cultural development, there is no logical reason why we should do so for past populations.

Chapter Three

Seeing the Wood from the trees – The Study

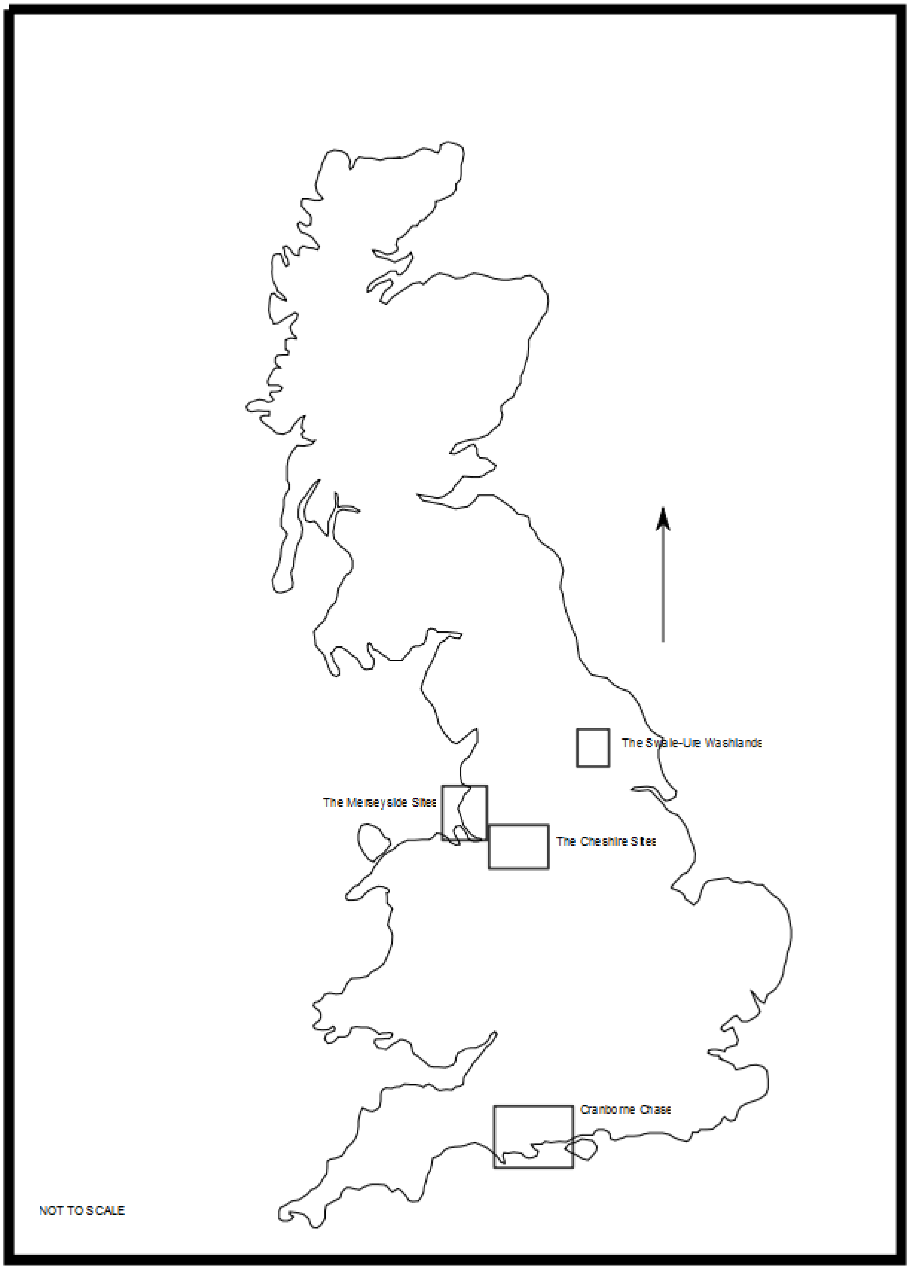
> If trees could scream, would we be so cavalier about cutting them down? We might, if they screamed all the time, for no good reason.
>
> Jack Handey

The aim of this investigation is to test whether palaeoecological data can be used to identify human activity in archaeologically 'empty' areas. As a pilot study for potentially further research, it is being carried out using pollen data from published sources, concentrating on the Mesolithic Neolithic Transition. The data used has been taken from the relatively empty areas of North West England, supplemented by data from areas thought to be archaeologically more complete from either side of the Mesolithic Neolithic divide – namely Yorkshire for the Mesolithic and Wessex for the Neolithic. In the archaeologically empty areas for the period there is little secure artefactual evidence to identify the exact moment of Neolithisation and so, in order to treat all data as comparable to each other, I have used the elm decline as a division between the two periods. In doing so, I am in no way supporting any ideas of the elm decline being anthropogenically induced. It is being used purely as a visible marker in palaeoecological terms which, in places where there is a secure and continuous archaeological record, often marks the changes in material culture.

The Sites

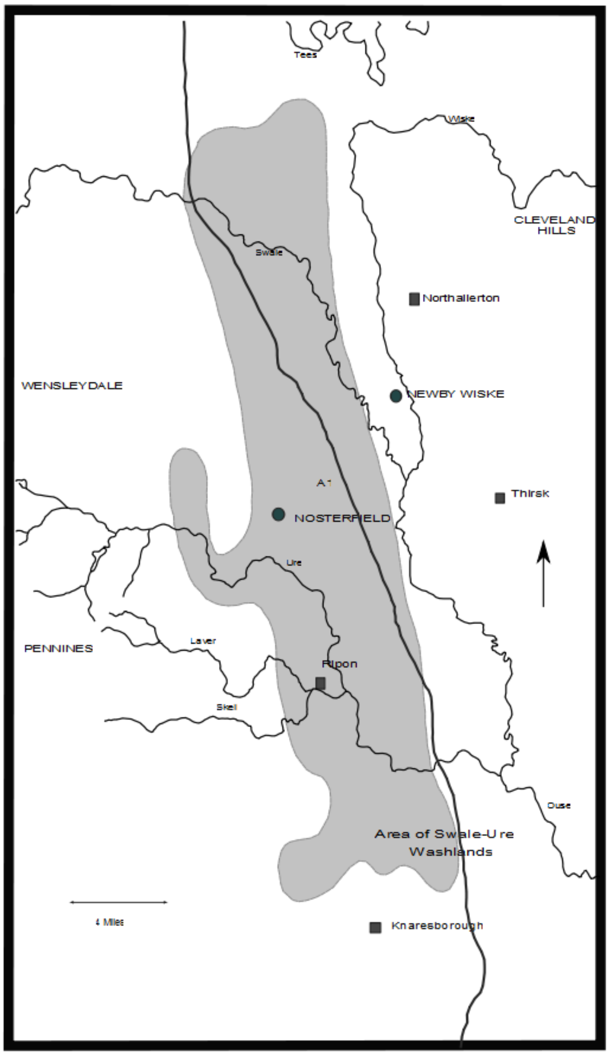
Figure 1 shows the location of the sites used in this investigation.

Figure 1: The Study Areas



The Swale-Ure Washlands: Situated in North Yorkshire, the 'Swale-Ure Washlands' is a name given to the low-lying area between the Pennines and the North Yorkshire Moors that is drained by the rivers Swale and Ure (Bridgland *et al*, 2011: 1)(see figure 2). These are the most northern of the Pennine rivers that flow east to the Humber, and drain the majority of North Yorkshire. With the melting of the last ice sheet, large amounts of sand and gravel were deposited in the washlands which have since accumulated organic sediments such as peats which represent rich sources of palaeoenvironmental and archaeological evidence (Bridgland *et al*, 2011: 1).

Figure 2 – Location of the Swale-Ure Washland Sites (from Bridgland *et al*, 2011:plate 1:1)



The undulating relief is characteristic of the transitional land between the lowlands and uplands of the Yorkshire Dales and is moderate; with the main river valleys lying below 30m OD and the intervening interfluves generally less than 100m OD (Bridgland *et al*, 2011: 2).

The bedrock geology of the Washlands is characterised by a series of eastward-dipping sedimentary rocks overlain by glacial till (boulder clay) and sands and gravels associated with meltwater (Bridgland *et al*, 2011: 6).

The area of North Yorkshire that includes the Swale-Ure Washlands has a rich and varied archaeological heritage - including the Neolithic Thornborough Henges and their associated multi-period landscape - usually biased by differential preservation of non-organic material and by site destruction and concealment due to intensive agriculture in recent times (Bridgland *et al*, 2011: 20). This has contributed to creating an area that **appears** increasingly 'empty', but as finer-grained alluvial sedimentation has preserved biological material as well as artefacts, in Holocene geoarchaeology of the area, there is a shift in emphasis from artefacts to environmental evidence, within which an increasing possible human presence can be detected.

<u>Nosterfield Quarry – The Flasks – Stakehole1</u>

There is a long history of gravel extraction in the vicinity of the village of Nosterfield with a number of abandoned quarries in addition to the extensive active quarry that was the object of the study (Bridgland *et al*, 2011: 65). The area known as the Flasks which lies in the North-eastern part of the quarry contains several deep, steep-sided shafts, and has possibly formed as a gypsum-karst feature. One of these depressions, termed Stakehole1, was chosen for detailed analysis after manual auguring showed that it contained deep organic sediments (Bridgland *et al*, 2011: 99). Samples for pollen analysis were prepared throughout the sequence at five centimetre intervals and preservation was found to be generally good. The pollen results table for Stakehole1 can be found at Appendix I. As the study includes analyses of late glacial depositional environments that were poor in trees; pollen and other microfossil frequencies were calculated throughout the study as percentages of total land pollen sum including trees, shrubs and herbs but excluding aquatic pollen and all spores (Bridgland *et al*, 2011: 88).

From this data the proportions of different types of vegetation surrounding the area can be extrapolated. Unfortunately there were no appropriate macrofossils present from which this level could be radio carbon dated, but interpolation between two dated levels produces a date for the elm decline of about 5200 BP (Bridgland *et al*, 2011: 105). Figures 3 and 4 show the general vegetation types from pre and post elm decline of the area.

Figure 3 – Stakehole1 – pre elm decline flora (see appendix I)
(Results calculated from the graph in the appendix)

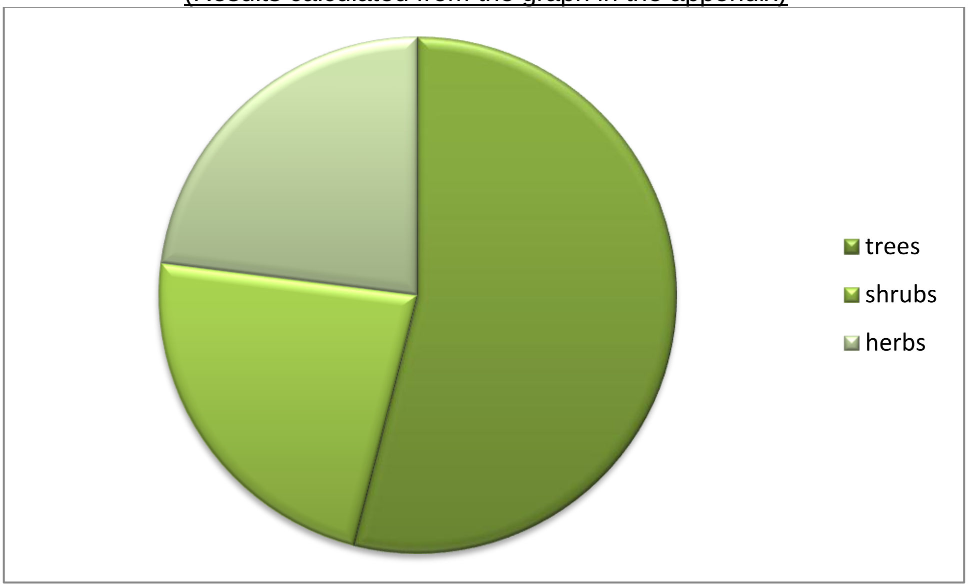
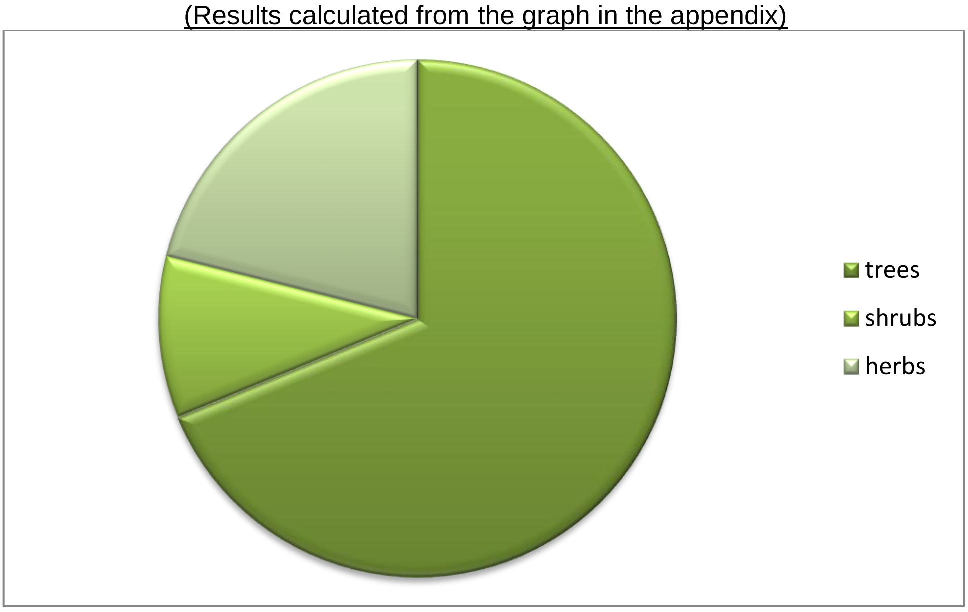


Figure 4 – Stakehole1 – post elm-decline flora (see appendix I)
(Results calculated from the graph in the appendix)



Although herbs and shrubs make up a considerable portion of the flora at both dates, there is not the same variability in species as can be found in trees. Figures 5 and 6 show the proportions of different tree pollen surviving at both dates. Hazel has been included in this data, not only as a visible and dominant shrub, but also because it can grow as a tree – especially with anthropogenic influence.

Figure 5 – Stakehole1 – pre elm decline trees (see appendix I)
(Results calculated from the graph in the appendix)

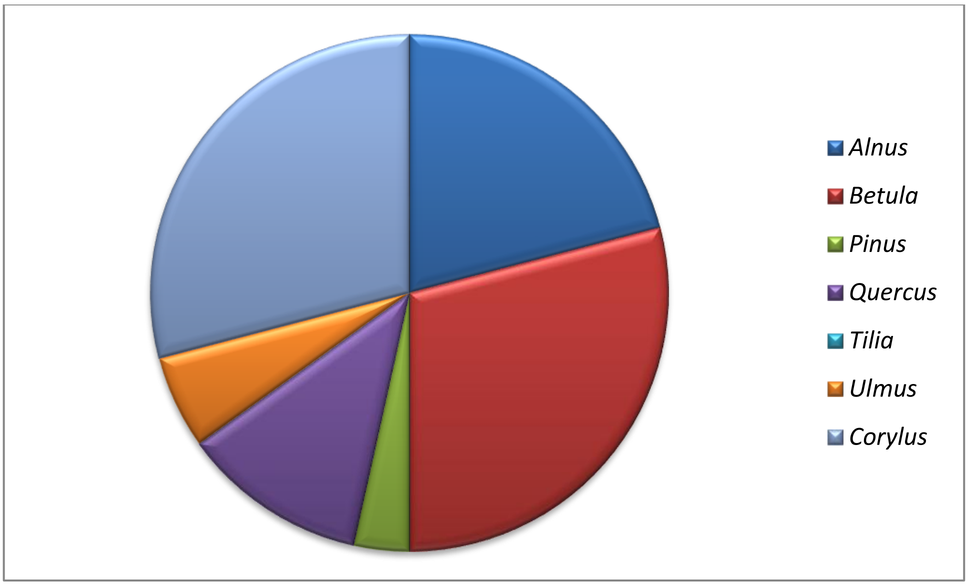
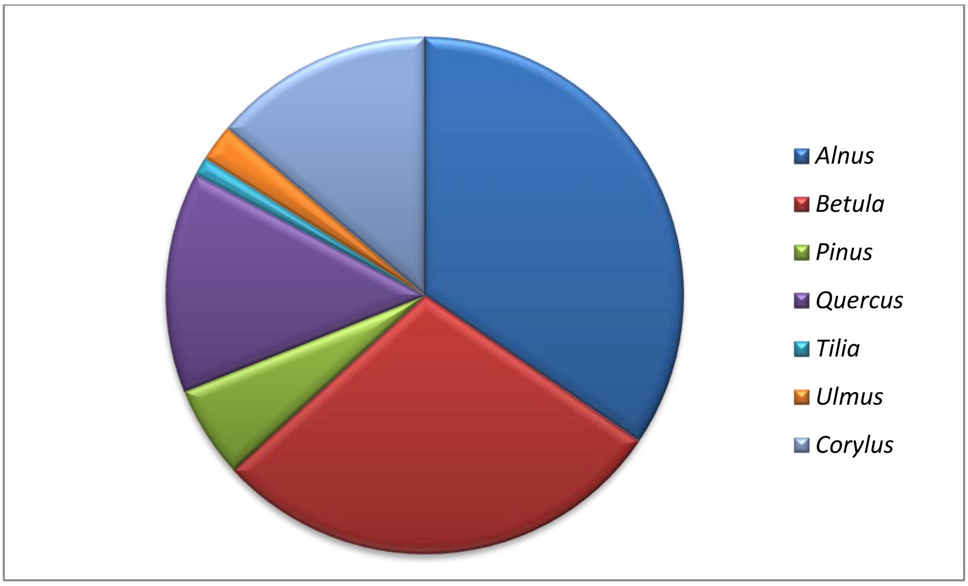


Figure 6 – Stakehole1 – post elm decline trees (see appendix I)
(Results calculated from the graph in the appendix)



There is neither anthropogenic evidence of clearance from Stakehole1 nor any cereal type pollen until much later in the sequence. In addition to this, there is no synchrony between alder pollen troughs and herbaceous indicators of open conditions such as *Plantago Lancelota, Rumex and Taraxacum* type although these are present sporadically. The results will be discussed in the next chapter.

Newby Wiske

The Newby Wiske site is located just south of the villages of Newby Wiske and South Otterington within the Wiske valley, the major eastern tributary of the River Swale within the Washlands (Bridgland *et al*, 2011: 112). It is an extensive area of peat bog within a former meltwater channel which is artificially drained. The detrital peat sediments contain abundant wood remains that form discrete layers in many places, including the sampled core (Bridgland *et al,* 2011: 114). The Newby Wiske profile was subsampled for pollen analysis at four centimetre intervals – closing to two centimetres where major frequency changes occurred. Pollen preservation was generally good. The pollen diagram can be found at Appendix II. From this pollen data radio carbon dates have been established with 5241±32 cal. BP for pre elm decline and 4921±33 cal. BP for post elm decline. Figures 7 and 8 show the distribution of flora from the pre- and post- elm decline of the area.

Figure 7 – Newby Wiske – pre elm decline flora (see appendix II)
(Results calculated from the graph in the appendix)

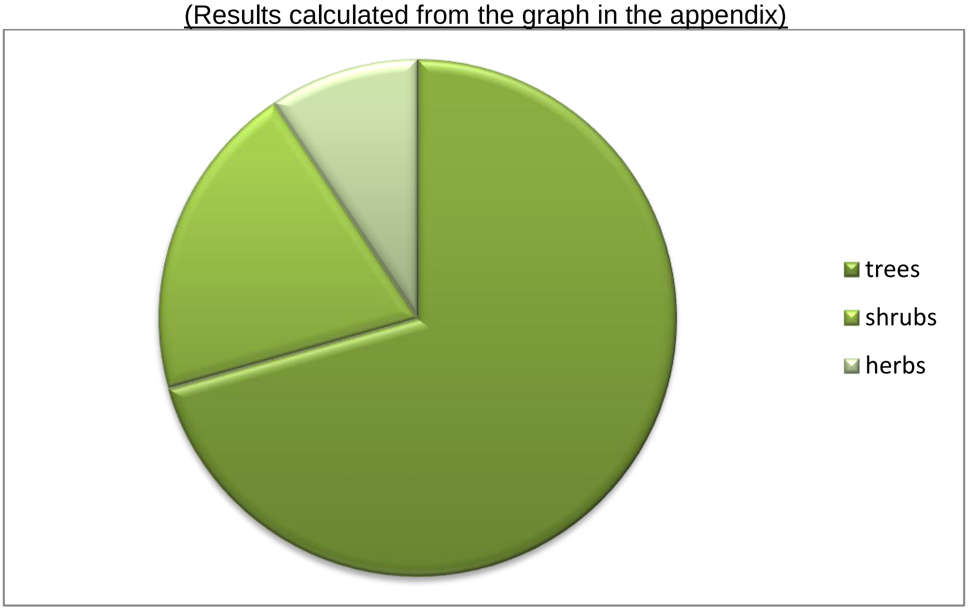
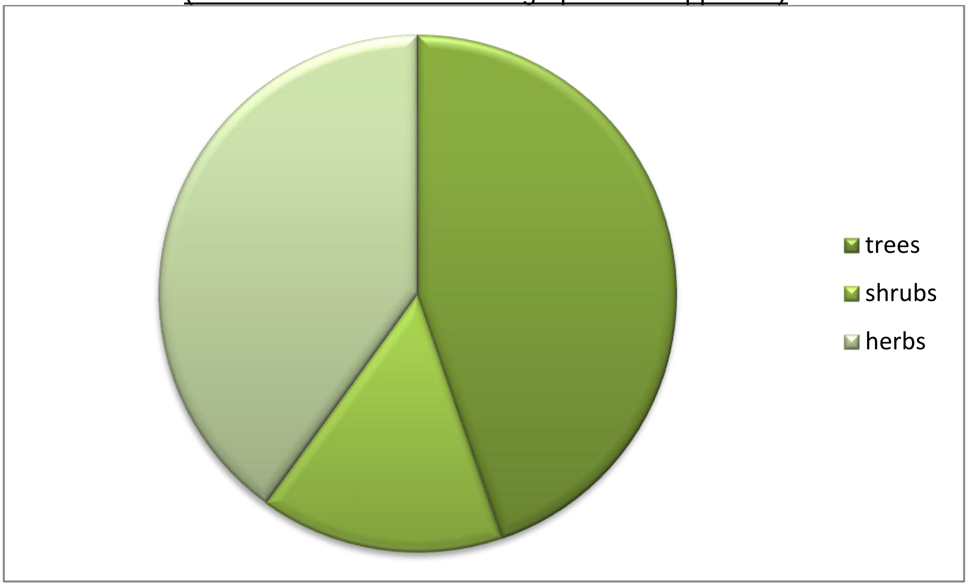


Figure 8 – Newby Wiske – post elm decline flora (see appendix II)
(Results calculated from the graph in the appendix)



It is evident that there is a considerable clearance episode at this time, particularly the clearance of trees. There is a reduction in the shrub pollen signatures but not to the same extent as the trees. This coincides with increased micro-charcoal, suggesting clearance by means of fire, and the appearance of cereal-type pollen for the first time which remains continuous from this date, and could indicate that the clearance was deliberate. This will be discussed in the next chapter. Figures 9 and 10 show the different tree pollen signatures for the pre and post elm decline.

Figure 9 – Newby Wiske – pre elm decline tree distribution (see appendix II)
(Results calculated from the graph in the appendix)

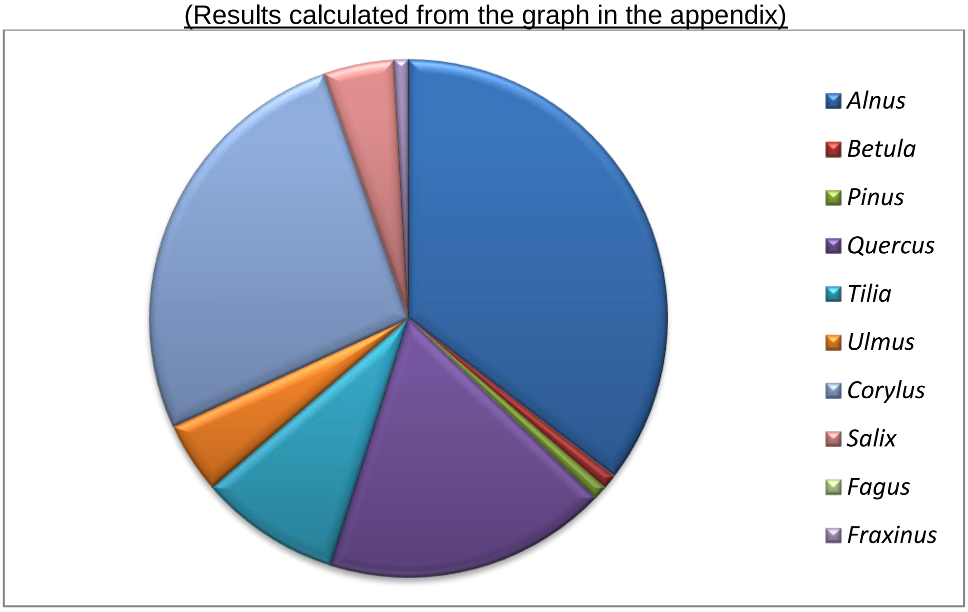
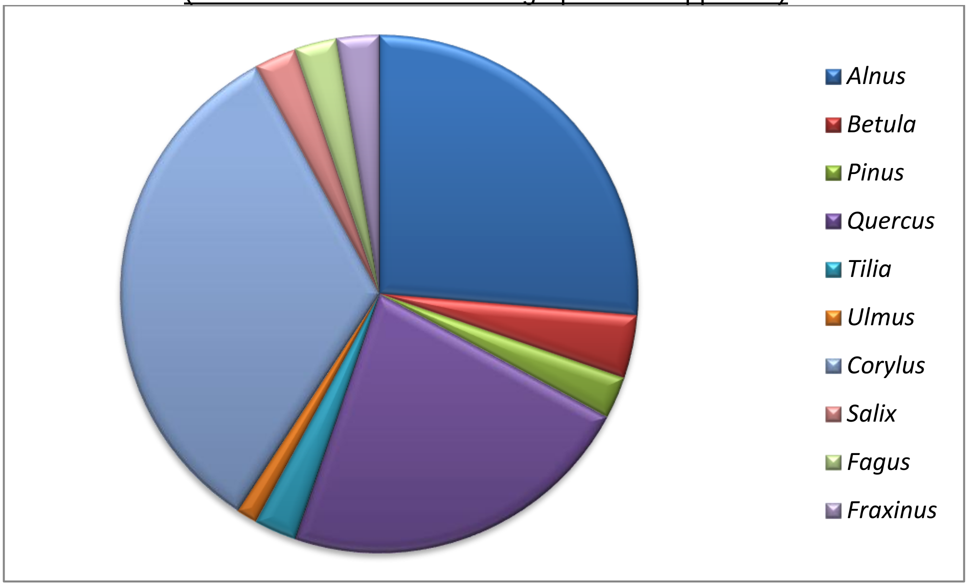


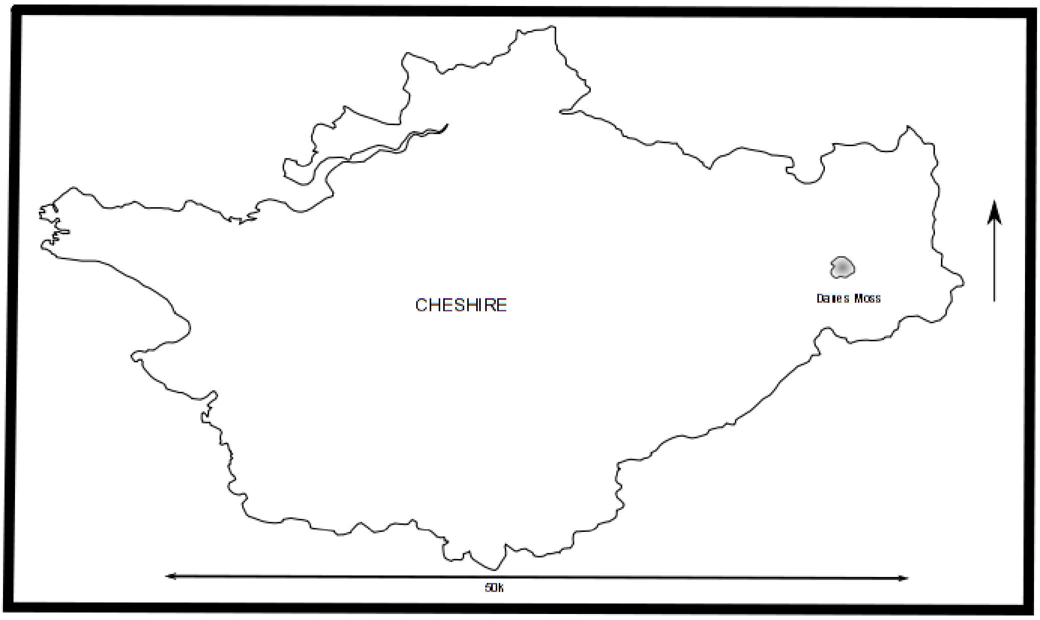
Figure 10 – Newby Wiske – post elm decline tree distribution (see appendix II)
(Results calculated from the graph in the appendix)



The most obvious differences between the two time zones are the visible reduction in alder frequencies and the more varied nature of the post elm decline woodland. As alder often prefers a wetland habitat, its reduction could indicate a level of drainage. Whether this is anthropogenic in cause is unknown but as the levels of hazel, which prefer the same environments, actually increases it could suggest that hazel were being preferentially protected from clearance due to their potential as a food source. The results will be discussed further in chapter 4.

Danes Moss – Cheshire

Figure 11 – Location map of Danes Moss (from Leah *et al*, 1997: 5)



Situated in the Cheshire Plain, Danes Moss is to the west of Macclesfield and occupies a shallow basin on the watershed between the river Bollin in the north and Cow Brook to the south (Leah *et al*, 1997: 63). The plain, although possessing occasional outcrops of solid geology, is characteristically flat. This is due to the blanketing of the underlying solid geology by thick deposits of glacial till during the last glaciation, which can attain a thickness of up to 100m (Leah *et al,* 1997: 10). The deepest peats remaining on the site reach 6.3m and mostly fall into the 3-4m range. It is tentatively suggested that the mire began formation in a broad depression in glacial sands and clays (Leah *et al*, 1997: 64) and with the deepest peats lying in the south east of the Moss, perhaps representing the site of a possible south-draining palaeochannel. The organic stratigraphy indicates that the mire probably began forming as a reed-swamp fringed by fen-carr, which then developed into a widespread alder and willow-dominated carr system as the wet shallow basin terrestrialised (Leah *et al*, 1997: 67). The elm decline at this site can be witnessed and dated to sometime immediately after 5640-5480 cal. BC. Figures 12 and 13 show the distribution of flora types for pre and post elm decline Danes Moss. (See appendix III).

Figure 12 – Danes Moss – pre elm decline flora (see appendix III)
(Results calculated from the graph in the appendix)

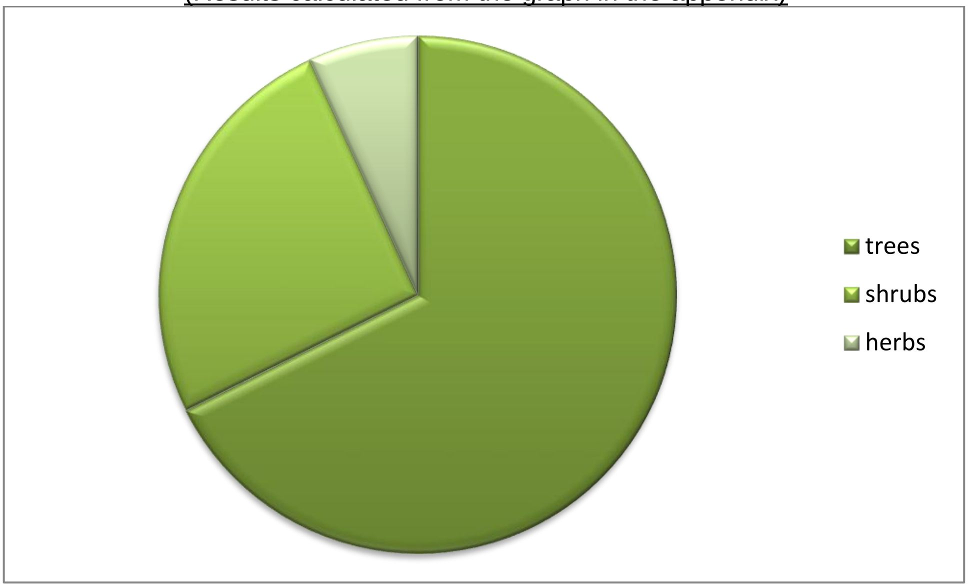
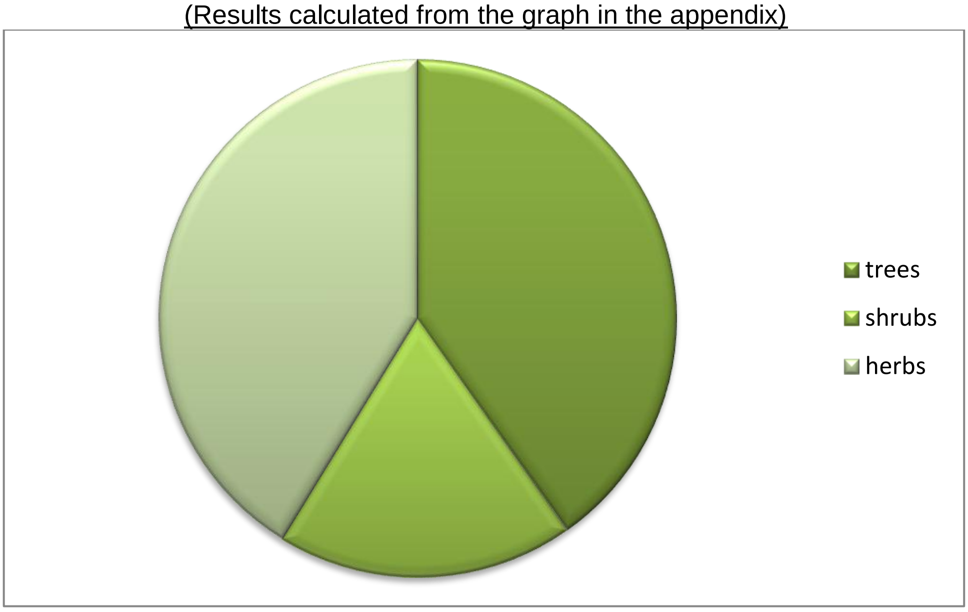


Figure 13 – Danes Moss – post elm decline flora (see appendix III)
(Results calculated from the graph in the appendix)



The most obvious difference between the two dates is the marked decrease in tree and shrub pollen with an increase in herbaceous pollen. This is coincident with a huge increase in charcoal which could suggest clearance by burning. Further discussion on this point can be found below. Figures 14 and 15 show the percentages of tree and shrub pollen at each date.

Figure 14 – Danes Moss – pre elm decline tree and shrub pollen distribution (see appendix III) (Results calculated from the graph in the appendix)

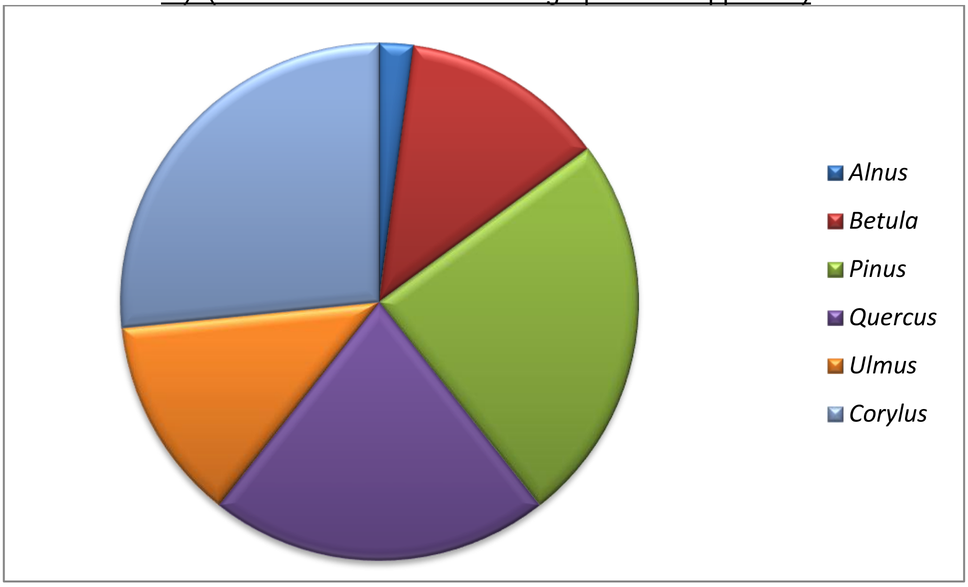
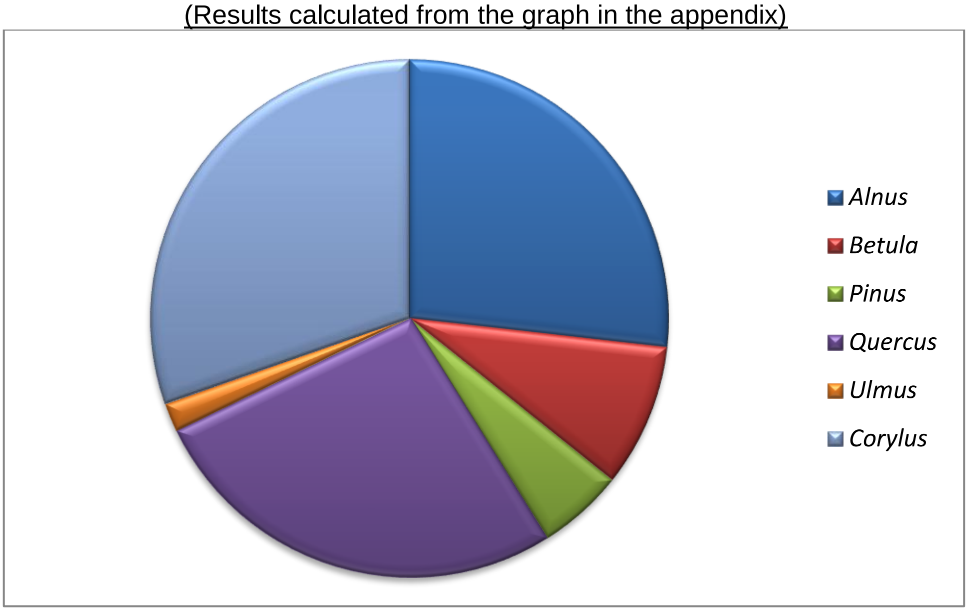


Figure 15 – Danes Moss – post elm decline tree and shrub pollen distribution (Results calculated from the graph in the appendix)

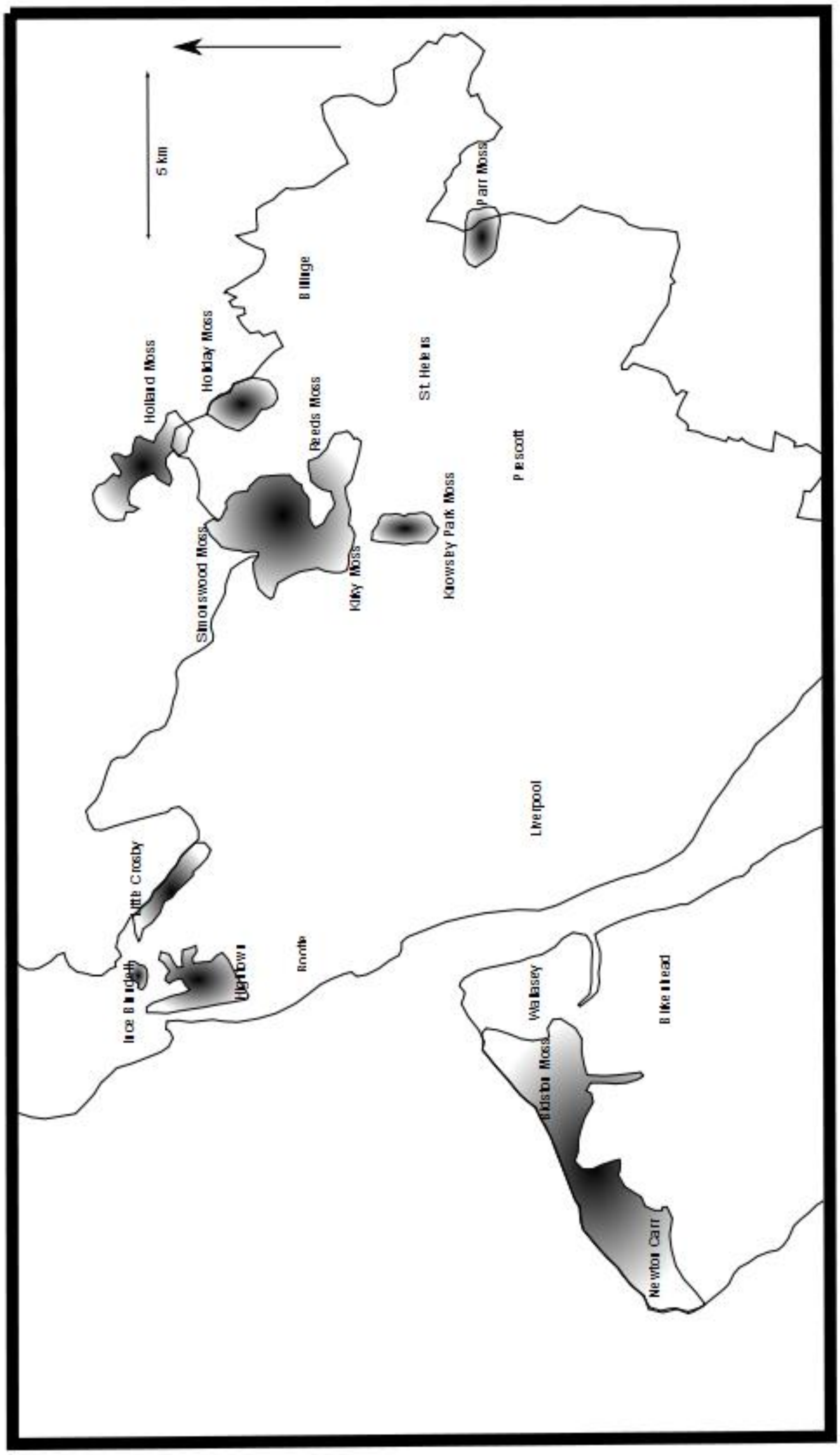


Despite the reduction in tree pollen in post elm decline Danes Moss, there is evidence of an increase in alder and yet hazel is slightly reduced. This is in contrast to Newby Wiske and as such suggests a different scenario is being played out at the two sites. This will be discussed in more detail in the next chapter.

The Merseyside Sites

Figure 16 shows the distribution of the Merseyside Sites

Figure 16 – The Merseyside Sites (from Cowell and Innes, 1994:7)



The Merseyside sites not only provide us with evidence for possible clearance activity during the Mesolithic Neolithic transition, but also allow us to assess the impact of sea-level changes at the time. For example, by the late 7th Millennium cal. BC, sea level increases had led to water-logged conditions along the present Wirral coastlines and low lying areas become dominated by wetland vegetation (Cowell and Innes, 1994: 35). This marks the beginning of a period of approximately two millennia when the prehistoric archaeology relates directly to fluctuating coastlines and periods of direct inundations within wetland embayments and inlets. Merseyside is on the low-lying Lancashire plain, which stretches from the Pennine uplands in the east to Wales in the south-west (Cowell and Innes, 1994: 2). The earliest deposits are represented by solid rocks laid down in Triassic and Carboniferous times. These form the main relief of Merseyside with relatively low sandstone hills and ridges distributed across the central and north-eastern part of the region. Glaciation was responsible for producing the major river channels that flow across the area and for the deposition of a thick sheet of boulder clay which smoothed existing contours and produced a landscape of undulating plains and low hills (Cowell and Innes, 1994: 2). These have been overlain by post-glacial deposits of peats, clays and silts, that have formed in the hollows in response to changes in the water table, due to factors associated with sea-level and climatic changes. As such the dominant relief of the county is mostly independent of the pre-Devensian solid geology (Cowell and Innes, 1994: 5). The boulder clay is a reddish-brown and slightly calcareous, medium to fine textured and rarely completely stoneless. In the north of the county there is a widespread deposit of wind-blown sand of fluvio-glacial origin which forms a plain with the occasional low ridge. These sands are rarely more than 5m thick (Cowell and Innes, 1994: 6). Organic preservation in the county is provided by the inland raised mires formed under climatic conditions of high precipitation, low evaporation and impeded drainage; and coastal peats formed in areas of low gradients, poor drainage and high water tables which are probably linked to sea-level oscillations.

Bidston Moss

Bidston Moss lies at the head of the former large tidal inlet of Wallasey Pool. Although previously a large area of raised bog and marsh, it has been disturbed in the recent past and little of it survives (Cowell and Innes, 1994: 31). For the period under investigation, it is a virtually archaeologically empty area with the few extant sites too sparse and ill dated to demonstrate any relationship between human settlement and changing environmental conditions (Cowell and Innes, 1994: 36). The palynological evidence, however, provides evidence for possible human activity, including the early adaption of cereal cultivation. Figures 17, 18 and 19 show the proportions of flora at the time of first cereal (7360±60 BP), pre elm decline and post elm decline. The elm decline at this site is dated to 5840±70 BP.

Figure 17 – Bidston Moss – First Cereal flora distribution (see appendix IV)
(Results calculated from the graph in the appendix)

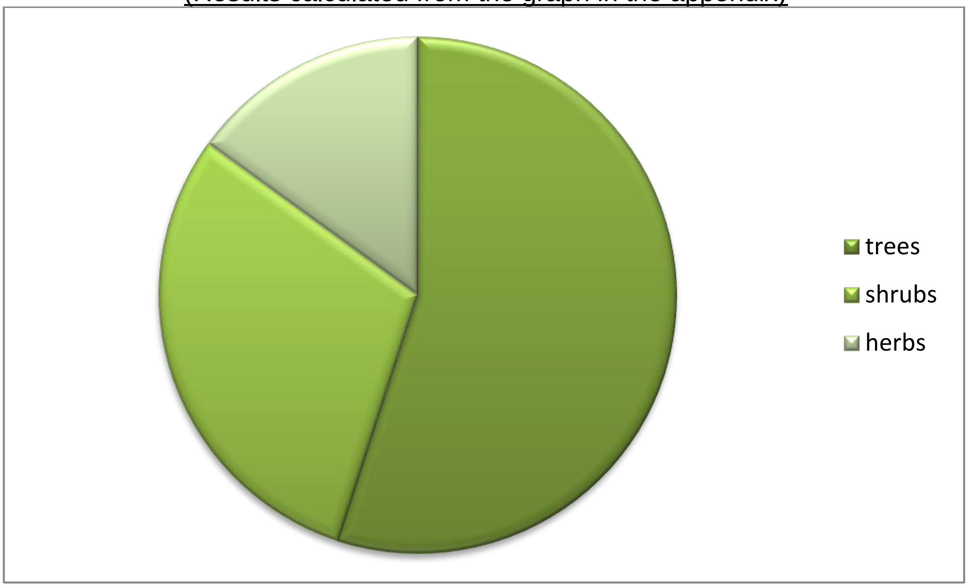


Figure 18 – Bidston Moss – pre elm decline flora distribution (see appendix IV)
(Results calculated from the graph in the appendix)

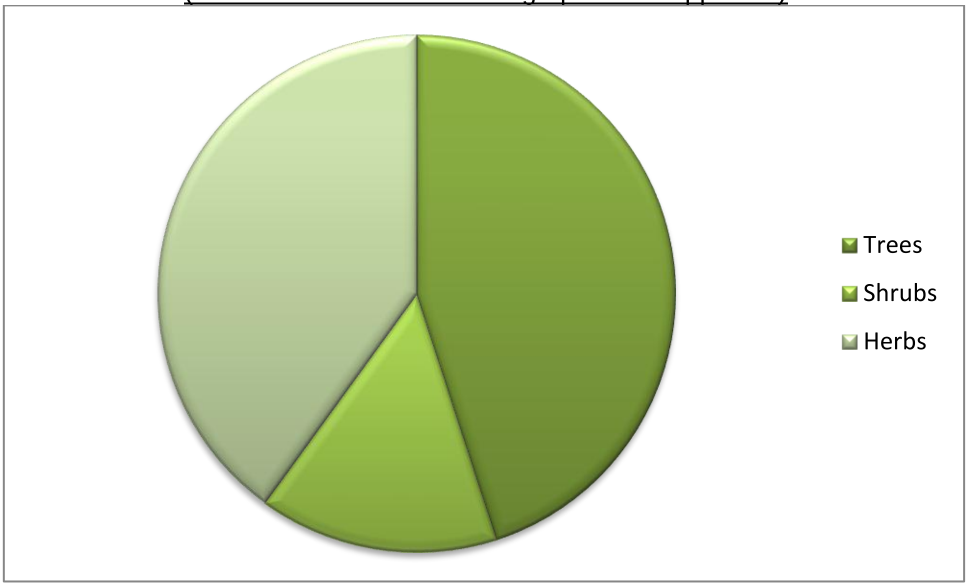
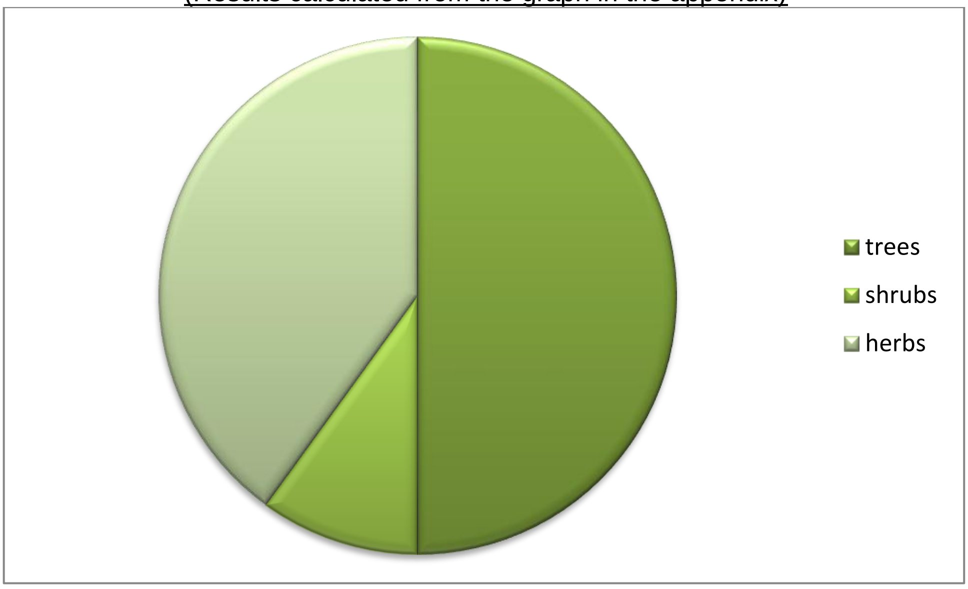


Figure 19 – Bidston Moss – post elm decline flora distribution (see appendix IV)
(Results calculated from the graph in the appendix)



At the instance of the first appearance of cereals at this site, it is evidently still reasonably heavily wooded. Any clearance activity noticeable in the palaeoecological record at this time is small scale. By the elm decline the landscape appears to be much more open and yet tree pollen increases after the elm decline. Figures 20, 21 and 22 show the tree pollen frequencies at this site for these times.

Figure 20 – Bidston Moss – first cereal tree frequencies (see appendix IV)
(Results calculated from the graph in the appendix)

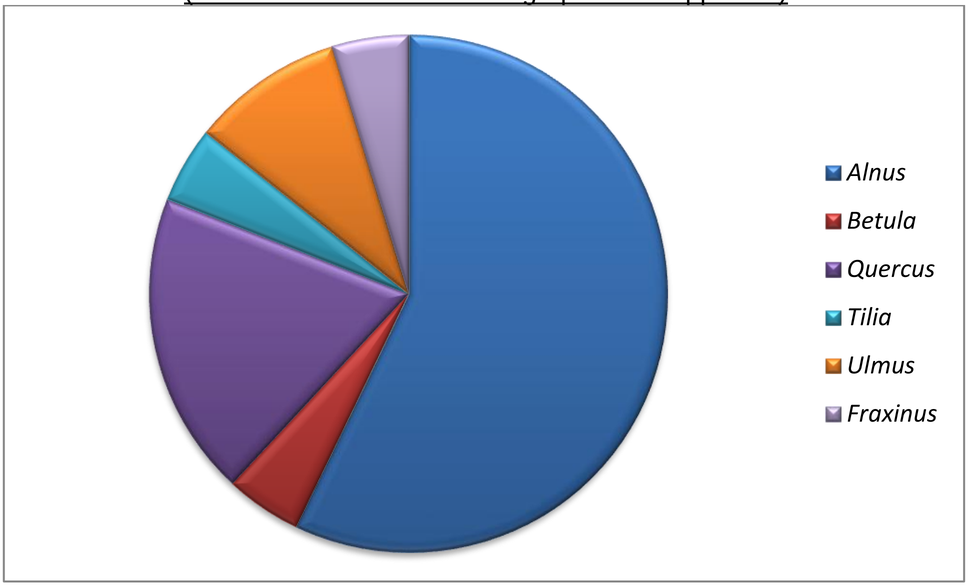


Figure 21 – Bidston Moss – pre elm decline tree frequencies (see appendix IV)
(Results calculated from the graph in the appendix)

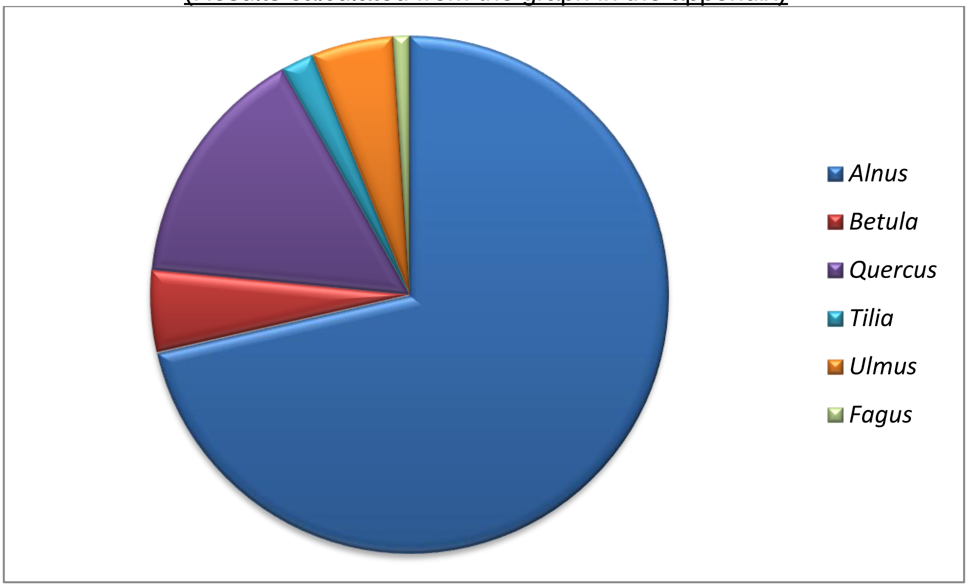
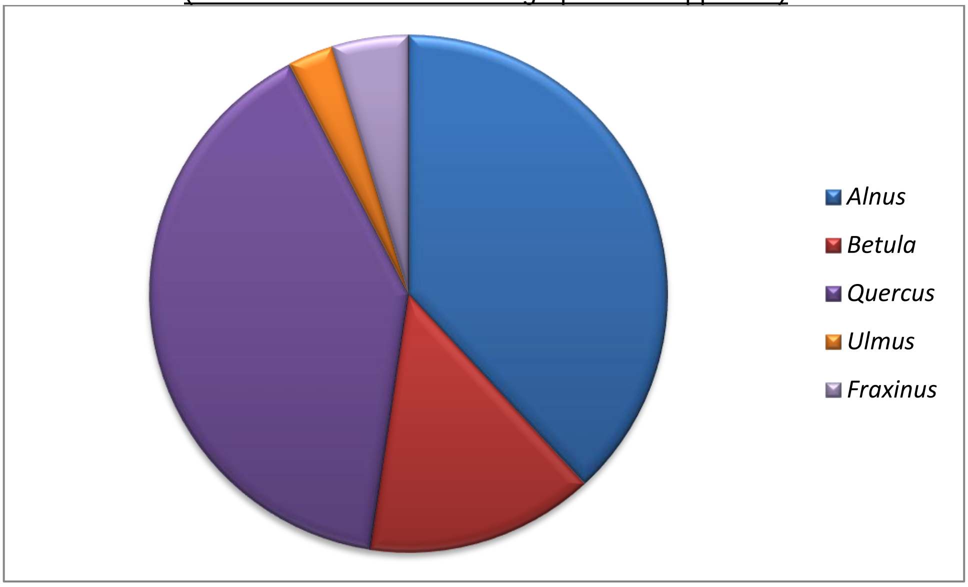


Figure 22 – Bidston Moss – post elm decline tree frequencies (see appendix IV)
(Results calculated from the graph in the appendix)



The results will be discussed in the next chapter.

Park Road, Meols – Wirral

This site contained a complex sequence of intercalated organic and clastic sediments. A lower blue-grey clay was overlain by 0.65m of peat bed which itself was covered by a grey clay (Cowell and Innes, 1994: 61). The pollen analysis was taken from intervals of no more than 30mm in the centre of the peat layers, closing to 10mm near the peat/clay boundaries. The elm decline is evidenced at 4234-3980 cal. BC. Figures 23 and 24 show the flora distributions from either side of the elm decline.

Figure 23 – Park Road – pre elm decline flora (see appendix V)
(Results calculated from the graph in the appendix)

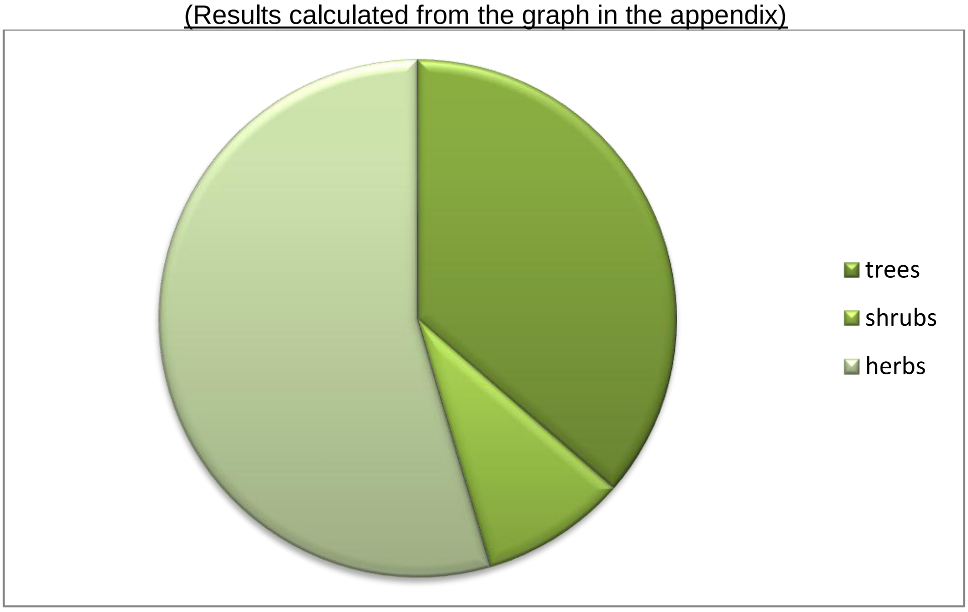
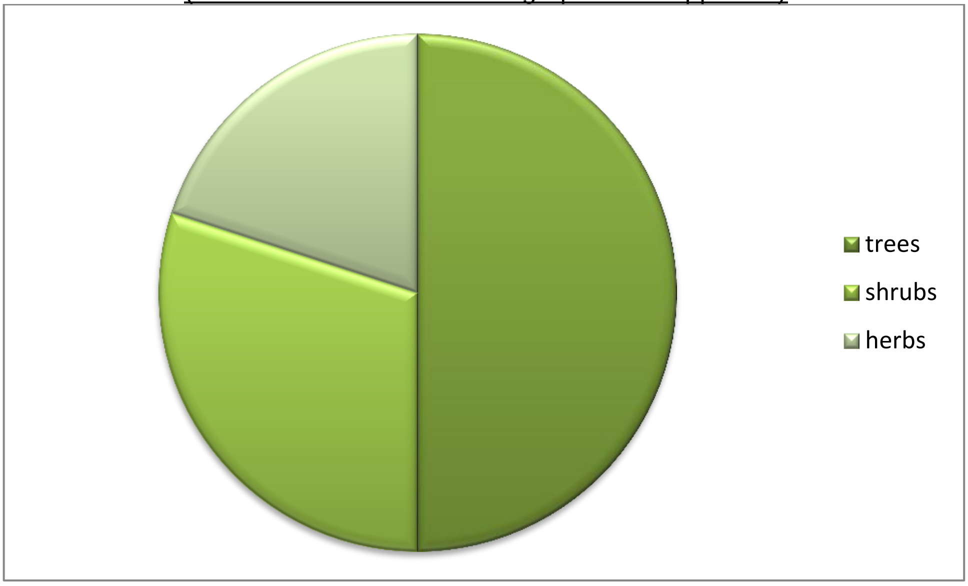


Figure 24 – Park Road – post elm decline flora (see appendix V)
(Results calculated from the graph in the appendix)



These indicate that the site is under-going a period of woodland succession and that anthropogenic clearance is not supported by the evidence. As further investigations have failed to uncover any archaeological evidence, this could be a genuinely 'empty' area. Figures 25 and 26 represent the composition of woodland for the pre and post elm decline of the site.

Figure 25 – Park Road – pre elm decline tree frequencies (see appendix V)
(Results calculated from the graph in the appendix)

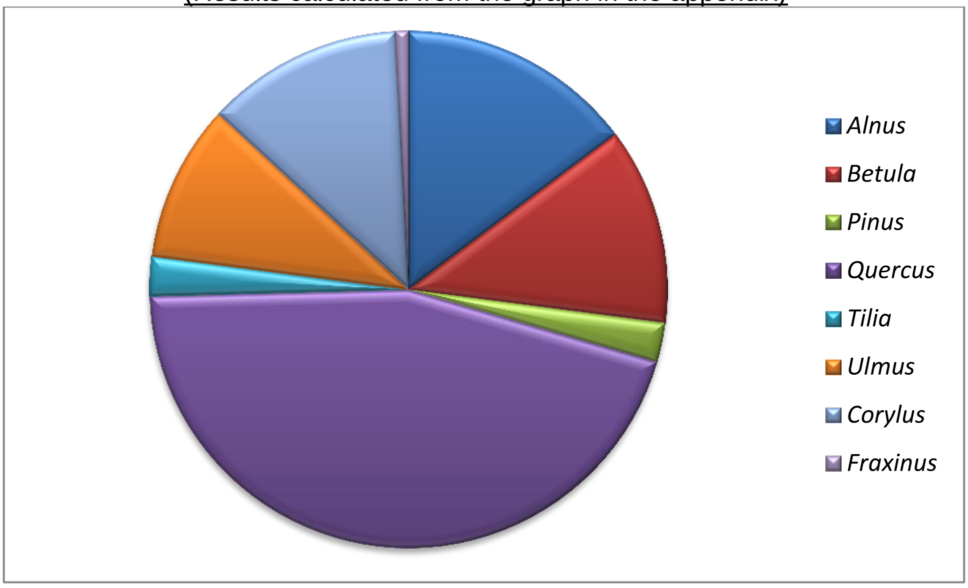
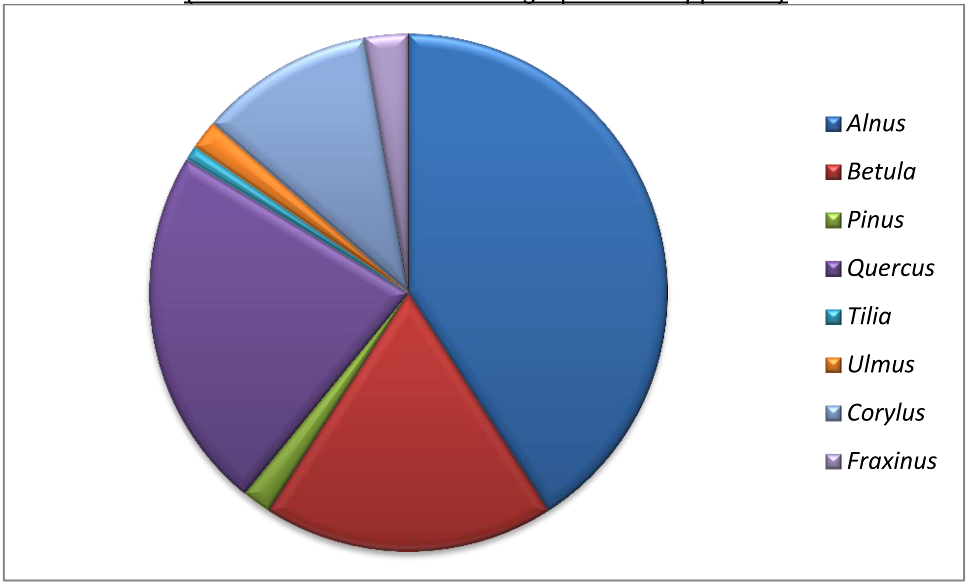


Figure 26 – Park Road – post elm decline tree frequencies (see appendix V)
(Results calculated from the graph in the appendix)



As we can see at the elm decline there is also a sharp reduction in oak values. Rather than the reduction in these trees being replaced by herbaceous pollen, it appears that the space is taken by alder. This is further discussed in chapter 4.

Flea Moss – Sefton

The Sefton Mosslands are topographically represented by a narrow belt of coastal peat largely overlain by blown sand (Cowell and Innes, 1994: 71). They started forming in response to rises in sea level which raised the water table and in doing so created waterlogged areas where fen woodland became established (Cowell and Innes, 1994: 74). Direct influence from sea level rises also led to the inundation of sands and muds to the peat areas. Several marine transgressions have been recognised from Downholland Moss and are summarised below:

Table 1 - The Marine Transgressions

Transgression	Date (C14 yrs BP)	Date (Cal BC)
DM I	6980-6755	5800-5680
DM II	?6500-6050	5450-4900
DM III	?5900-5615	4800-4500
DM IV	?4800-4545	3550-3350
DM V	?-2335	?-400

(Cowell and Innes, 1994: 76)

In the area north of Flea Moss Wood, peat is intercalated with marine silts and clays suggesting that some of the earlier marine transgressions reached at least this far inland (approximately 2.2km). The Sefton peats are at their deepest here at approximately 3m (Cowell and Innes, 1994: 79). For the later Mesolithic/earliest Neolithic of the area, the lack of an excavated framework makes it difficult to identify the introduction of a Neolithic culture into the area through flint assemblages alone. As such, the end of the Mesolithic period in this area may therefore be quite vague and could be marked by assemblages that differ little in many technological details (Cowell and Innes, 1994: 83). Cereals are present here prior to the elm decline, dated to 4939-4720 cal. BC. The elm decline is witnessed just before 3622-3340 cal. BC. Figures 27 and 28 show the distributions of flora for the pre and post elm decline of the area.

Figure 27 – Flea Moss – pre elm decline flora (see appendix VI)
(Results calculated from the graph in the appendix)

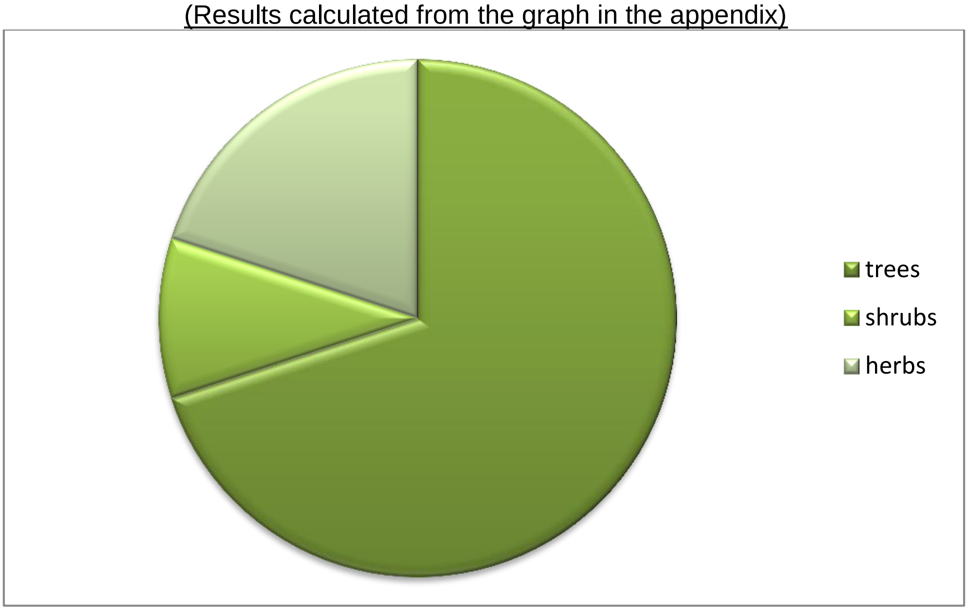
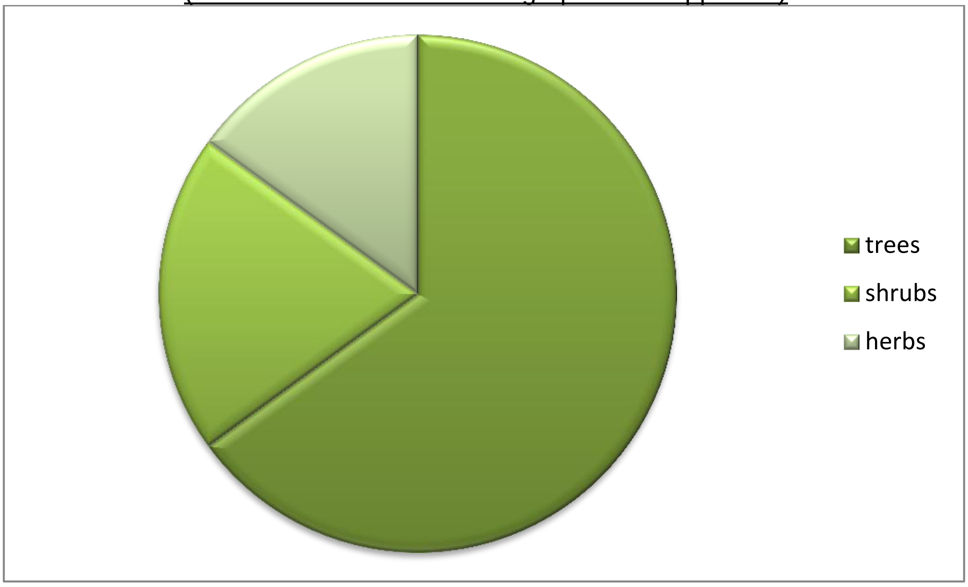


Figure 28 – Flea Moss – post elm decline flora (see appendix VI)
(Results calculated from the graph in the appendix)



Although there is a marked reduction in the tree frequencies after the elm decline, here again it is the shrubs rather than the herbs which colonise the land. It is not until later in the sequence when herbaceous species gain a more secure foothold. Amongst the herbs present prior to the elm decline are *graminae, cyperaceae* and *rumex,* along with *Triticum* (wheat) and is likely to represent a genuinely early episode of cereal cultivation. This will be discussed later. Figures 29 and 30 show the frequencies of trees and shrubs from either side of the elm decline in the area.

Figure 29 – Flea Moss – pre elm decline tree frequencies (see appendix VI)
(Results calculated from the graph in the appendix)

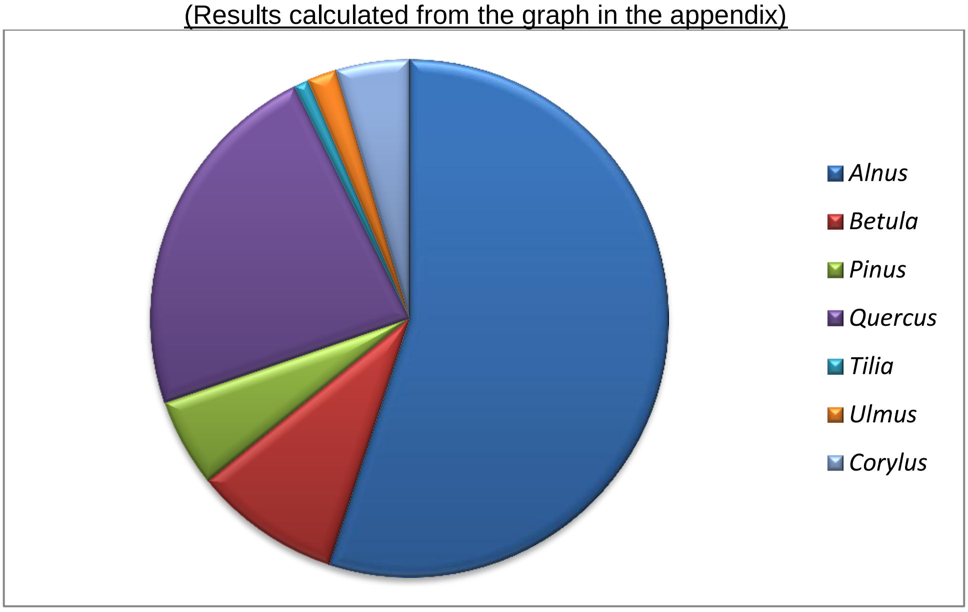
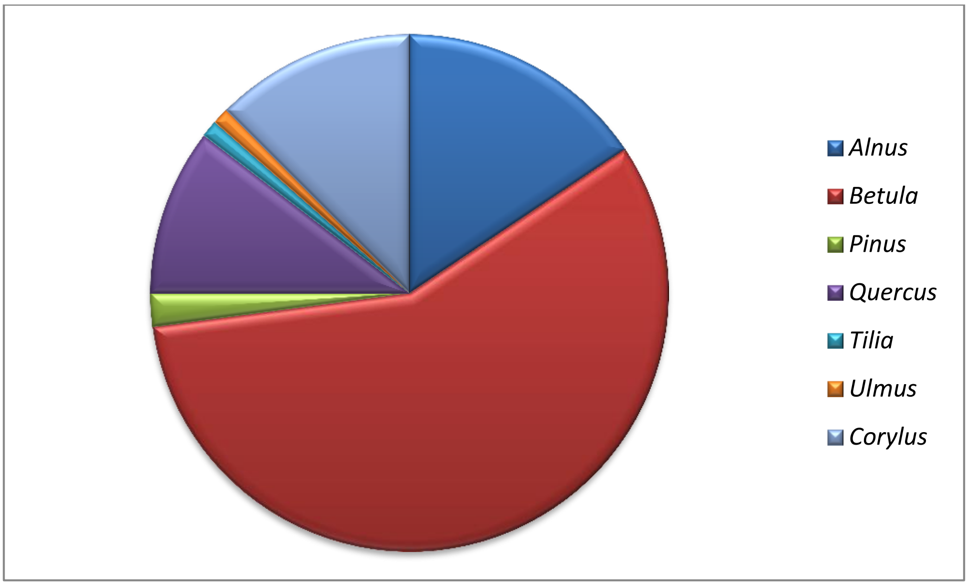


Figure 30 – Flea Moss – post elm decline tree frequencies (see appendix VI)
(Results calculated from the graph in the appendix)



After the elm decline, birch succeeds alder as the dominant species but a significant rise can also be witnessed for hazel. For further discussion please see chapter 4.

Parr Moss, Burtonwood

The area of the southern mosses are characterised by extensive boulder clay meeting both the southern end of the Carboniferous sandstone and the south-eastern edges of a series of lower Triassic sandstone ridges and outcrops (Cowell and Innes, 1994: 169). The mosses in this area have developed in an undulating landscape caused by a series of low hills and ridges that are typically 50-60m OD. These are made up largely of Carboniferous sandstone around which glacial boulder clay has been deposited to form an extensive plain (Cowell and Innes, 1994: 171). The wetlands began as open water occupying hollows in the glacial deposits, around which reed-swamp gradually developed. This may have been dry during the Mesolithic period and, as it is in an area of extensive boulder clay soils, it may not have been attractive to prehistoric communities (Cowell and Innes, 1994: 173). There is, however, evidence of Mesolithic activity on the sandstone ridges surrounding the moss. As with Prescott Moss (see below) there are very low *Ulmus* values making the elm decline difficult to recognise. There is a reduction in elm pollen evidenced at approximately 4740 BP but, as this is late, it could represent a secondary event. However, as it is the only place that the elm decline is evidenced at this site, it is this date that is being used to separate pre and post elm decline vegetation. Any conclusions that can be drawn from this evidence will consider the late date of this event. Figures 31 and 32 show the vegetation type distributions at this site from either side of this late elm decline.

Figure 31 – Parr Moss – pre elm decline flora frequencies (see appendix VII)
(Results calculated from the graph in the appendix)

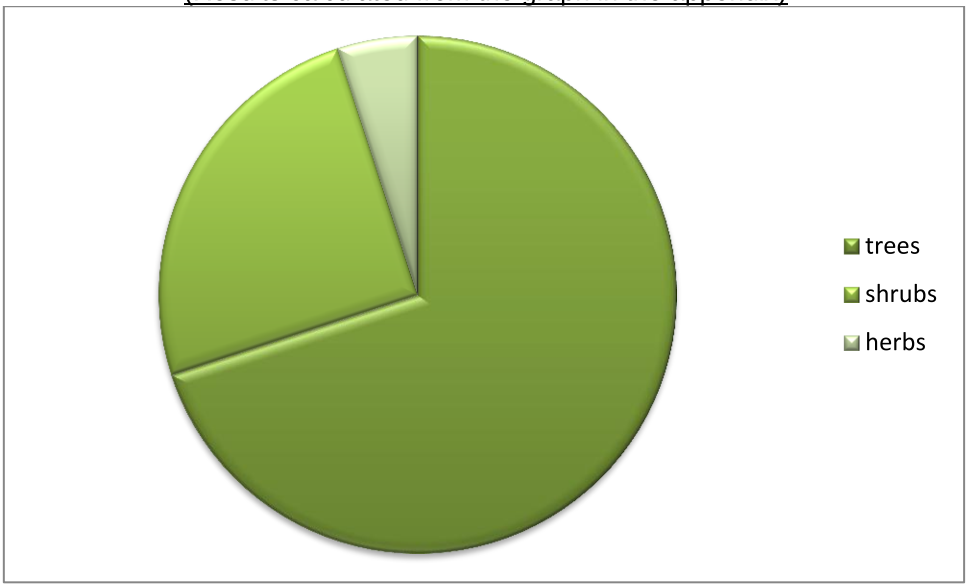
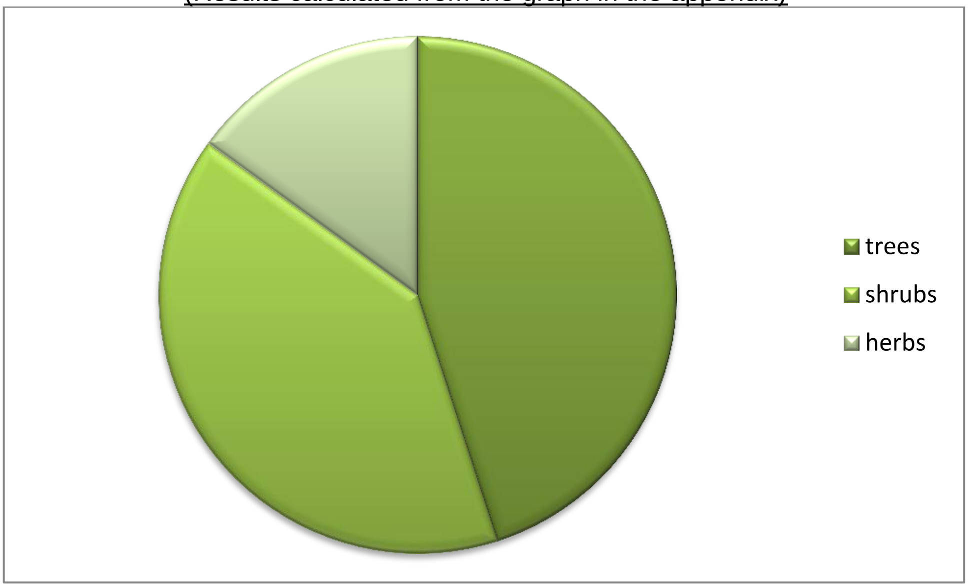


Figure 32 – Parr Moss – post elm decline flora frequencies (see appendix VII)
(Results calculated from the graph in the appendix)



The most obvious characteristic evidenced is the increase in herbaceous pollen that, along with the shrubs, is replacing the trees at this date. Figures 33 and 34 show the frequencies of tree pollen found at either dates.

Figure 33 – Parr Moss – pre elm decline tree species (see appendix VII)
(Results calculated from the graph in the appendix)

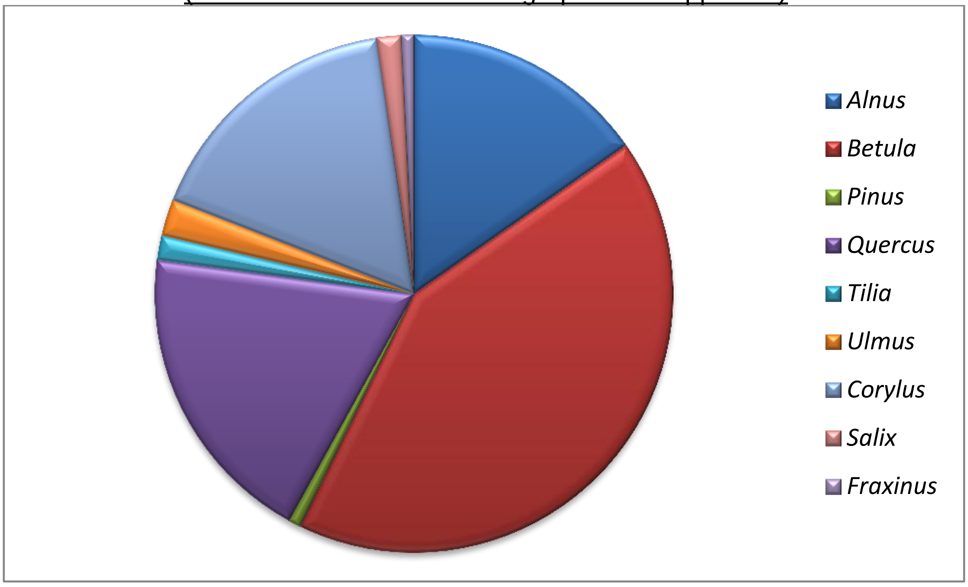
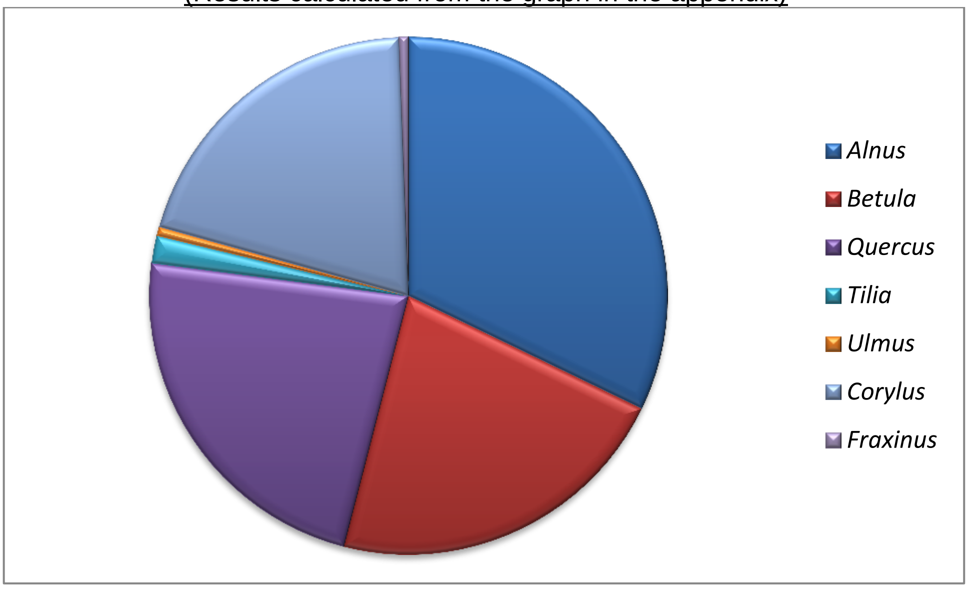


Figure 34 – Parr Moss – post elm decline tree species (see appendix VII)
(Results calculated from the graph in the appendix)



Pre-elm decline Parrs Moss has a more varied forest canopy. After the elm decline there is a reduction in the number of tree species and birch pollen is reduced at the expense of alder. See chapter 4 for further discussion.

Prescott Moss

This moss lay in a small basin at the foot of the gentle slopes on the northern edge of the town of Prescott where there is a boulder clay capping to the sandstone (Cowell and Innes, 1994: 171). The moss is now covered by late 19th century development and as such any surviving archaeology is difficult to access. The peat itself is only 0.6m deep and is covered with a thick layer of modern building material (Cowell and Innes, 1994: 173). The first indications of possible human exploitation occurs between 3630-3106 cal. BC recognised by a slight decrease in canopy cover and the presence of wheat cereal grains with some weed pollen. This coincides with the first evidence of the elm decline at this site. Figures 35 and 36 show the frequencies of different vegetation types both prior to and at this date.

Figure 35 – Prescott Moss – pre elm decline flora frequencies (6840±80 BP) (see appendix VIII) (Results calculated from the graph in the appendix)

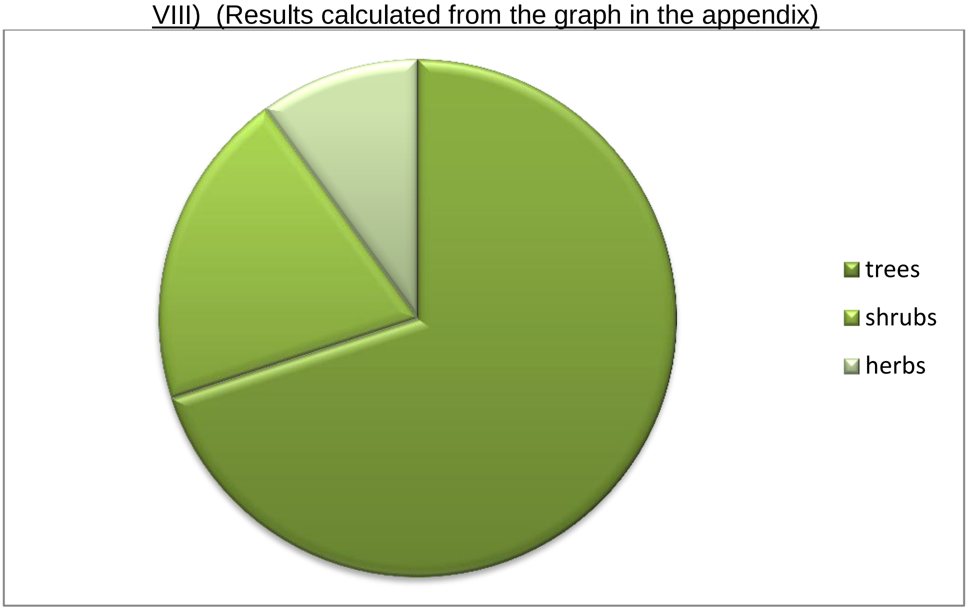
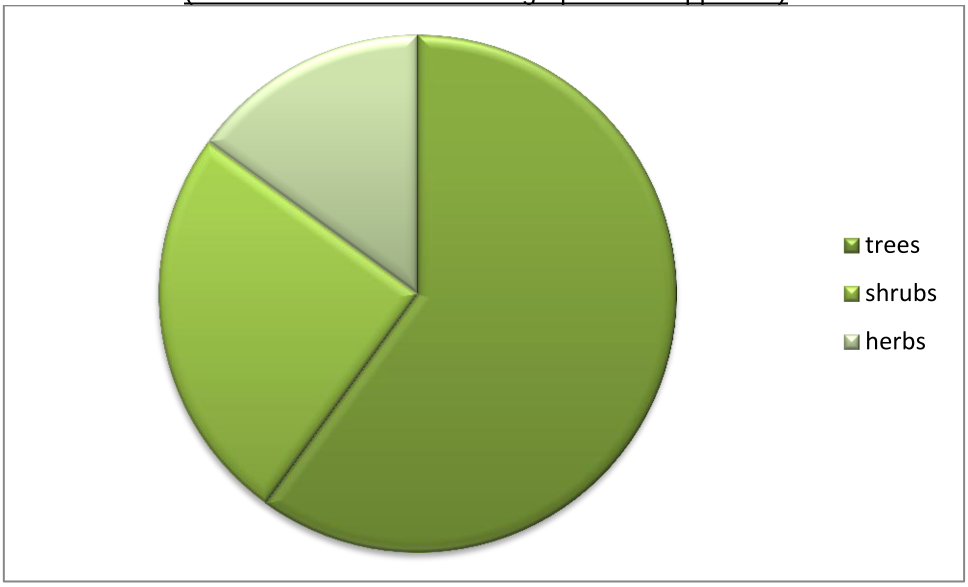


Figure 36 – Prescott Moss – post elm decline flora frequencies (see appendix VIII)
(Results calculated from the graph in the appendix)



As with Parrs Moss it is a reduction in tree cover that creates space for increased herbaceous species. Shrubs show a slight increase but remain largely unaltered. Figures 37 and 38 show the frequencies of tree pollen at each date.

Figure 37– Prescott Moss – pre elm decline tree cover (see appendix VIII)
(Results calculated from the graph in the appendix)

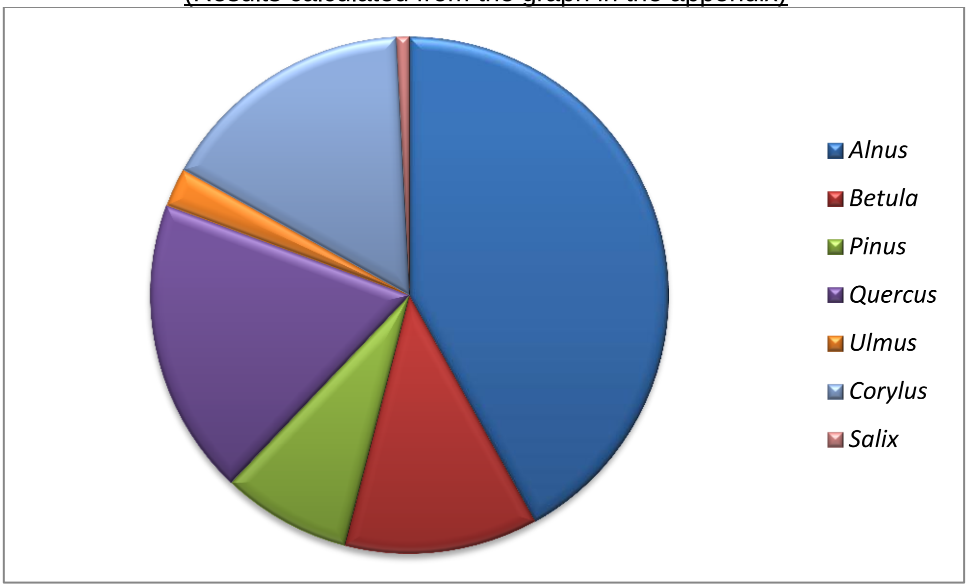
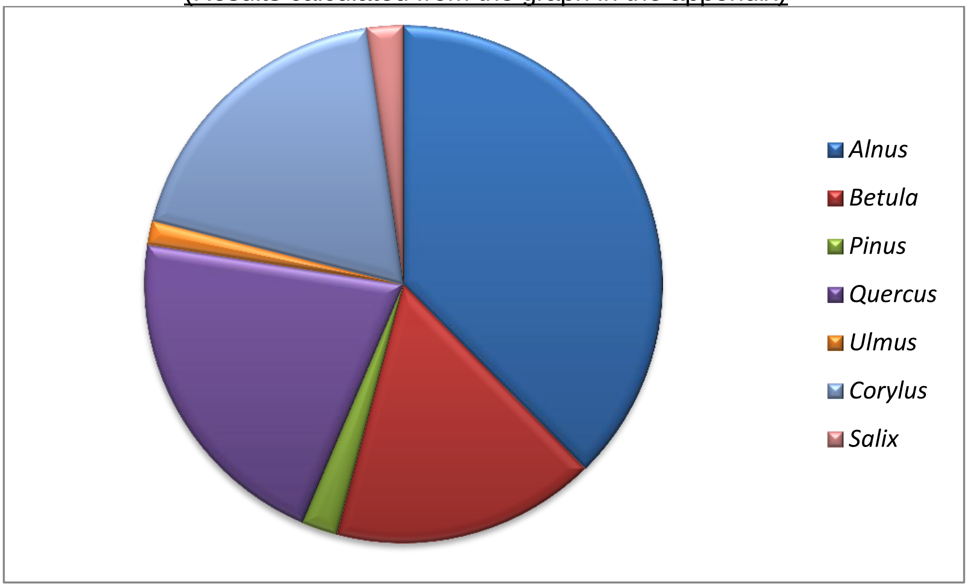


Figure 38 – Prescott Moss – post elm decline tree cover (see appendix VIII)
(Results calculated from the graph in the appendix)

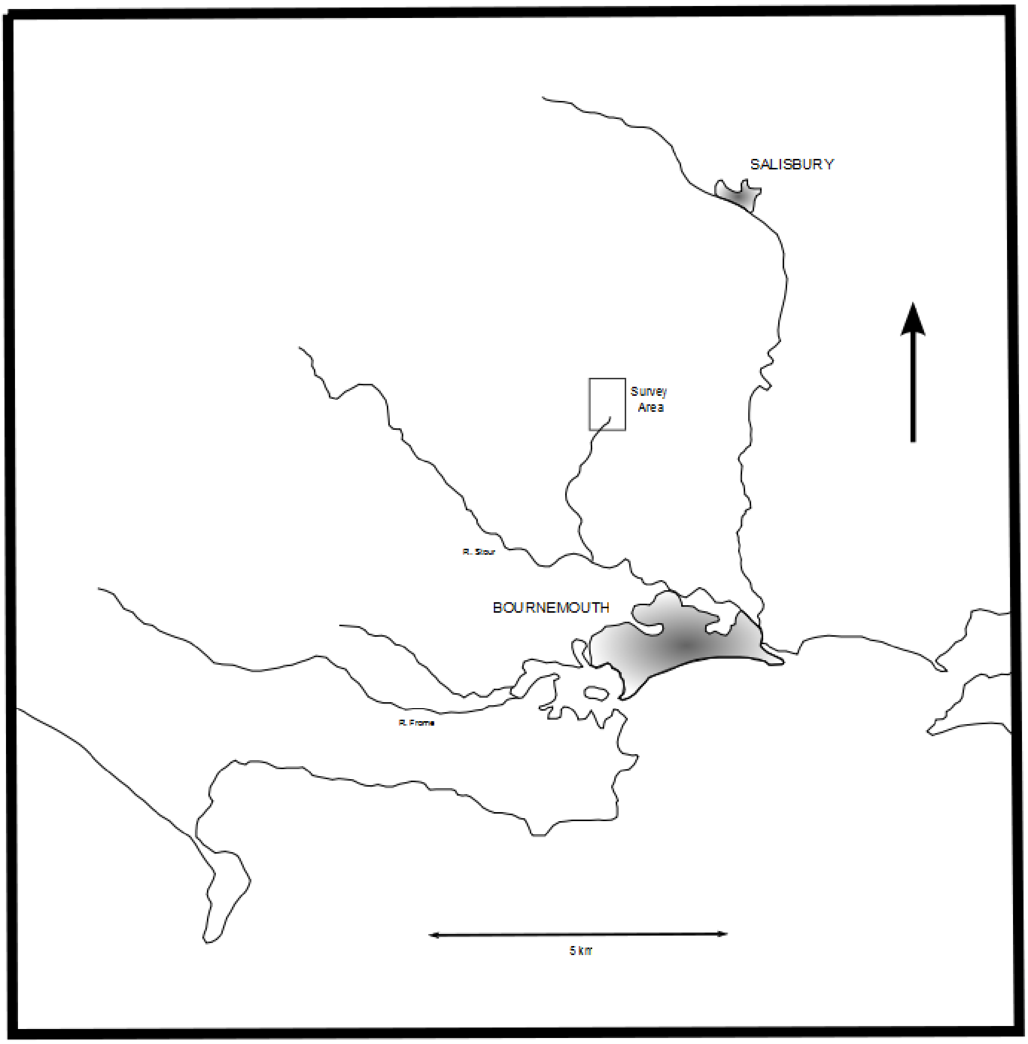


Here we can see an increase in birch while oak and hazel values remain largely consistent. Pine is reduced suggesting climatic amelioration. For further discussion see chapter 4.

Cranborne Chase – Dorset

This project was based in the classic example of the chalk downlands of southern England, and within a typical Wessex prehistoric landscape (French *et al*, 2007: 1). As the area is severely plough denuded, the study concentrated on buried soils under monuments and their associated colluvium and alluvium deposits. Due to the paucity of peat accumulations in the region, and the poor or absent pollen preservation where they do exist, the nature of past vegetation and the development of the chalklands has remained enigmatic (French *et al,* 2007: 44). Contrary to perceived wisdom for the area, of a full climax deciduous woodland, new data suggests that woodland development in the earlier Holocene of this landscape was more patchy over space and time (French *et al*, 2007: xix). Open areas were already present during the Mesolithic period with evidence from the 4th millennium BC of soil change from more organic, clay enriched brown earths to thin rendzinas more associated with established grassland. As a consequence it is possible that many areas never developed the argillic brown earths suggested for the downs under forest, but rather thin brown earths. In this study area, geomorphological survey and ditch-fill studies have provided evidence suggesting that neither significant nor extensive colluviation took place until historic times, with Aeolian evidence for bare or tilled earth only appearing occasionally in later prehistoric times. Figure 39 shows the location of the survey area

Figure 39 – Cranborne Chase Survey Area (from French *et al,* 2007: 2)



The site containing the pollen evidence for the period under investigation is located on the River Allen flood plain. Pollen analysis was carried out as part of the Wimborne Minster town centre flood relief scheme (French *et al,* 2007: 51). The stratigraphy shows a complex pattern of changing fluviatile conditions with periods of relative stability when fen peat formed on the fringes of the flood plain to freshwater alluvial sediments containing mollusca. A radio carbon date of 5980-5780 cal. BC was obtained for the lower peats. The stratigraphy of this sequence comprises of approximately 1.3m of organic peat, fluvial silts and sands. The top of the pollen column was 67cm below the present land surface. Figures 40 and 41 show a summary of the vegetation types present at the site before and after the elm decline.

Figure 40 – Allenborne Car Park – pre elm decline vegetation (7010±40 BP) (see appendix IX) (Results calculated from the graph in the appendix)

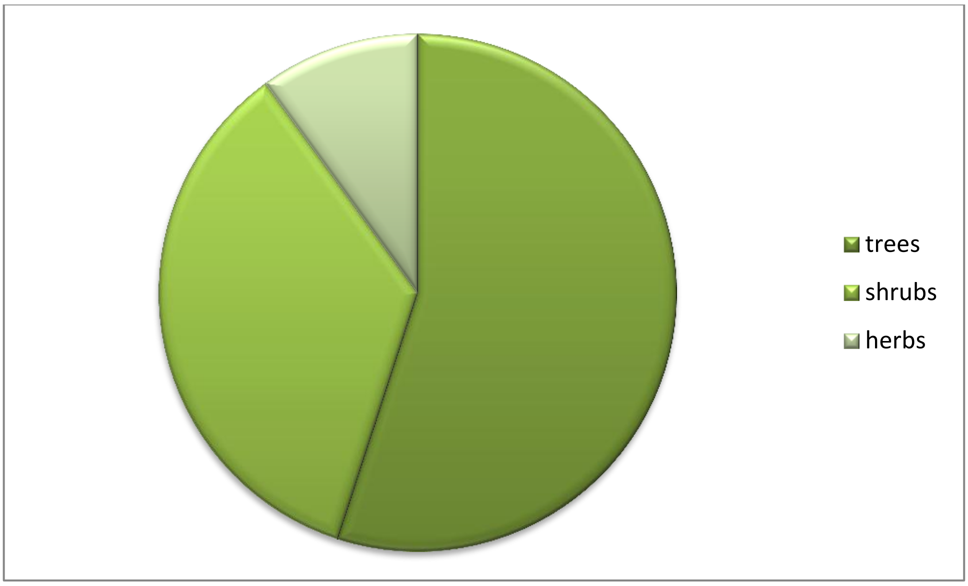
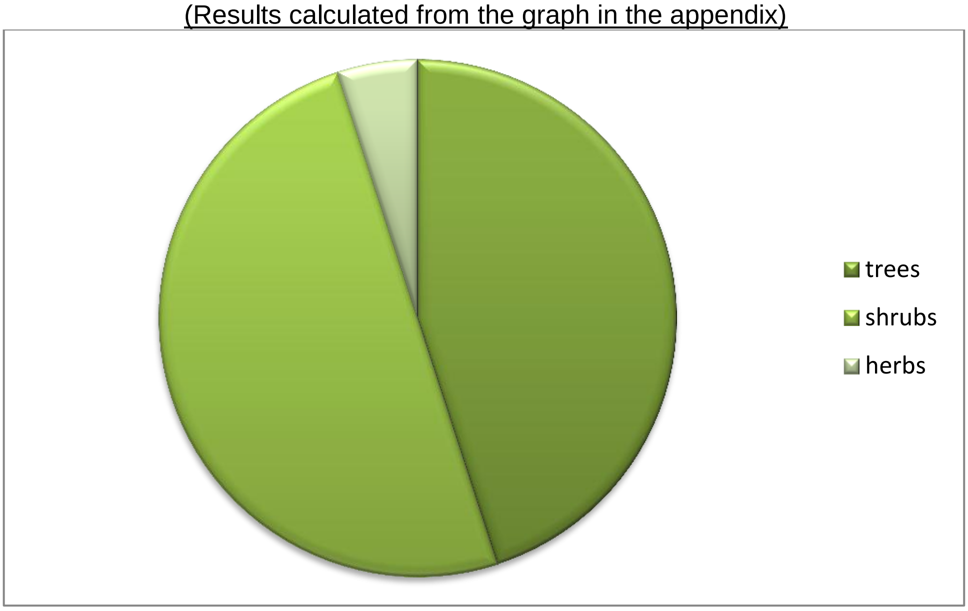


Figure 41 – Allenborne Car Park – post elm decline vegetation (see appendix IX) (Results calculated from the graph in the appendix)



At this site we see that both tree and herb species are reduced in favour of shrubs at the elm decline and yet it is at this point that the evidence for the first continuous records of cereal pollen appear – although they are witnessed sporadically prior to 7010 BP. It is likely, therefore, that cereal cultivation at this site is on a very small scale. If we were looking for evidence of woodland clearance for cultivation, we would expect to find increases in birch and wild grass pollen. Figures 42 and 43 show the proportions of tree pollen to be found at this site, at these dates.

Figure 42 – Allenborne Car Park – pre elm decline tree cover (see appendix IX)
(Results calculated from the graph in the appendix)

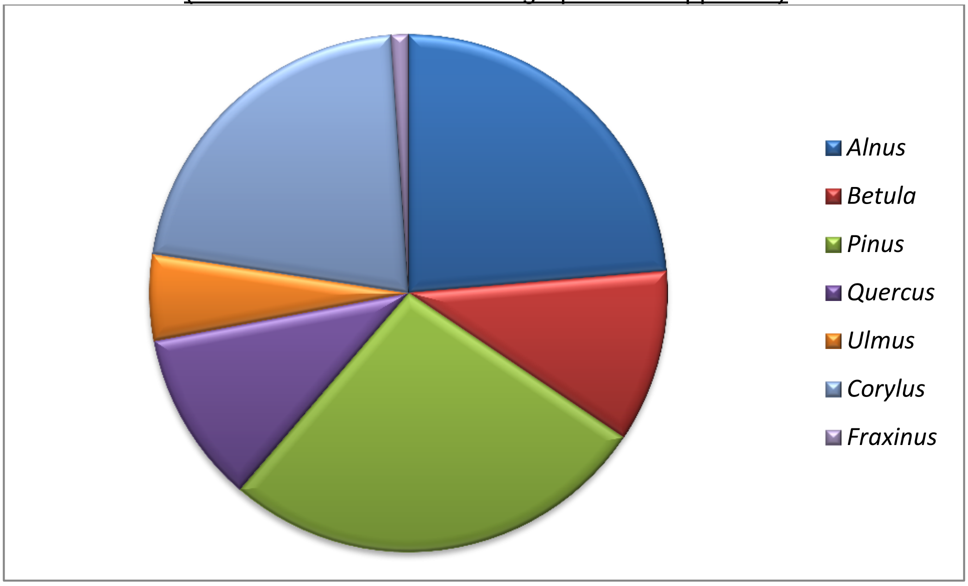
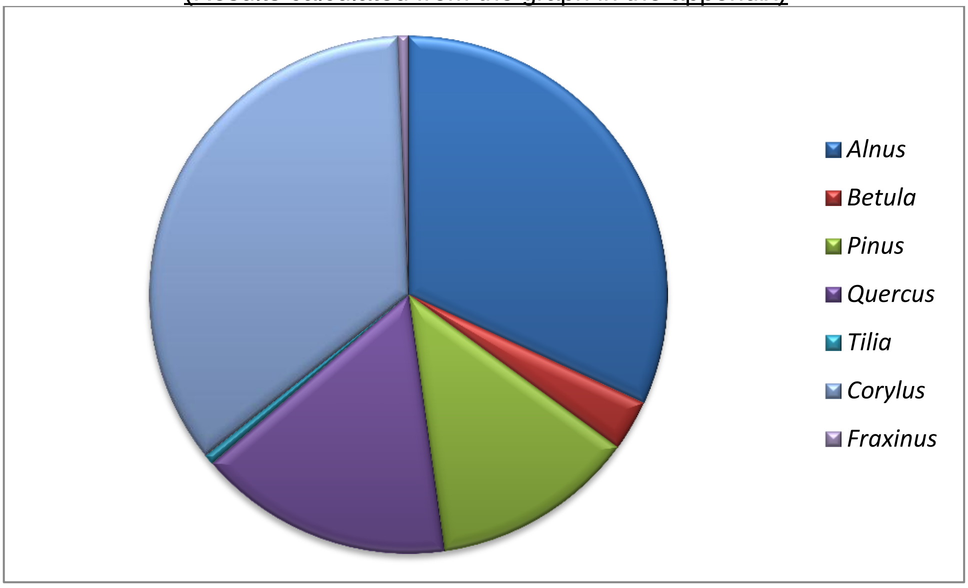


Figure 43 – Allenborne Car Park – post elm decline tree cover (see appendix IX)
(Results calculated from the graph in the appendix)



There is no increase in birch evident at the cereal phase, and it is instead considerably reduced. This has implications for the presence of cereal pollen demonstrating arable activity taking place and will be discussed further below.

Table 2 shows a summary of the results found in this investigation.

TABLE 2

SUMMARY OF RESULTS - human activity

Site	Archaeological Evidence	Palaeobotanical Evidence	pre-investigation classification	post-investigation classification
Stakehole1 N. Yorkshire Appendix I	largely absent	largely absent	empty	empty
Newby Wiske N. Yorkshire Appendix II	largely absent	present	empty	site
Danes Moss Cheshire Appendix III	largely absent	present	empty	site
Bidston Moss Merseyside Appendix IV	largely absent	present	empty	site
Park Road Merseyside Appendix V	largely absent	absent	empty	empty
Flea Moss Merseyside Appendix VI	largely absent	present	empty	site
Parr Moss Merseyside Appendix VII	absent	present*	empty	site
Prescott Moss Merseyside Appendix VIII	absent	present*	empty	site
Allenborne Car Park Dorset Appendix IX	present	present	site	site

This summary demonstrates the changes in the distribution of archaeological sites when an inter-disciplinary approach is applied. Sites marked as having largely absent archaeology either have known archaeology within the general region of the site (for example, Stakehole1 and Newby Wiske) or have poorly-stratified and/or un-diagnostic finds associated with them (for example Danes Moss and Bidston Moss).

The main hypothesis – the use of palaeobotanical data can identify archaeological activity in apparent archaeologically empty areas – appears to be substantiated by these results. By using the Dorset site as a control, it has been established that in many places the evidence for anthropogenic clearance and adoption of agricultural behaviour exists despite a lack of the traditional and secure archaeological evidence that is more commonly used to identify prehistoric activity. The lack of any evidence present at Park Road demonstrates that the diagnostic pollen data supporting clearance and agricultural activity does not exist at all sites, and as such the sites that display this evidence are likely to have been genuine sites of prehistoric activity. The absence of evidence at Stakehole1 was unexpected given its proximity to the Thornborough Henges and is likely to instead demonstrate the level of taphonomic filtering that applies to all data of this kind. Rather than weakening the results as a whole, it shows clearly how localised certain activity has to be to appear in the archaeological and environmental record. Absence of evidence does not necessarily equate to evidence of absence; and in many of the sites covered by this study, the absence of evidence was not supported by the ecological data.

Chapter Four

Going out on a limb – discussion

> You've got to go out on a limb sometimes because that's where the fruit is.
>
> Will Rodgers

The aim of this study was to test whether using pollen data as material culture would alter the distribution maps for prehistoric archaeology, specifically, for the otherwise ephemeral, Mesolithic Neolithic transition. When we find standard artefacts for the period, such as lithics or pot sherds, close examination enables us to greatly inform the knowledge of the behaviour and activities of the past populations that created and used these artefacts. In fact, where this material culture is rare, we often analyse it much more closely, and in greater depth, to enable us to write the stories behind its appearance in the archaeological record. Traditionally palaeoecological data, such as pollen evidence, has been used to back up the evidence created by the archaeological finds; or has been used to re-create the environmental backdrop onto which the prehistoric actors can be placed. However, as these past populations are living within this environmental scenery, their actions have direct influence on the behaviour and movement of the vegetation that it is made of. Therefore we can treat the pollen data as a microscopic item of material culture, as where there are past populations living among this vegetation, their presence alters the distribution of the pollen into the environmental record. This occurs regardless of any reasoned and deliberate environmental manipulation; just walking through an area will spread pollen away from its natural catchment zone. To restrict the use of the pollen data available to a supplementary role means that it becomes an under-used resource. When used in this way, as an item of material culture, it can greatly improve our understanding of the periods under investigation; and is especially useful in areas where there is a dearth of archaeological evidence. Information relevant to the study of most topics in archaeology can be obtained from more than one source and, in general, a multidisciplinary approach to a problem will yield a better result (Carter and Holden, 2000: 1). By applying palaeoecological data to the archaeological record it is possible that we attain a richer understanding of the past, and in this study, many potential new sites have been discovered.

It is not enough to treat the absence or presence of certain pollen grains as evidence of past human activity as there are many taphonomic factors to take into consideration. These include the mechanics by which the pollen arrives and is deposited at a site, and the factors affecting the preservation of the grains. There also needs to be an understanding of plant behaviour and their interaction and movement within the environment.

Several aspects are important in the recruitment of pollen to a site. The parent plant and whether it is wind or insect pollinated impacts on the amount of pollen being deposited. The size of the site will affect the influence it will have on the recruitment of pollen. The physical make-up of a site, whether it is lake, peat or soil, also has a direct influence on the stratigraphic integrity of the pollen assemblage (Smith, 2000: 16). Assemblages of pollen grains accumulating in sedimentary environments are predominantly allochthonous (Tipping, 2000: 23). At terrestrial sites a proportion of the pollen can be expected to have originated from within a metre or two of the sampling site, but a substantial number of pollen grains are derived from sources at considerable distances from site.

The preservation of the grains will introduce biases in pollen representation and may lead to a re-construction that differs in composition from the assemblage originally deposited (Smith, 2000: 16). Due to differential destruction of pollen grains occurring post-deposition, the depiction of pollen grains as percentages of the total pollen sum can be potentially misleading (Tipping, 2000: 24). Pollen types differ in the susceptibility with which they undergo different types of preservation. For example, *Juniperus* pollen is often split, cyperaceae is more susceptible to crumbling than other grains (Tipping, 2000: 23) and *Corylus* is predisposed to corrosion (Tipping, 2000: 24). Even after deterioration C*orylus* and *Alnus* are very easily recognisable whereas graminae is not so (Tipping, 2000: 25)

Periods of soil instability can lead to the redeposition of pollen, eroded from soils, in lake sediments (Tipping, 2000: 27). Although this can lead to a misrepresentation of past environments, they are often more deteriorated than pollen from contemporaneous sources and as such, can be recognised as anomalies.

Varying methods of pollen dispersal have implications for the presence or absence of pollen at any particular site, and should be taken into consideration when drawing conclusions regarding either environmental reconstruction or anthropogenic behaviour in the past. *Salix* (willow) is zoophilous, specifically by bees, but is facultatively wind pollenated as the technique of the bees' pollen collection disperses part of the pollen into the air. *Tilia* (lime) although zoophilous produces such great quantities of pollen that their production is fully comparable to that of wind pollinated species (Faegri and Iversen, 1989: 12). The method of pollen dispersal also has implications for the catchment area. These are not as straightforward as it would at first appear. For example, experiments in pollen trapping have shown that the greatest catches of pine and oak pollen are not made in the forest, but in the open – partly on open bogs within the forest area and partly on the grassland outside. Also, whereas the AP (Arboreal Pollen) count in the grassland station was of the same magnitude as in the forest, practically no NAP (Non-Arboreal Pollen) came into the forest from the grasslands (Faegri and Iversen, 1989: 27). As mentioned in chapter two, the nature of pollen cores is that they represent only a very local record of past vegetation. When we consider this in our conclusions, it appears that the appearance of any NAP from within a woodland-dominated sample strongly suggests either a clearance episode occurring within a wooded area or an herbaceous area close to the forest edge. This is one of the instances where a more detailed survey would help. However, due to the nature of pollen survival, this is not always possible.

In pollen analysis, land-use is most commonly identified by indicator species (taxa) pollen, based on preference for, or avoidance of, anthropogenic communities (Faegri and Iversen, 1989: 182). Therefore, the narrower and more well-defined the ecological tolerance of a taxon towards human influence, the more indicative it is in a pollen diagram. Obviously this means that crop plants themselves are the best indicators, together with weeds and ruderals such as *Plantago lanceolata, P. major, rumex, Artemisia and* chenopodiaceae. However, as many important crop plants are insect-pollinated or autogamous, and disperse very little pollen into the air, they are only accidentally registered in the pollen count and **it is not**

possible to exclude their occurrence on negative evidence (Faegri and Iversen, 1989: 186). As such, the first find does not necessarily indicate the first occurrence and the percentages themselves are not indicative of quantitative relations. Species such as *Chenopodium album L.* (fat hen), *Rumex acetosella L.* (sheep sorrel) or *Spergula arvensis L.* (corn spurry) are known ethnohistorically to have been cultivated for their seed (Carter and Holden, 2000: 4) and yet as there may exist no modern or historically known equivalent to past land uses and their concomitant plant communities, the use of indicator species may therefore mislead by indicating a modern plant community instead of the extinct one in which the indicator originally grew (Faegri and Iversen, 1989: 186).

From the results in figure 45, the sites can be grouped according to their classification, either as genuinely empty, archaeologically empty, or as secure and recognised sites. Although there are different mechanics occurring at each site, there are also patterns of behaviour in evidence which appear to be linked by geographical regions or similarities.

The Swale-Ure washlands, although not coastal, could be considered as transitional sites as they do not fall into either the upland or lowland classification. As has been mentioned in previous chapters, the majority of known archaeological activity for the region and period appears to occur at sharply defined upland or lowland locations. Settlement activity at this elevation is unusual in this area. The reasons behind the lack of settlement activity evidenced at sites like these remain debatable, and are as likely to be due to uneven preservation as a genuine artefact of settlement preference.

As mentioned in the previous chapter, stakehole1 appears, unexpectedly, to be a genuinely archaeologically empty site. It does present us with an indicator of climatic conditions however, with the presence of lime in post elm decline suggesting climatic amelioration. Although there is no evidence for human activity, the elm decline still occurs. When we consider the restricted catchment area for the palynological evidence at this site, it suggests that here, at least, the elm decline occurred without direct links to anthropogenic influence. This can be seen at the other apparent empty place in the study group, Park Road, Meols.

Here the elm decline is evidenced without any human activity, and although oak is slightly reduced at this time, it is otherwise declining at a time of local woodland succession.

The selection of alder for woodland reduction as opposed to hazel at Newby Wiske could demonstrate that hazel were being specifically protected from destruction, perhaps due to their importance as a dietary staple. Fertile calcareous soils are indicated by the hazel frequencies and may have been selected for clearance due to fertility. The presence of the *tilia* here suggests well drained soils close by that are base rich. This species is rare this far north today, and where it does exist it does not flower, which suggests that for the period under investigation there were higher temperatures than experienced today. However, pollen analysis can only provide information on the vegetation itself. Any conclusions about the climate or human disturbance are secondary deductions from the vegetational record and depend upon the closeness of the relations between the vegetation and the features studied (Faegri and Iversen, 1989: 2). Even if we take this into consideration, the pre elm decline data indicates a higher value for hazel at Newby Wiske than at Stakehole1, and as hazel grows on the most fertile soils, it could indicate that the most fertile ground was being selected for clearance. If not for the increased charcoal instances evident at Newby Wiske, it could be suggested that the clearances may be due to beaver activity. As mentioned in chapter two, beavers prefer hazel to many other trees, and reductions in hazel at some sites may be due to their feeding and harvesting. If the cereals appeared after the clearance of hazel without any evidence of firing, it could indicate a human population taking advantage of natural, fertile ground.

Both Newby Wiske and Danes Moss provide evidence for deliberate, fire induced clearance together with the appearance of cereals yet at the latter, the values for hazel decrease along with the clearance. It could be that here there was less importance given to the hazel, or that despite the economic value of the hazel, the growth of cereals was considered more important. The more open nature of the woodland post elm decline is best evidenced by increased *fraxinus* (ash) and *betula* (birch) frequencies; both of which are successional forest trees. Danes Moss can be safely classified as a lowland site, and as mentioned in chapter two, evidence for clearance by fire refutes suggestions that the lowland forests were beyond the capabilities of indigenous hunter gatherers' clearance behaviour.

At Danes Moss we can see huge increase in herbaceous pollen and charcoal post elm decline supported by *plantago lancelota* pollen but burning events are evidenced throughout its history with varying degrees of intensity. *Stellaria media* (chickweed) and *Polygonum spp.* (knotweeds) are rapid colonisers of disturbed ground and are therefore typical components of arable fields (Carter and Holden, 2000: 5). Other quick colonisers such as *Plantago Lanceolata* and *Ranunculus* (buttercup) also show a preference for nutrient rich soil. Together they represent a high-nitrogen, high-disturbance field environment.

At both Bidston Moss and Flea Moss there was no archaeology and yet anthropogenic activity is supported by the environmental evidence. Both sites demonstrate very early episodes of cereal activity in an otherwise virtually archaeologically empty environment (there is a little archaeological evidence from the areas surrounding Flea Moss). These cereal episodes were occurring in an era of forest regeneration. The find of a macrofossil is a fairly certain indicator that the species in question occurred in or near the locality at the time of deposition of the sample, but nothing can be concluded from its absence. Whereas, taphonomic factors aside, if a wind-pollinated species flowers in a neighbourhood, its pollen grains will be sifted over the whole region, including bogs and lakes: they will be embedded and can be recovered. If no pollen from a particular species is found, there is only a small chance that the species grew locally and thus, its absence is meaningful (Faegri and Iversen, 1989: 4). Wheat is autogamous and therefore its absence in pollen records is not always significant regionally. Although autogamous, at certain times, in dry and warm conditions, approximately 2% of its pollen gets carried by wind. Combined with the relatively large size of its pollen grains which make it subject to more filtering, this makes it vastly under-represented in pollen diagrams. This indicates that the presence of cereals at this site, despite their very early date, should be taken as evidence of a level of agricultural activity.

As these sites are situated in Merseyside, the human activity has to be viewed in the context of the continually alternating sequence of environmental changes related to changes in sea level. This will presumably have led to changing patterns of settlement and land use around the margins of the mosses and the adjoining plain. The very early cereal episode at Bidston Moss, although secure, is sporadic, and this type of activity is only continually seen post elm decline. In addition, the post elm decline also sees increased oak frequencies suggesting forest is getting more established outside of the clearance/cultivation areas. After these clearance and cultivation episodes there is evidence of the succession of alder rather than herbs, which provides evidence for the sporadic nature of these episodes. At Flea Moss, despite the early cereal cultivation in post elm decline, again it is the shrubs that colonise. As mentioned in chapter two, alder and other shade-intolerant species are likely to colonise recently cleared forest areas. If the clearance was continuously maintained (either for cereal cultivation or to attract game), it is likely that the alder would be removed. The fact that the shrubs were allowed to colonise strongly suggests that these clearances, and the activities associated with them, were episodic.

The environmental evidence for the elm decline at both Parr Moss and Prescott Moss is very difficult to identify due to the very low values of elm at these sites. There is an elm decline but it appears to be very late; well within the Neolithic period. As such, the conclusions that can be drawn from the evidence at these sites do not really have any impact on the nature of the Mesolithic Neolithic transition, yet they can provide comparisons to earlier sites. At Parr Moss although the elm decline is late, there are cereals present at this point with increased *plantago.* This suggests a genuine clearance and cultivation period which although is not unusual for this era, does provide a direct comparison with the earlier sites mentioned where we can see similar vegetational biographies. Birch is reduced at the expense of alder while oak and hazel remain largely consistent and the reduction in pine suggests climatic improvement. .

The Cranborne Chase data shows pre elm decline cereals but also continuous cereals post elm decline but without the clearance and regeneration data to back it up. This could suggest that the cereals at this site were being imported rather than grown although this is unlikely as pollen diagrams only represent flowering. If a species is regularly harvested before reaching flowering age it will not show in a pollen diagram no matter how common it is in an area (Faegri and Iversen, 1989: 116). It is also possible that the pollen arriving at this site was due to either natural or deliberate manuring. Manuring is destructive to the record as both animal and human manure contains great and uncontrollable quantities of ingested pollen (Faegri and Iversen, 1989: 197).

In conclusion, it appears that for this study, the original hypothesis has been verified. By using palaeoecological data as an item of material culture, we can expand the number of sites for the period. Based on the samples included in this study, I am able to say with some confidence that the use of environmental data, does in fact, alter the distribution maps of known activity for the Mesolithic Neolithic Transition.

If we return to one of the main debates covered in chapter one; regarding whether the process of Neolithisation arrived at these islands by a mechanism of colonisation or acculturation, we can see evidence suggesting that, at least for the introduction of agriculture, the act of becoming Neolithic appears to have elaborated processes already under way in the Mesolithic. The early cereal episodes evidenced at Bidston Moss and Flea Moss demonstrate that at least some communities traditionally classified as Mesolithic, and therefore hunter gatherers, were carrying out a level of agricultural behaviour. These environments were not identical; at Bidston Moss the AP is dominated by alder at the instance of the first cereal evidence and pre elm decline whereas at Flea Moss the alder is reduced at the expense of birch. Birch Carr is indicative of a more acidic wet woodland whereas Alder Carr, being a late successional species, indicates either a drying out of the woodlands or an area at the edge of river margins and flood plains. Birch is also a very early pioneer species and is found especially after fire. This suggests that both sites are likely to have been influenced by the tidal inundations and associated climatic changes occurring at the time, but that the clearance and agricultural activity is being carried out at different stages of the Carr development at the sites. Both sites suggest deliberate but small-scale clearance and cultivation episodes which are in contrast to the perceived subsistence activity of the indigenous hunter gatherer population.

The clearance by burning evidenced at Newby Wiske and Danes Moss, as already mentioned, is in contrast to the speculation that anthropogenic firing of lowland wet woodland areas was not deliberately carried out by the indigenous populations. At Danes Moss oak is still dominant yet birch is again succeeded by alder. The reduction in the alder values at Newby Wiske could indicate a level of drainage, either natural or human induced, yet as birch (an early pioneer) is also slightly increased it suggests instead that the alder was being selected for clearance rather than the oak. As there is also an increase in hazel frequencies, it could indicate that acorn and hazel nuts were forming part of the subsistence strategy for this population. This being the case, the cultivation of cereals is likely to have contributed only partly to the diet of these people. This contrasts with the idea of the switch to a Neolithic way of life being wholesale and sudden.

Parr Moss and Prescott Moss provide us with secure and expected agricultural activity associated with early Neolithic populations. Again these sites have environmental differences to each other with the absence of willow at Parr Moss post elm decline contrasting with slightly increased values at Prescott Moss. Willow Carr is indicative of a less acidic wet woodland environment so although they both appear to be late successional alder Carr environments, Prescott Moss could have been a more biologically active site. The reduction in pine at these sites indicates climatic amelioration.

At Dorset, where we would possibly expect to see the traditional wholesale and uniform Neolithisation, we once again witness pre elm decline cereal cultivation. The cereals present post elm decline also occur without the clearance evidence normally associated with it. This could indicate that the ‘fields’ being used for agriculture were formed a considerable time prior to the elm decline, and as such could suggest continuity of behaviour. In contrast, it could simply indicate that the natural clearances within the canopy cover were maintained rather than created. This still indicates at least a level of continuation although it does not definitively preclude the possibility that a new population or culture took advantage of the resources and environmental backdrop already in place.

At Stakehole1 and Park Road we have neither archaeological nor palaeoecological evidence for human activity. As such these are likely to be genuinely empty areas that are undergoing a period of woodland succession. Being geographically close to the areas affected by tidal innundations, Park Road demonstrates evidence of an increasingly wetland area which is geographically similar to the majority of the Merseyside sites, whereas, environmentally, Stakehole1 is more closely affiliated with Newby Wiske and, to some extent, Danes Moss. Although neither of these sites provides evidence for the nature of the Mesolithic Neolithic Transistion, they indicate that the palaeoenvironmental evidence being used here as an item of material culture indicating human activity, does not appear at all places and environments in the past, and as such are likely to be genuine indicators of the presence and activities of human populations.

In conclusion, the evidence found at the sites under investigation suggests that the transition was neither homogeneous nor immediate and that, for the subsistence strategy at least, belongs firmly as part of the continuation argument. By its nature however, it was quite narrow and restrictive. More work needs to be carried out, on a much wider data set and concentrating on freshly gathered samples. Having quantitative values for each species, and being able to concentrate less on the arboreal pollen, should enable results that are capable of standing up to more rigorous scrutiny.

<u>Glossary</u>

Aeolian	Wind blown
Allochthonous	Originating in a place other than where it is found
Autogamous	Self-fertilising
Basin Mire	Mire developed in enclosed waterlogged depressions which have become colonised by peat-forming vegetation.
Blanket Mire	Peat developed directly over mineral ground, normally in an upland environment.
Calcareous	Partly composed of calcium carbonate – containing lime or being chalky
Cereal Type	Large grass pollen grain of between *c* 40 µm and 60µm in size
Clastic Deposits	Deposits arrived by movement e.g. fluvial, colluvial. Non-clastic deposits are *in situ* e.g. peats
Colluvium	Downslope accumulation of eroded rock, soil and sometimes archaeological material. Also known as hillwash. As formed by sedimentary processes can be both a soil and a sediment.
Fen	General term for minerotrophic mires
Gleyed	Waterlogged
Loess	Fine grained Aeolian dust
Minerotrophic	Used to describe a mire whose surface receives water from outside that mire's own limits
Mire	Peat producing ecosystem which develops in sites of abundant water supply
Ombrotrophic	Used to describe a mire which receives water only directly from the atmosphere in the form of precipitation
Pedogenesis	Soil formation
Podzols	Typical soils of coniferous or boreal forests. Although often poor for agriculture, they provide useful stratified pollen sequences due to the acidity and slow organic matter breakdown
Raised Mire	Ombrotrophic mire characterised by a very low amplitude convex profile and usually occupying topographical situations such as level floodplains of river systems and alluvial deposits of estuaries
Rendzinas	Dark greyish brown, humus rich, intrazonal soil. Most closely associated with the bedrock type and an example of the initial stages of soil development. Usually formed by the weathering of soft rock types
Zoophilous	Pollinated by animals

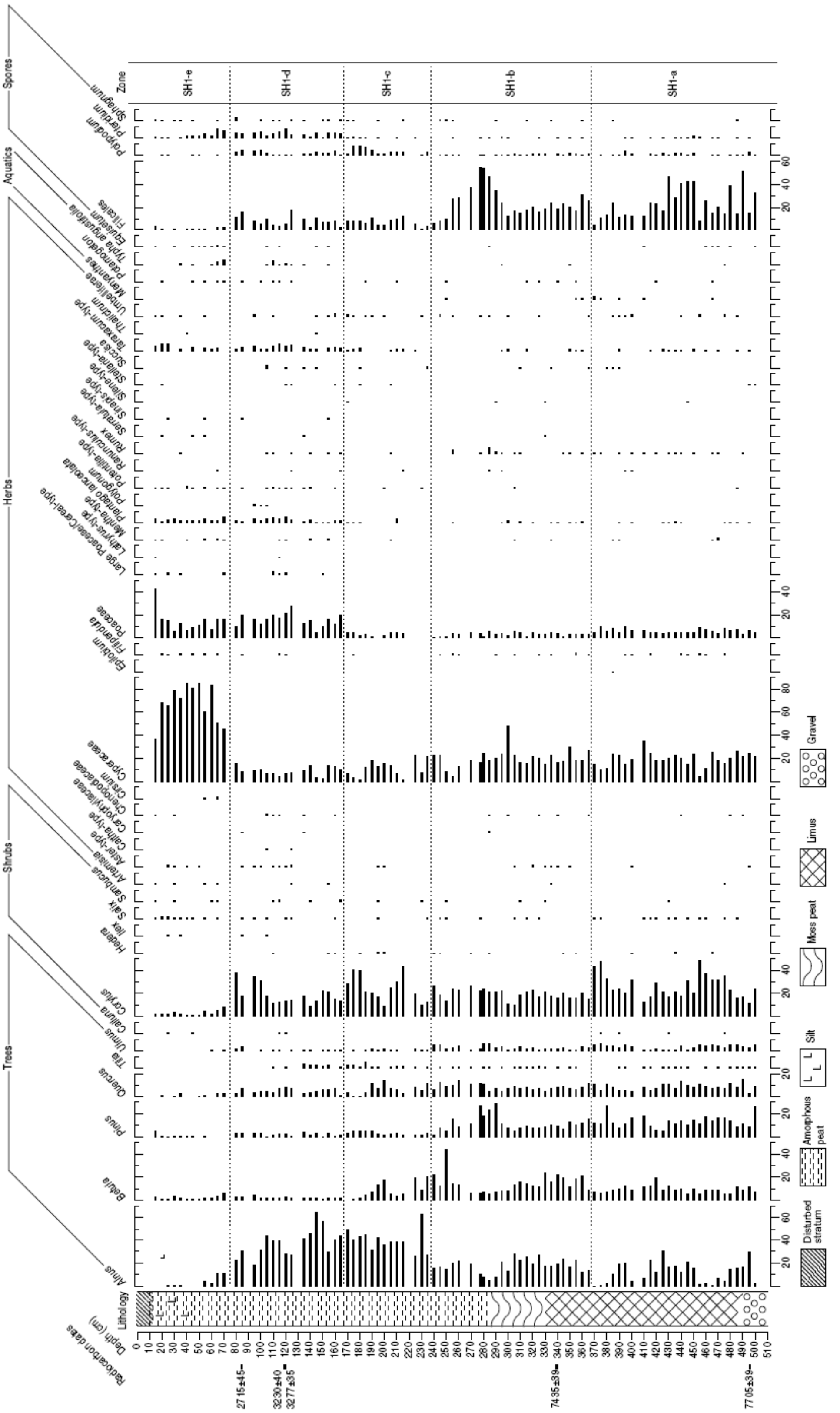


Fig. 3.3 Pollen diagram from Nosterfield, the Flasks, SH1. Frequencies are calculated as percentages of the total land pollen sum (trees, shrubs and herbs).

<u>APPENDIX II</u>

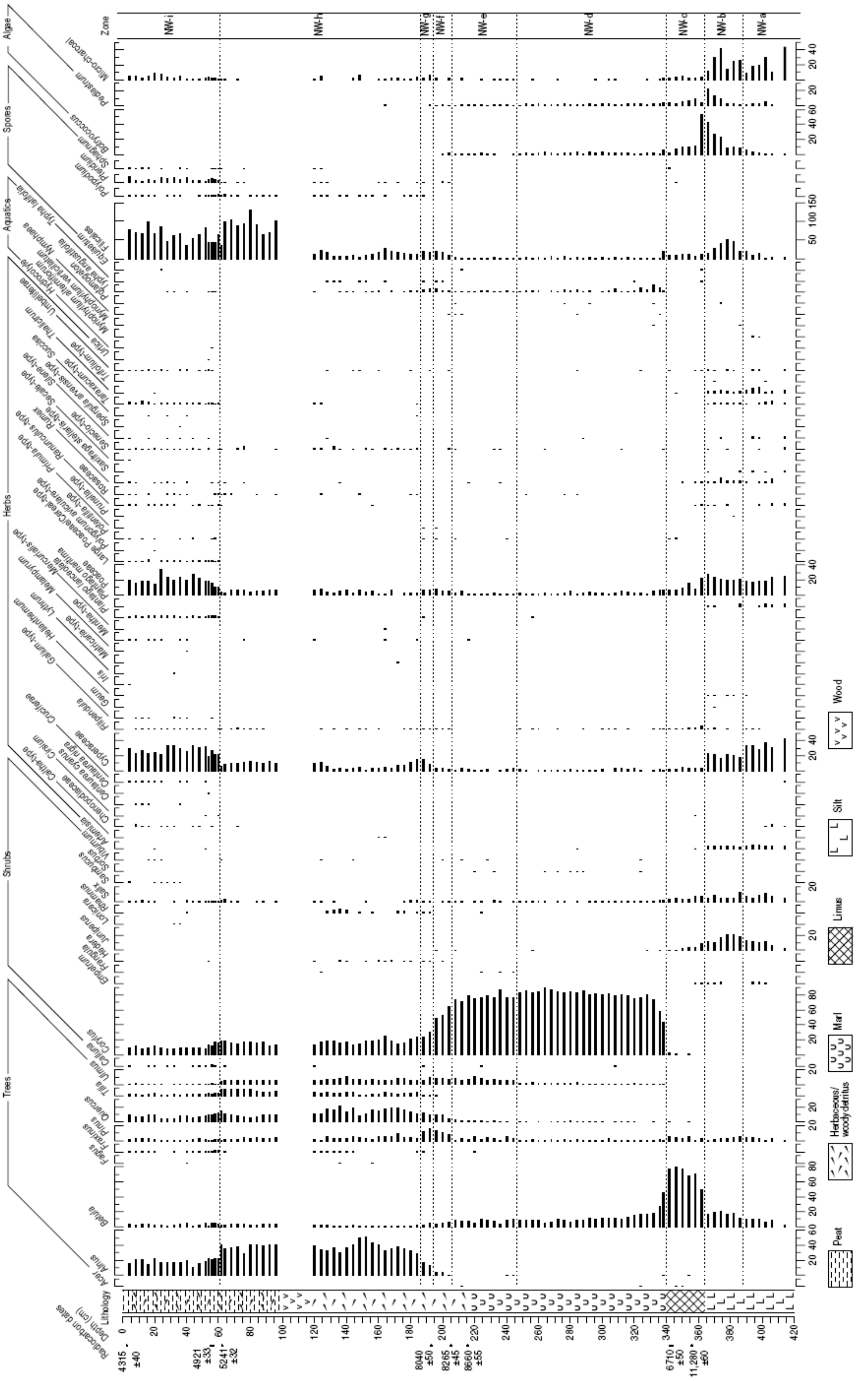
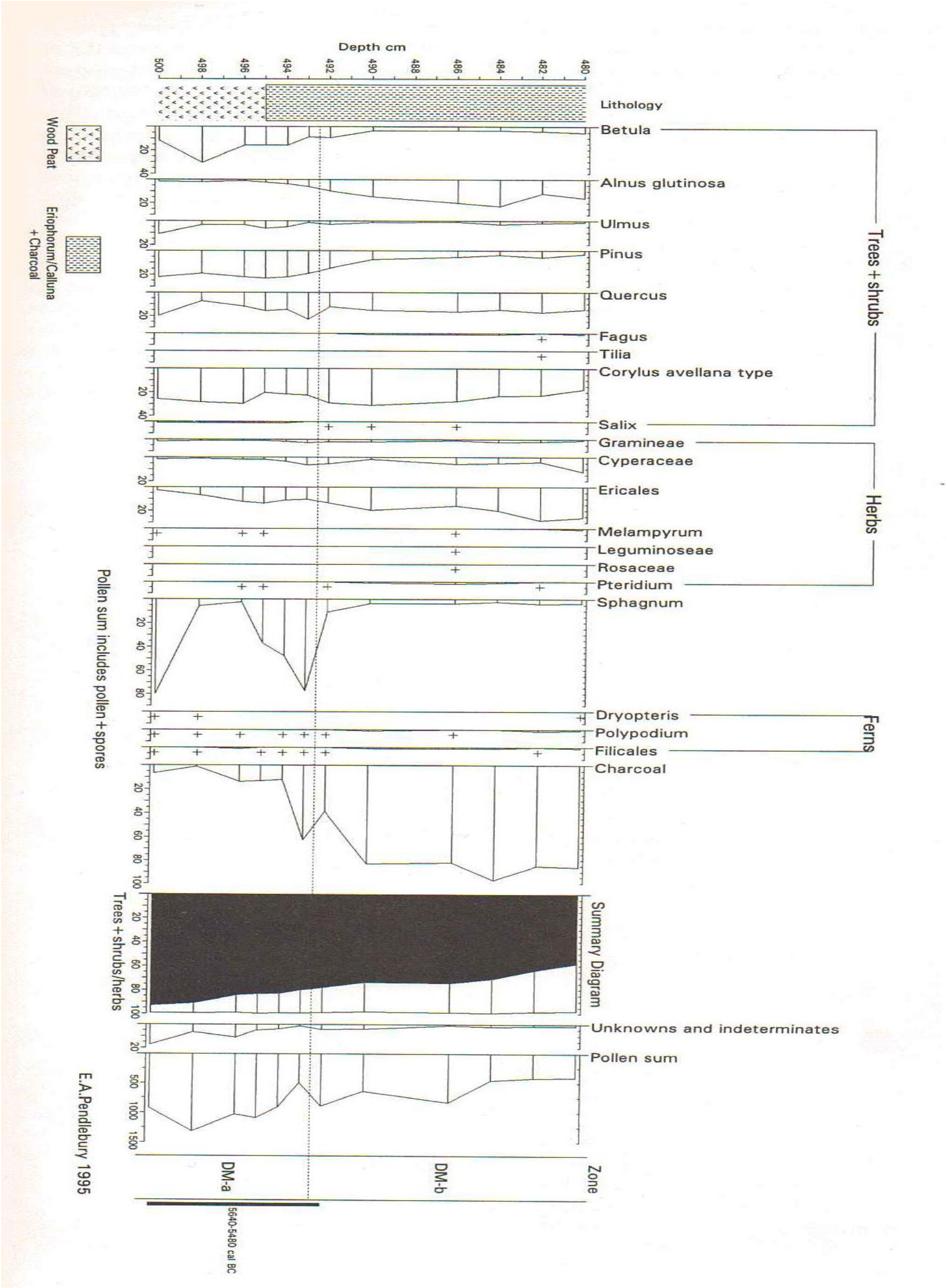


Fig. 3.7 Pollen diagram from Newby Wiske NW1. Frequencies are calculated as percentages of the total land pollen sum (trees, shrubs and herbs).

<u>APPENDIX III</u>



APPENDIX IV

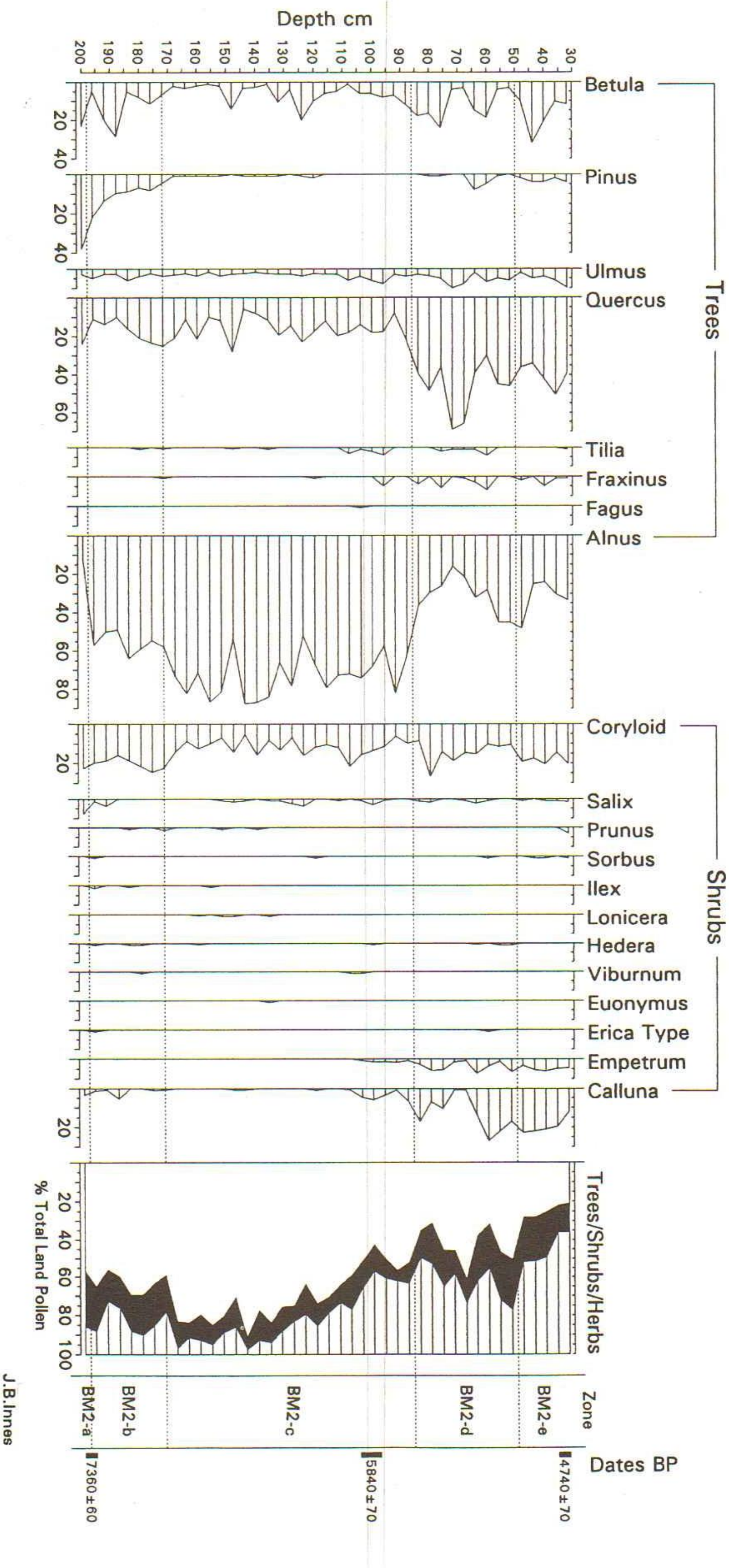


Fig 8 Wirral: Bidston Moss 2, percentage arboreal pollen diagram (trees plus group)

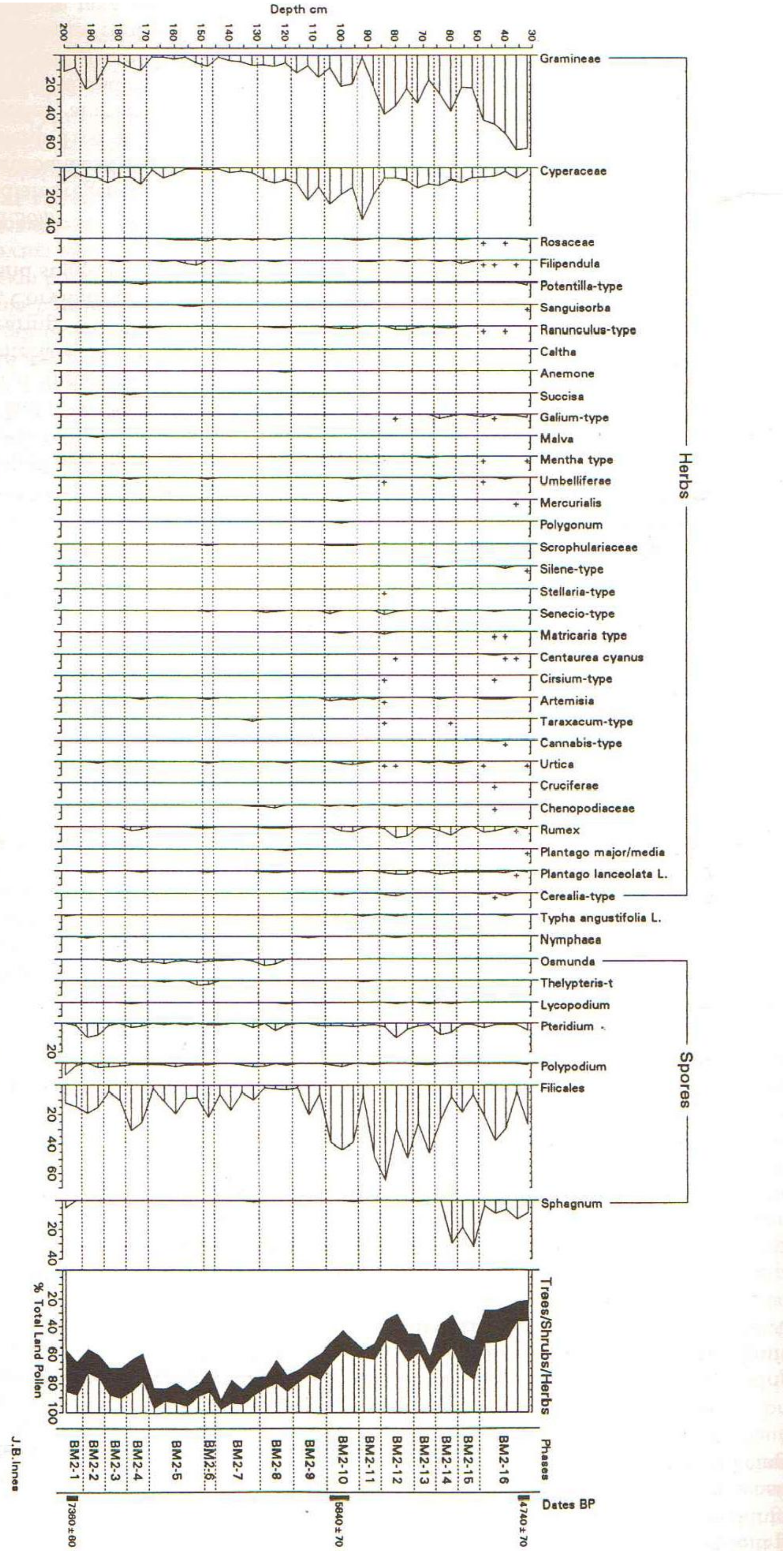


Fig 9 Wirral: Bidston Moss 2, percentage herb pollen diagram (trees plus group)

APPENDIX V

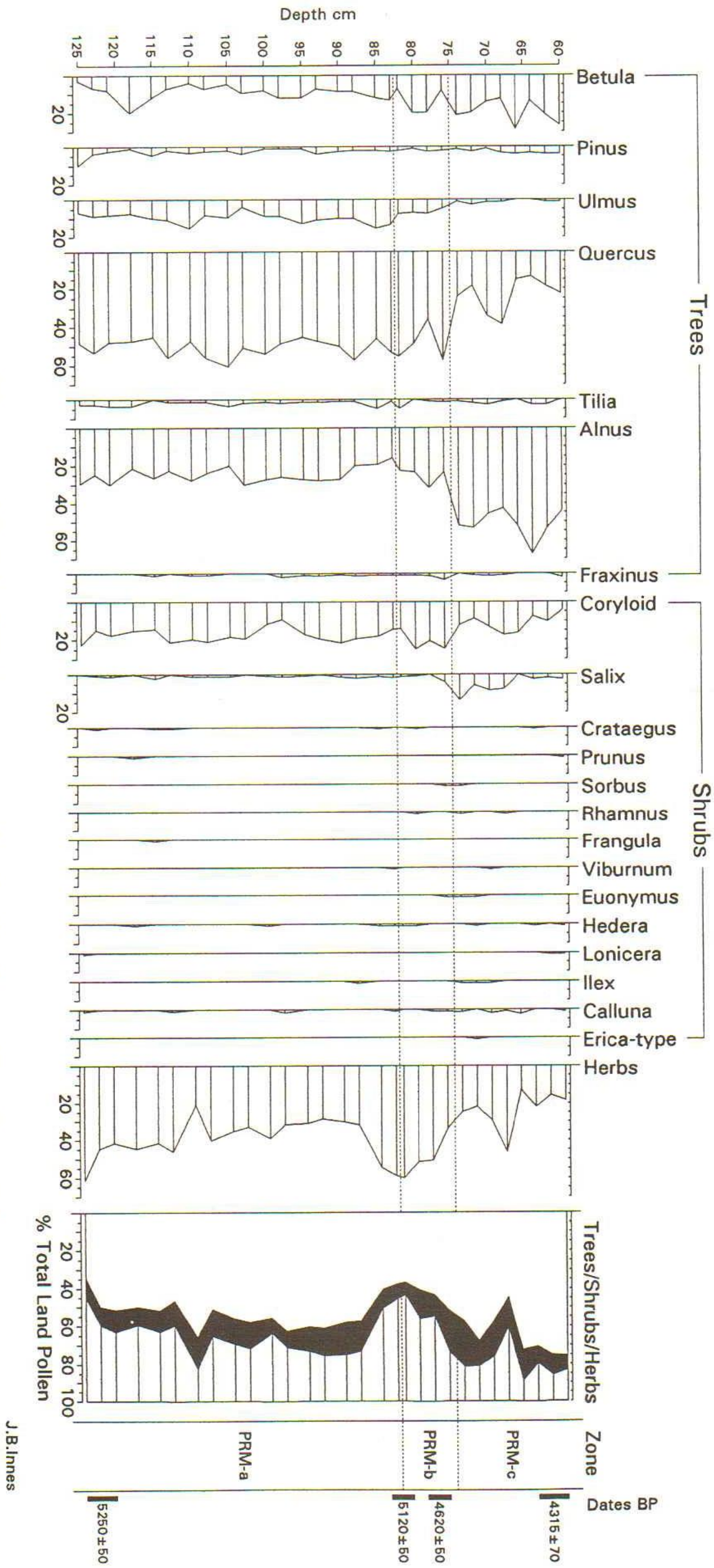


Fig 16 Wirral: Park Road, Meols, percentage arboreal pollen diagram (trees plus group)

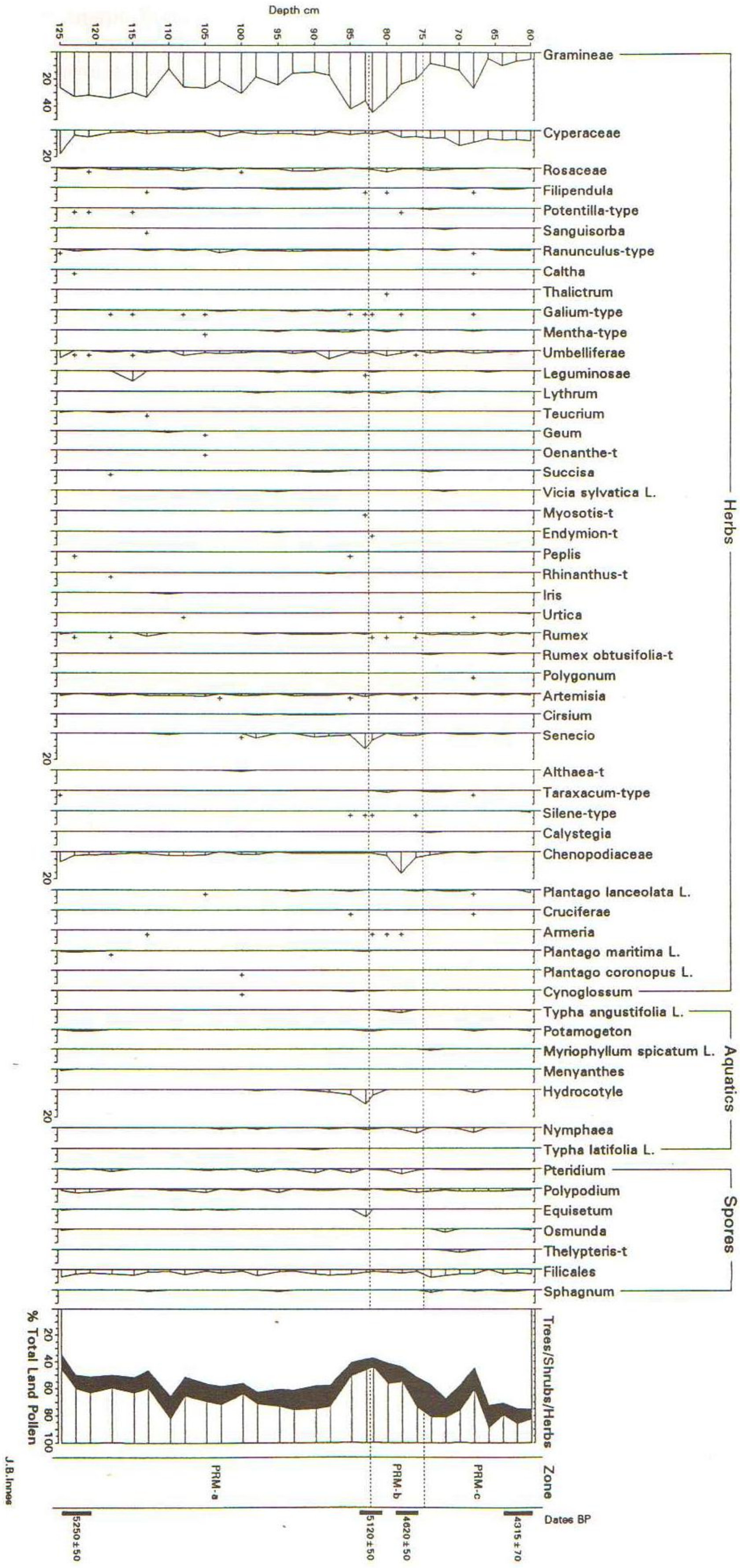


Fig 17 Wirral: Park Road, Meols, percentage herb pollen diagram (trees plus group)

APPENDIX VI

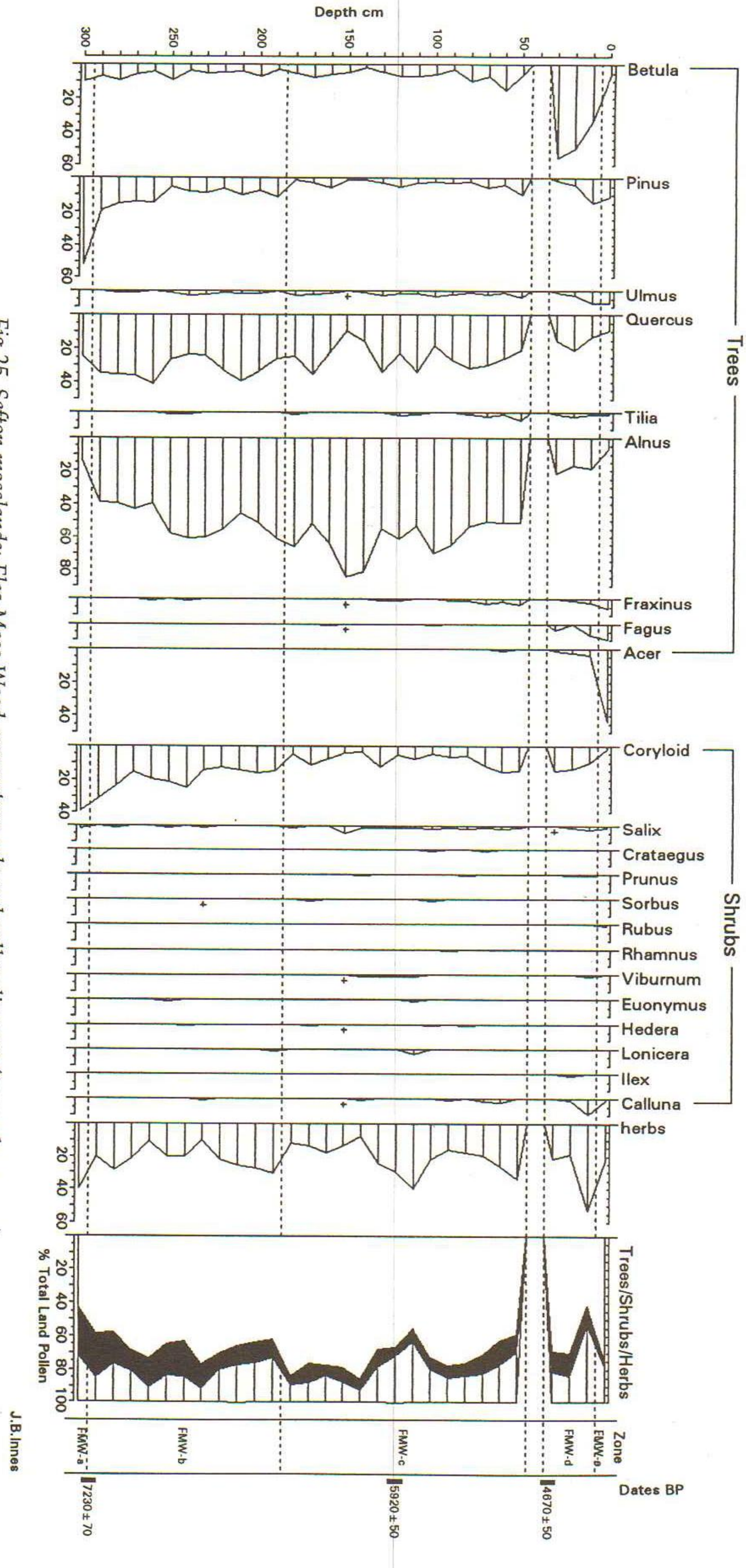


Fig 25 Sefton mosslands: Flea Moss Wood, percentage arboreal pollen diagram (trees plus group)

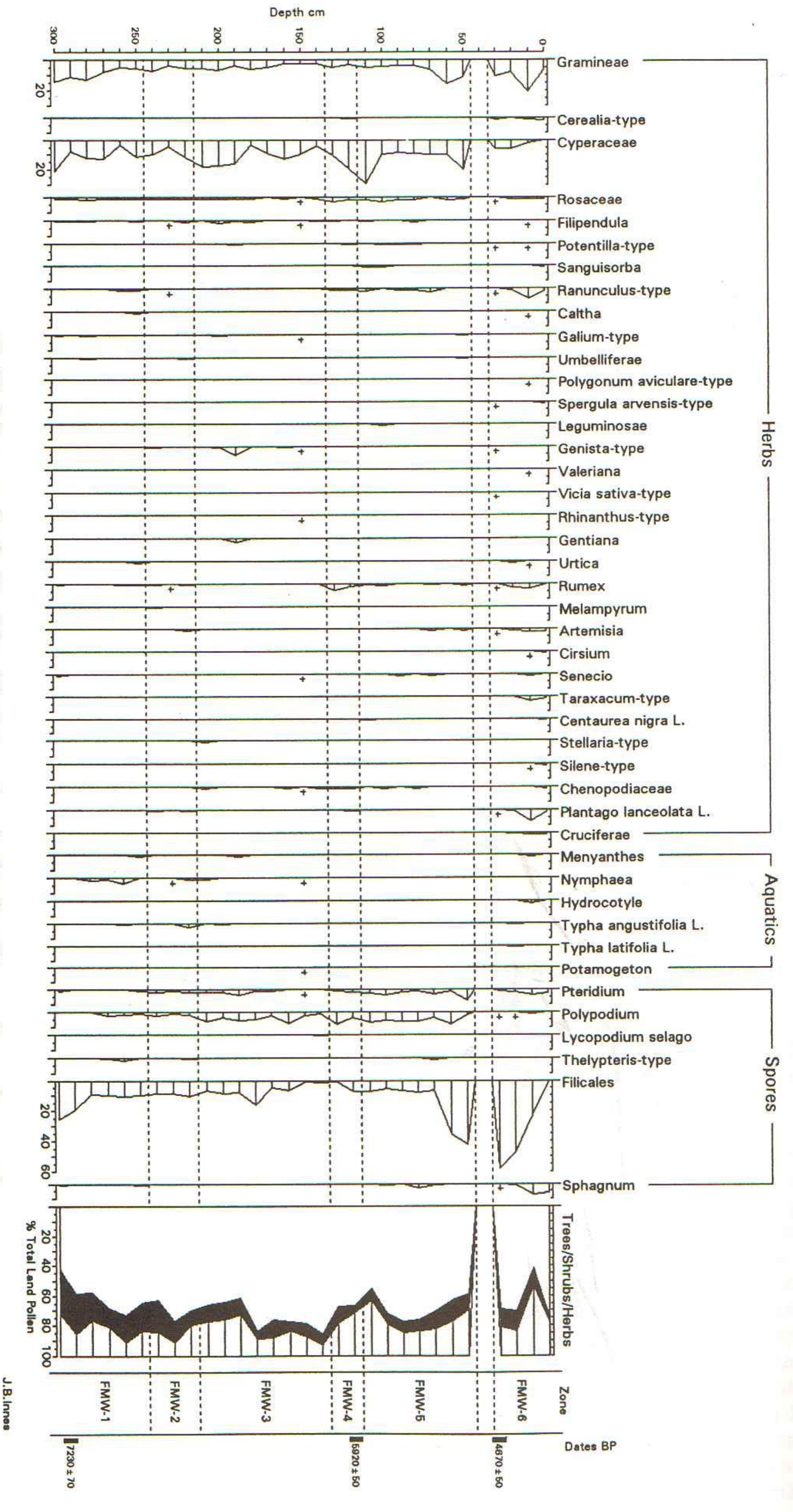


Fig 26 Sefton mosslands: Flea Moss Wood percentage herb pollen diagram (trees plus group)

<u>APPENDIX VII</u>

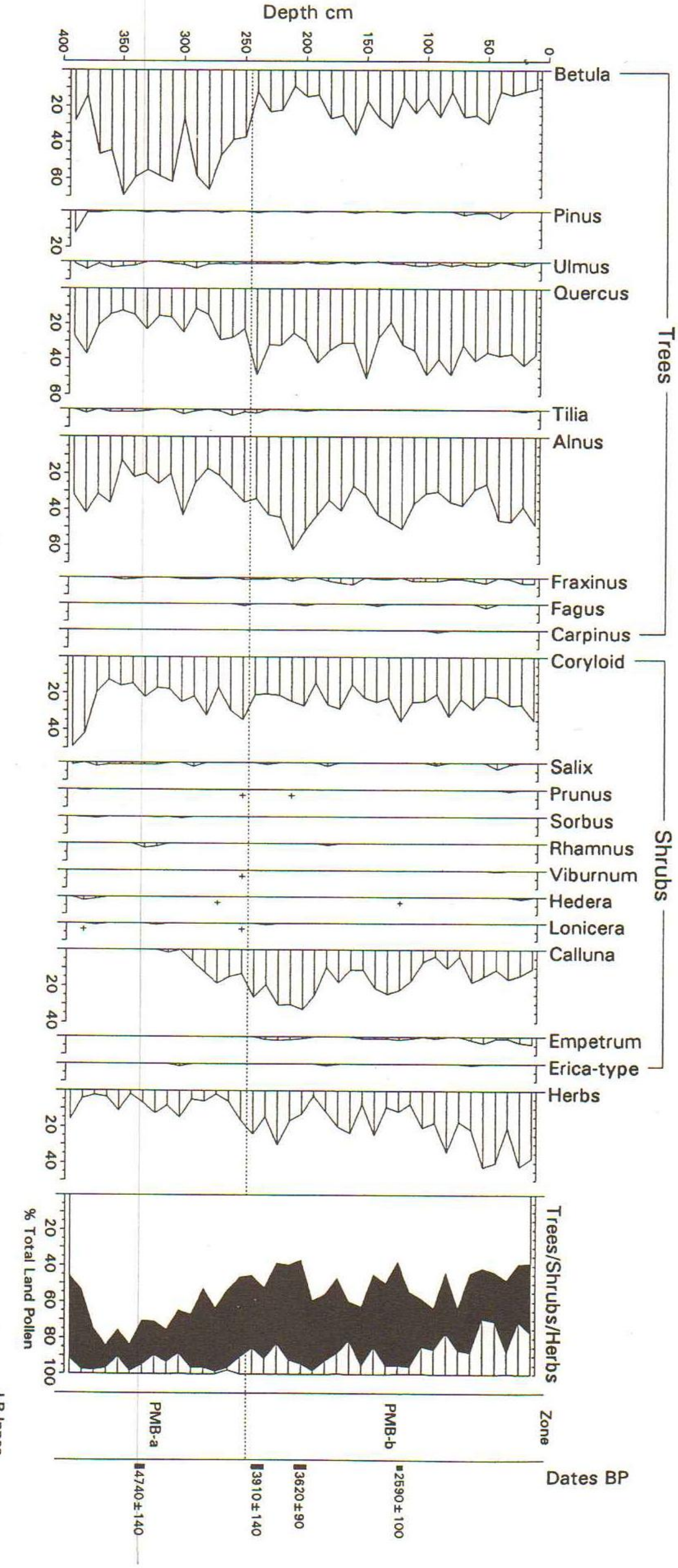


Fig 61 Southern mosslands: Parr Moss, Burtonwood, percentage arboreal pollen diagram (trees plus group)

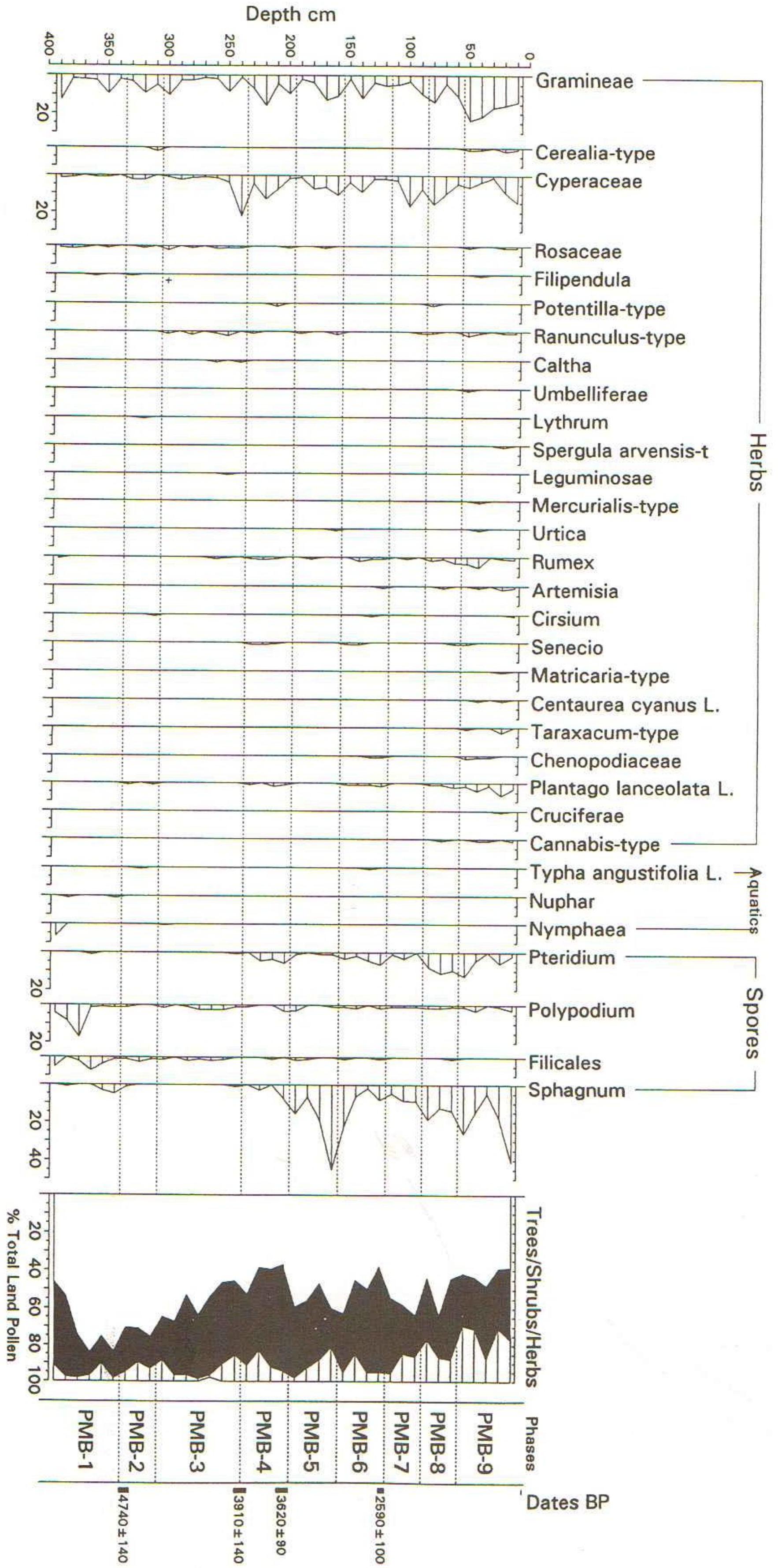


Fig 62 Southern mosslands: Parr Moss, Burtonwood percentage herb pollen diagram (trees plus group)

APPENDIX VIII

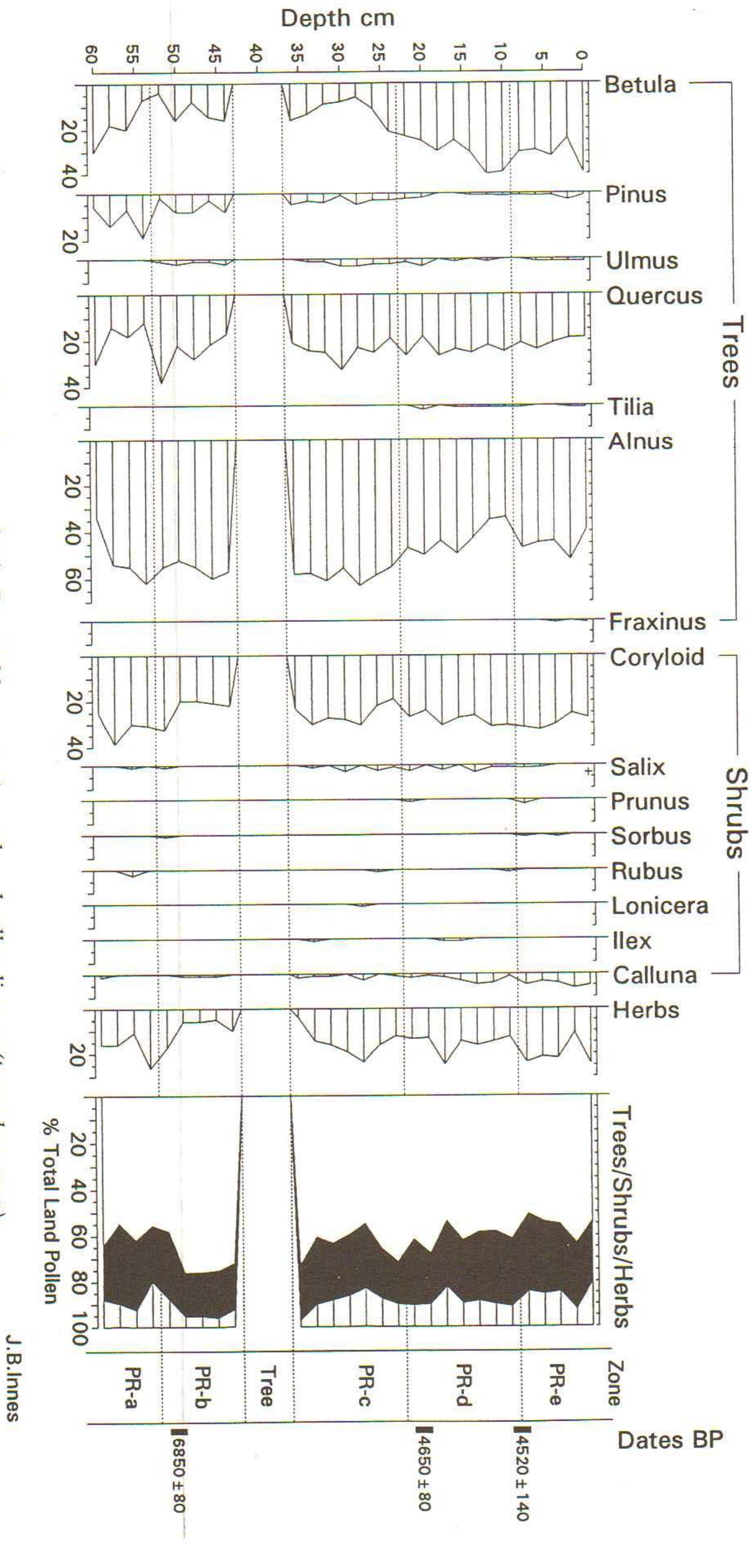


Fig 63 Southern mosslands: Prescot Moss percentage arboreal pollen diagram (trees plus group)

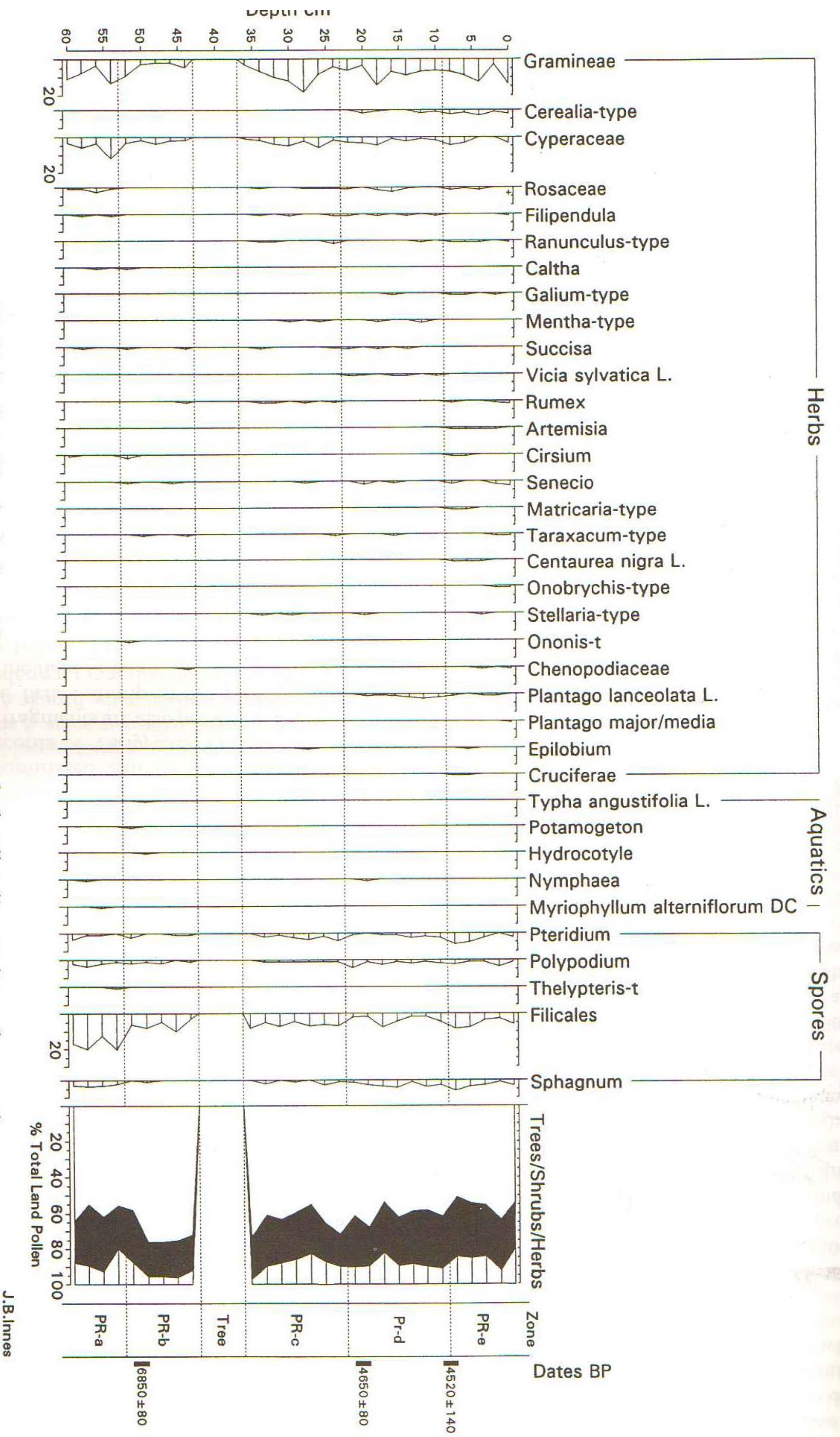
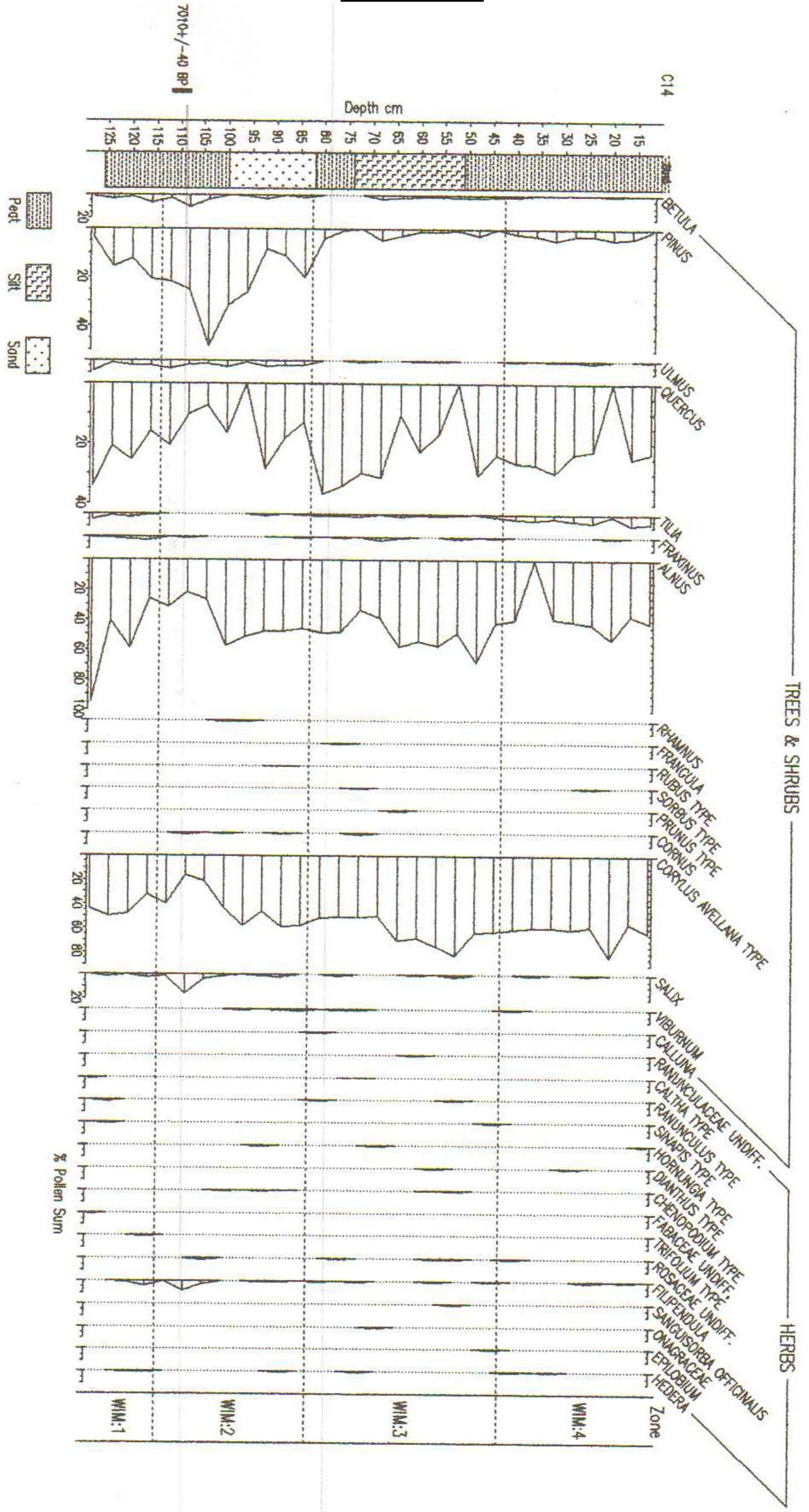
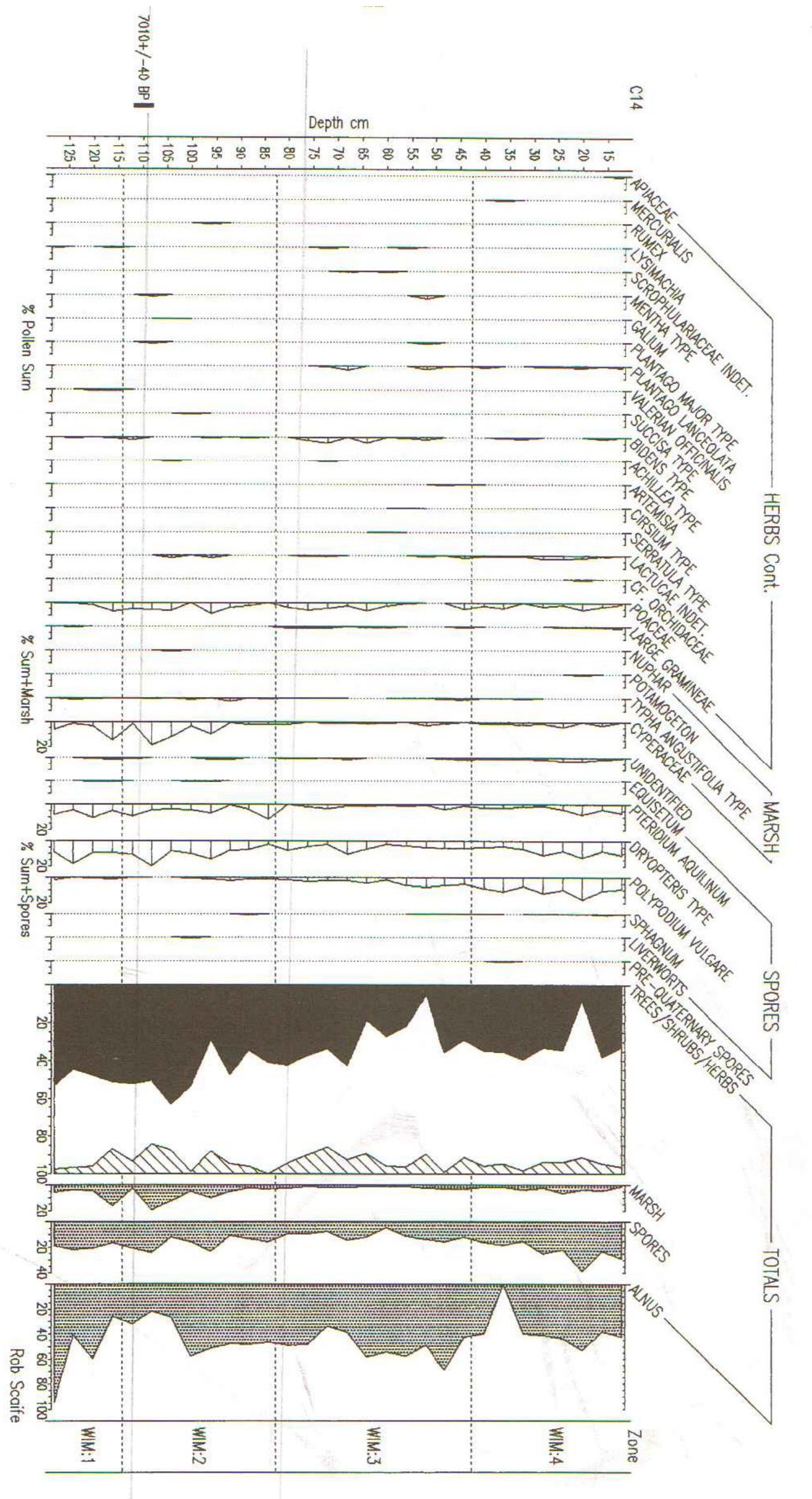


Fig 64 Southern Mosslands: Prescot Moss percentage herb pollen diagram (trees plus group)

APPENDIX IX



C14
7010+/-40 BP
Depth cm
125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15
BETULA
PINUS
ULMUS
QUERCUS
TILIA
FRAXINUS
ALNUS
RHAMNUS
FRANGULA
RUBUS TYPE
SORBUS TYPE
PRUNUS TYPE
CORNUS
CORYLUS AVELLANA TYPE
SALIX
VIBURNUM
CALLUNA
RANUNCULACEAE UNDIFF.
CALTHA TYPE
RANUNCULUS TYPE
SINAPIS TYPE
HORNUNGIA TYPE
DIANTHUS TYPE
CHENOPODIUM TYPE
FABACEAE UNDIFF.
TRIFOLIUM TYPE
ROSACEAE UNDIFF.
FILIPENDULA
SANGUISORBA OFFICINALIS
ONAGRACEAE
EPILOBIUM
HEDERA
TREES & SHRUBS
HERBS
Zone
WIM:1
WIM:2
WIM:3
WIM:4
Peat
Silt
Sand
% Pollen Sum



C14
7010+/-40 BP
Depth cm
APIACEAE
MERCURIALIS
RUMEX
LYSIMACHIA
SCROPHULARIACEAE INDET.
MENTHA TYPE
GALIUM
PLANTAGO MAJOR TYPE
PLANTAGO LANCEOLATA
VALERIAN OFFICINALIS
SUCCISA TYPE
BIDENS TYPE
ACHILLEA TYPE
ARTEMISIA
CIRSIUM TYPE
SERRATULA TYPE
LACTUCAE INDET.
CF. ORCHIDACEAE
POACEAE
LARGE GRAMINEAE
NUPHAR
POTAMOGETON
TYPHA ANGUSTIFOLIA TYPE
CYPERACEAE
UNIDENTIFIED
EQUISETUM
PTERIDIUM AQUILINUM
DRYOPTERIS TYPE
POLYPODIUM VULGARE
SPHAGNUM
LIVERWORTS
PRE-QUATERNARY SPORES
TREES/SHRUBS/HERBS
MARSH
SPORES
ALNUS
HERBS Cont.
MARSH
SPORES
TOTALS
% Pollen Sum
% Sum+Marsh
% Sum+Spores
Rob Scaife
Zone
WIM:1
WIM:2
WIM:3
WIM:4

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