3

Neolithic and Early Bronze Age Environmental Background

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3.1 Introduction

The Neolithic and Early Bronze Age periods both fall within the middle of the Holocene geological series (equivalent to the Flandrian stage, RL Jones and Keen 1993, 208). In north-western Europe, the Holocene has been sub-divided in a number of ways based on vegetation changes observed in palynological and plant macrofossil records from peat bogs, including, in the case of the former, the Somerset Levels (Figure 3.1 on the next page).

The Neolithic coincides with West's (1980) Fl II–Fl III chronozones, in other words the early to late temperate periods of the Holocene. Therefore, in West's model, the Neolithic is seen as immediately post-dating the Holocene interglacial optimum. A further means of subdividing the Middle Holocene is Godwin's (1940) pollen zonation scheme (Figure 3.1 on the following page). The Neolithic is encompassed in the first two sub-stages of zone VII and is characterised by high-diversity temperate forests. Indeed by the end of chronozone Fl II/zone VIIa all the deciduous tree species characteristic of the mid-interglacial woodland were in place. All later colonisations would be as a result of deliberate or accidental importation by people.

The frequently used, "climatic optimum" phrase relates to the period 7000–3700 BC when Nordic seas were at their warmest and waters off Greenland less affected by sea ice than today (Koç and Jansen 1994). Nevertheless, Girling's (1979; Coles and Coles 1986, 48) well-known discovery of insect fossils associated with the Sweet Track, that are suggestive of summers 2–3°C hotter and winters 2–4°C cooler at 3800 BC, provides a salutary reminder of the local relevance of hemispherical climate reconstructions such as those of Koç and Jansen (1994). Mark Robinson's (2002) review of insects from southern English Neolithic sites similarly suggests that mean summer temperature may have been 2–3°C higher during the Neolithic, although he also points out that loss of some indicator species could have been caused by human habitat modification.

Relative sea level rise decelerated throughout the Neolithic from the peak levels seen in the Early Mesolithic (Haslett *et al.* 2001). Although the most recently published Holocene sea level curve for the South West (Heyworth and Kidson 1982; Haslett *et al.* 1997b; 2001) lacks the detail of its counterparts for the east coast of England (Devoy 1979; Haggart 1995; Shennan and Andrews 2000), it does provide some indication of the magnitude of coastal changes in the Neolithic (Figure 3.2 on page 65). A separate sea level curve has been produced for the Isles of Scilly by Charles Thomas (1985, 17–34), but it lacks absolute dating control for the prehistoric period and does not extend beyond the Early Bronze Age. For these reasons the generic South West sea level curve is used for the Isles of Scilly in this report.

According to the sea level curve for the South West, sea levels at about 4500 BC were *c.*5m below those of the present, and by 1500 BC were within 1–2m of current levels (Figure 3.2 on page 65). Therefore, during the course of the Neolithic, there was substantial coastal change resulting in the inundation and subsequent burial by marine and intertidal deposits of significant areas of former coastline. Several of these buried landscapes (termed "submerged forests" in the case of those exposed in the present intertidal zone) have been investigated (see for example, Balaam *et al.* 1987; Druce 1998) but direct evidence for Neolithic human activity has only been found on the Somerset Levels (Coles and Coles 1986). Sedimentation of intertidal muds resulting from Neolithic sea level rise has been informally classified by

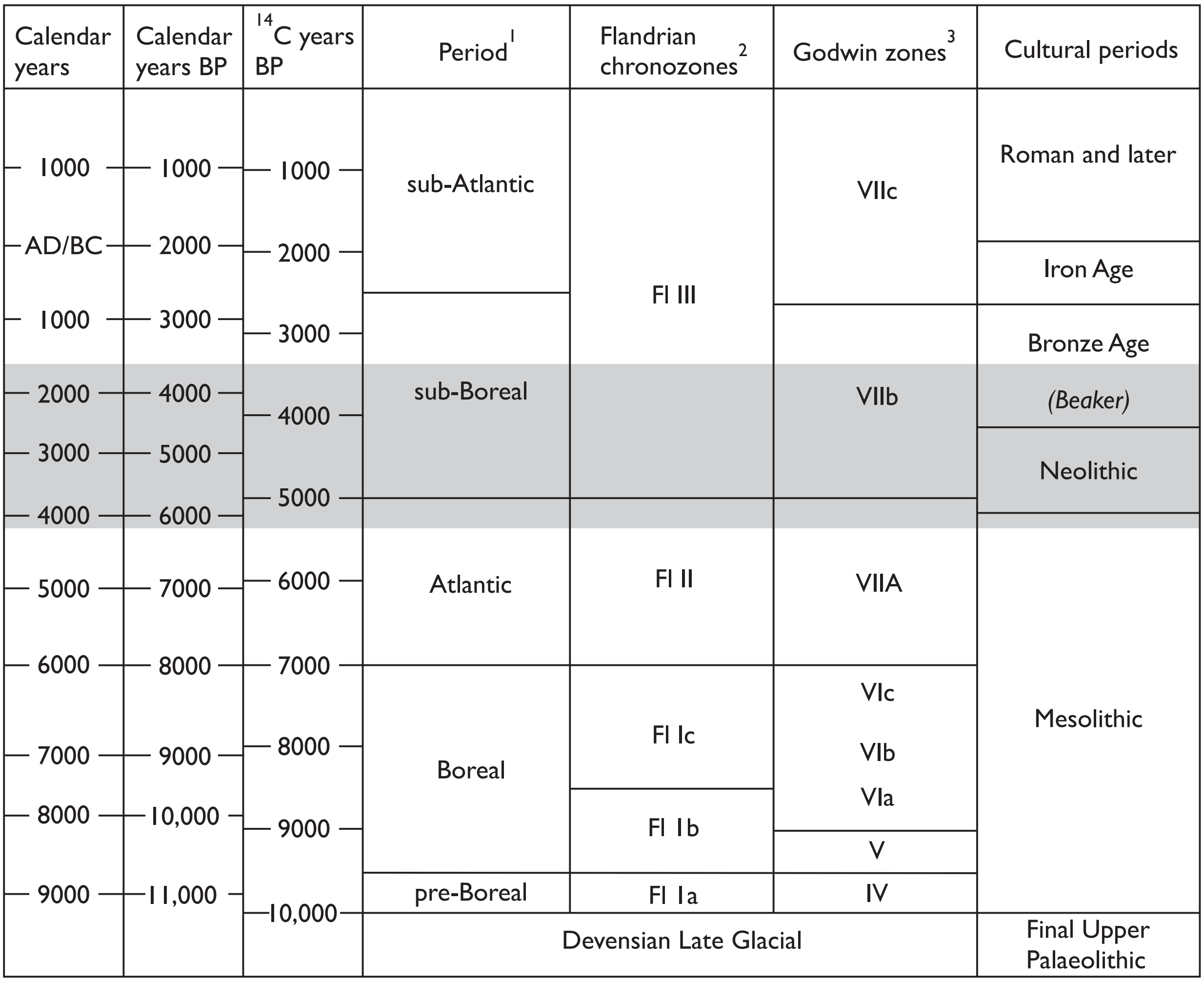

Figure 3.1: *Holocene stage names and cultural periods. Notes: 1 after Blytt (1876) and Sernander (1908), 2 after West (1980), and 3 after Godwin (1940). The shading covers the period discussed in this chapter*

John Allen as the lower Wentlooge formation (Allen 1987; Allen and Rae 1987) in the Severn levels and formally as the Somerset Levels Formation in that part of Somerset (Kidson and Heyworth 1976; Campbell *et al.* 1999).

Change in Holocene river valley environments is partly related to the pattern of relative sea level rise. Rising sea levels reduced river gradients, which, together with the development of Middle Holocene forests, led to alterations in river bedform. Thus by the beginning of the Neolithic, in common with most lowland rivers in north-west Europe as a whole, rivers in the South West had evolved meandering or anastomosing bedforms (AG Brown 1997, 210). Unlike the same river floodplains today, there is little evidence for channel migration or indeed deposition of fine-grained sediments on floodplains during the Neolithic and much of the Bronze Age. AG Brown (1997, 210) has argued that the stasis of lowland floodplain during the Late Mesolithic to Late Bronze Age was a product of the stabilising influence of the alder and hazel woodland, combined with a less seasonal flood regime than that seen at present.

Some floodplains in calcareous areas of the South West also saw the development of tufa during the Middle Holocene, while similar deposits are also associated with spring waters of the same period. These deposits result from the evaporation of water that is super-saturated with calcium carbonate and can only develop in low-energy, sediment-free waters; they also require a warm climate to form (Pedley 1990). It is notable that where tufa has been investigated in the South West it has always been associated with shade-loving land snails, suggesting adjacent forest environments (Evans and Smith 1983; Willing 1985; Goudie and Parker 1996, 60–6; Davies *et al.* 2001).

River behaviour only appears to have altered, from the pattern described, from the Late Bronze Age onwards when sedimentation of mineral silts and clays on floodplains is attributed to widespread forest clearance of floodplains and in the wider river catchment (Robinson 1992). Detailed palynological studies from

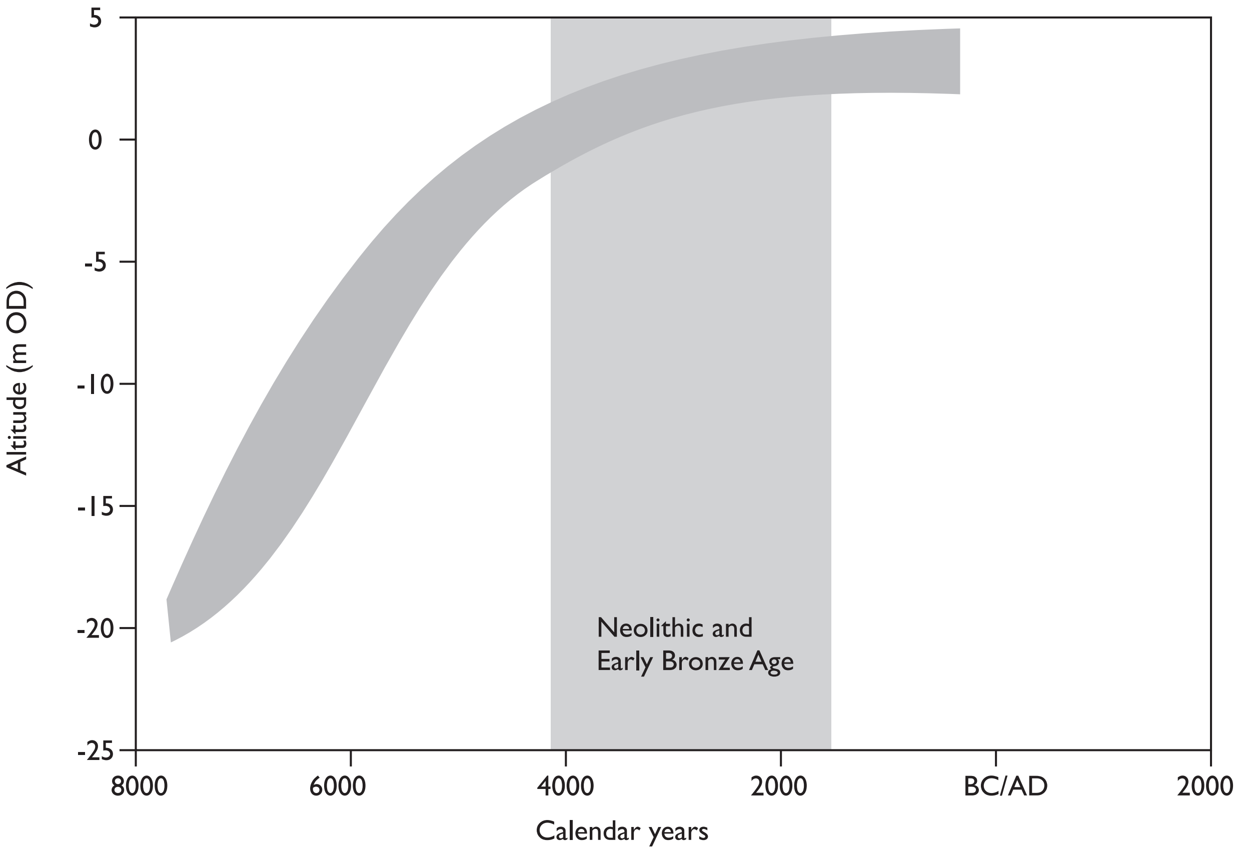

Figure 3.2: *Holocene sea level curve for the Severn estuary by Heyworth and Kidson (1982) as modified by Haslett* et al. *(2001) and the authors.*

Ripple Brook, near Tewkesbury on the River Severn, suggest a time lag of 300 to 400 years between woodland clearance and deposition of fine-grained alluvium on the floodplain (AG Brown and Barber 1985).

Away from the coasts and floodplains, the soils of the South West at the beginning of the Neolithic are thought to have been forest-supporting Brown Earths (Limbrey 1975). These had developed continuously since the Devensian Late Glacial and were of variable thickness depending upon parent material. Brown Earths developing on the Wessex chalklands, Mendip, areas of south Devon and the Lizard peninsula of Cornwall, did so in loess, creating particularly silt-rich soils (Catt 1977; 1978). Models developed in south-eastern England suggest there was little geomorphological change in these "dry" landscapes during the Neolithic, and that widespread slope erosion and consequent deposition in dry valleys only occurred in the Late Bronze Age (Bell 1983).

This hypothesis has yet to be tested over most of the South West region. However, Mike Allen's work (1992; 1995) on the chalklands of Wiltshire and Dorset demonstrates that in some valleys colluvial sedimentation had started in the Late Neolithic/Early Bronze Age.

3.2 Vegetation

Palynological work carried out in the region has enabled a detailed picture to be drawn of the Middle Holocene forests which Neolithic people exploited, settled, cleared and farmed. Whereas those studies undertaken before 1990 allowed a regional vegetation model to be constructed (for example, Birks *et al.* 1975; Bennett 1989; Birks 1989), analyses conducted after that date have filled in much of the sub-regional detail. Study of insect remains from archaeological sites – mostly carried out in the last two decades – has enabled detailed reconstructions of local woodland habitat to be established (see Robinson 2002 for a review). Indeed Robinson's (2002) synthesis of insect studies from southern England emphasises the diverse character of Neolithic woodland and it is notable that many insect species once characteristic of the "wildwood" have disappeared from the modern fauna. Therefore in this section the regional vegetation is discussed first, together with general explanations for its change. Following this, attention is turned to the Neolithic environmental history of the six topographic zones that characterise the South West and the models of people-environment interaction that have been proposed.

According to Bennett's (1989) analyses of the pollen diagrams available in the 1980s, the vegetation of the South West at the end of Fl II varied according to geological substrate (Figure 3.3 on the next page). On the limestone (and chalk) of the Cotswolds, Mendip and Wessex Downs the forest was dominated by broad-leaved lime (*Tilia*) (henceforth called "lime"), oak (*Quercus*), ash (*Fraxinus*) and elm (*Ulmus*). Lowlands bordering the Severn and above the intertidal zone largely comprised alder (*Alnus*) carr, whereas the Carboniferous, Devonian, Triassic and Jurassic rocks of western Somerset, Devon and Cornwall supported an oak-hazel (*Corylus*) woodland, apart from Dartmoor, which seems to have been covered by birch (*Betula*) (Caseldine and Maguire 1986).

It is now known that on the "eve" of the Neolithic, these woodlands were not the pristine natural environment that biogeographers once thought. Recent palynological data from the South West indicate localised Mesolithic clearance in areas that are now moorland, on floodplains and also in lowland peat bogs (for example, Caseldine 1999; Fyfe *et al.* 2003a; J Jones 2004). Nevertheless for the most part these impacts appear to have been slight, short-lived and temporally diverse. Initial Neolithic forest clearance in the South West dates from around 4000 BC in eastern Dorset and slightly later in areas further to the west (Waton 1982). As with previous Mesolithic woodland modification it was initially small-scale and of short duration (Roberts 1998, 195). However, often coincident with Early Neolithic woodland clearance is the well-known elm decline which has been recognised in numerous pollen diagrams from the South West and dates to around 3700 BC. The exact causes of the Early Neolithic elm decline are still a source of some debate, but the consensus is that humans were a vital agent, either in the spread of Dutch elm disease or by "weakening" elm forests, thereby making them more susceptible to attack (Scaife 1988).

Pollen spectra from the South West that post-date the elm decline indicate that woodland grew back in many areas from which it had been cleared, although elm did not always recover to its former levels. Thereafter the woodland was only occasionally impacted by people – and only then on a small scale – until the very Late Neolithic and Early to Middle Bronze Age. It would appear, therefore, that a pattern of shifting agriculture and small scale pastoralism was maintained throughout the Neolithic. The Wessex Downs seem to be an exception in this respect as analysis of mollusc shells from buried soils and ditch sequences associated with monuments that span the entire Neolithic indicate the maintenance of open grassland throughout the period (for example, Evans 1971b; 1972). It would appear that this area was kept open by grazing herds of cattle and sheep, perhaps to maintain visibility to the funerary and ritual monuments that are widespread in this part of the region (Roberts 1998, 196). Fowler (1983, 36) has suggested that there was a fundamental change in subsistence economy in the Early to Middle Bronze Age to one where arable crops became of paramount importance. Widespread forest clearance accompanied this change in order to open up new areas on which crop cultivation could take place. These large-scale clearances took place asynchronously across the South West and were frequently accompanied by a significant decline in lime pollen (see for example, Waton and Barber 1987; JP Gardiner *et al.* 2002). Such vegetation changes are coincident with the development of complex societies, significant population growth and the so-called secondary products revolution (Sherratt 1981; Fowler 1983, 33), and thereby mark the end of the period covered by this text.

3.3 Area reviews

3.3.1 Chalk downland (Wiltshire and Dorset)

The Neolithic of the Wessex chalklands has been investigated far more intensively than any of the areas discussed below. This statement applies equally to the study of the environment as to artefacts and archaeological features, and in the former case is largely thanks to the work of John Evans from the 1960s and Mike Allen from the 1980s. As chalk is highly calcareous and permanently waterlogged deposits on the Wessex Downs are few, palaeoenvironmental reconstruction has largely had to rely on the study of sub-fossil mollusc shells.

Pollen analysis has been attempted on soils buried beneath Neolithic monuments but there appear to be significant taxa-related taphonomic problems to this approach (Dimbleby and Evans 1974). Therefore palynological data for chalkland environments in the Neolithic have had to be generated from floodplain features in adjacent areas. Waton's (1982; Waton and Barber 1987) analysis of 18m of peats infilling a 25–35m wide doline at Rimsmoor near Wareham is the most significant of these, despite the fact that it has only a local pollen catchment (70% of the pollen is from within 20m of the sample site). A mixed oak-elm-lime forest is recorded for the Late Mesolithic, prior to a short-lived elm decline between 4230–3770 cal BC (HAR-3919) and 3640–3350 cal BC (HAR-3920), which seems to have promoted pasture (although cereal pollen was found). After *c.*3500 BC the forest regenerated and was dominated by hazel and oak, until there were further localised forest clearances associated with a decline in lime pollen at 2480–2030 cal BC (HAR-3921). Nevertheless, permanent and large-scale clearance only occurred in the Late Bronze Age.

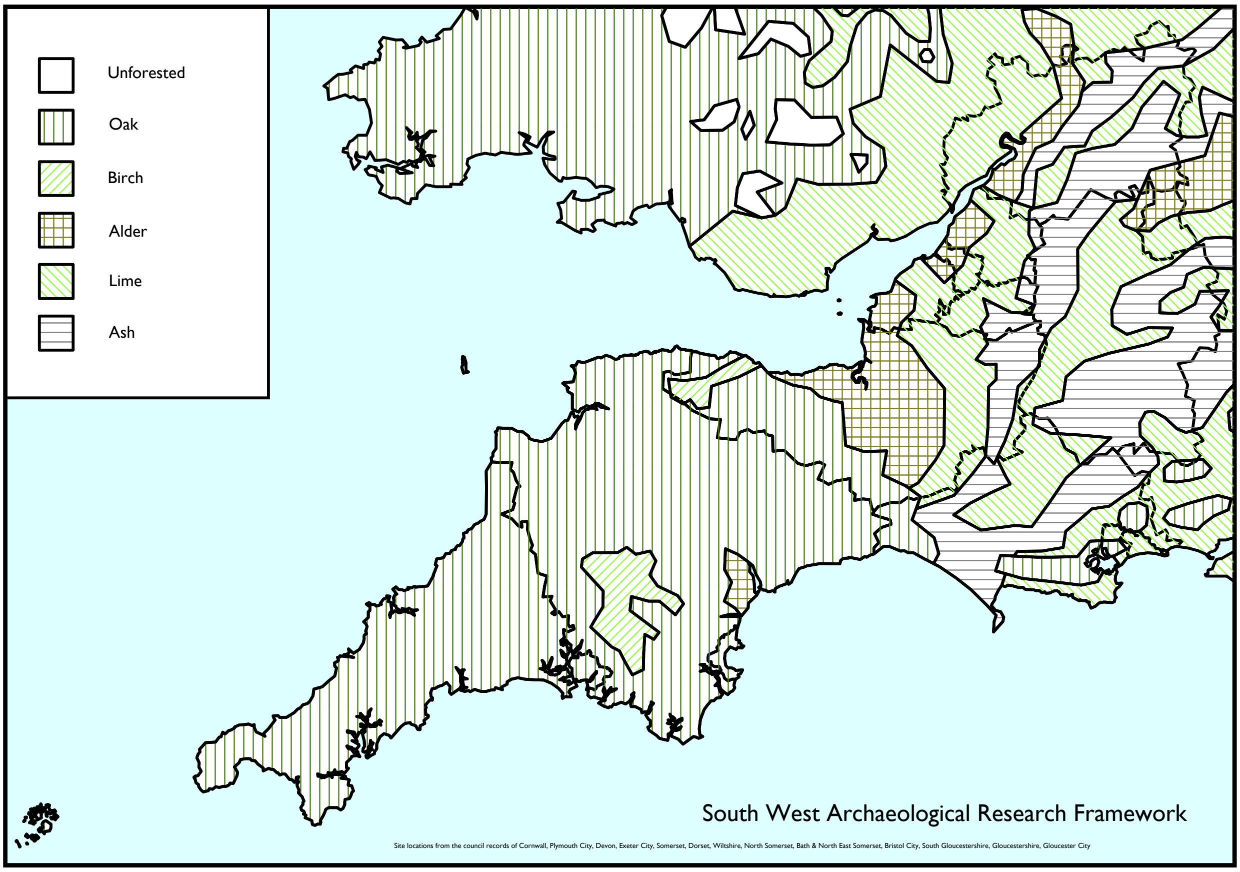

Figure 3.3: *"Climax" vegetation of south-west Britain at the Atlantic–subboreal transition,* c.*3750* BC*. Modified from Bennett (1989) and RL Jones and Keen (1993, 232)*

Mollusc studies carried out on soils buried beneath Early Neolithic monuments provide evidence of the variation of chalkland environments at this time. Molluscs from buried soils at Windmill Hill and Maiden Castle suggest these causewayed enclosures were respectively constructed in species-rich, grassland scrub after 3800–3350 cal BC (OxA-2406) and in primary woodland after 3770–3370 cal BC (OxA-1148) respectively (Evans and Rouse in Sharples 1991a, 119–20; Fishpool in Whittle *et al.* 1999, 127). Similarly the hilltop enclosures at Hambledon Hill and Whitesheet Hill seem to have been built in local woodland clearings, according to the mollusc evidence, in the first case episodically between 3700 and 3300 cal BC (based on Bayesian modelling of a large series of dates: Bayliss in Mercer and Healy forthcoming), and the second in 3710–3520 cal BC (BM-2785, Allen in Green 2000, 43).

Other Early Neolithic monuments on Cranborne Chase also seem to have been built in woodland and include the Handley Down mortuary enclosure, built somewhere between 3700–3000 BC and the Dorset Cursus of 3650–2900 cal BC (OxA-624, Entwistle and Bowden 1991; Allen in Green 2000, 43–45). In the former, the clearance was very small-scale and the woodland was allowed to regenerate once the site had fallen into disuse. In the case of the latter, clearance was on a much larger scale, but woodland regeneration occurred during the use of the Cursus.

However, all these monuments occupy relative topographic highs in the landscape which appear to have been more heavily vegetated than the surrounding "lowlands". For example Evans' (Evans 1971b; 1972) mollusc analysis of soils buried beneath South Street long barrow, near Avebury, dating to 3800–3100 cal BC (BM-356), suggests that construction was in grassland pasture. Similarly Mike Allen's (in RJC Smith *et al.* 1997, 167) analysis of shells from a pit predating the Flagstones indicates grassland environments at 3960–3630 cal BC (HAR-9161). A colluvial sequence at Middle Farm, Dorchester dating to 3710–3370 cal BC (OxA-2382), similarly accumulated in a grassland environment (Allen in RJC Smith *et al.* 1997, 177). One further site – the Down Farm Shaft (also known as Fir Tree Field Shaft, see also pages 58 and 75) – is worthy of special mention, given that the palaeoenvironmental data span the Late Mesolithic to Early Bronze Age (Green and Allen 1997; Allen and Green 1998; Allen in Green 2000, 40–43). Mollusc shells from an erosion cone in the shaft suggest that dense woodland of the Middle Holocene was locally cleared at *c*.4240–3970 cal BC (OxA-7987); an event that was associated with red deer bones and Late Mesolithic microliths. The remaining palaeoenvironmental data have yet to be published but, given the well-stratified ceramic assemblages, promise a detailed picture of a key environment for the entire Neolithic.

There are more widespread mollusc data available for the Late Neolithic and Early Bronze Age. Those from ditch sediments in the abandoned causewayed enclosures indicate that woodland or scrub regenerated in these situations during the Late Neolithic and that permanent clearance occurred in the Early Bronze Age (see for example, Evans and Rouse in Sharples 1991a, 120–21). However, elsewhere Late Neolithic monuments, such as the henges at Avebury, Stonehenge, Durrington Walls, Mount Pleasant and Woodhenge were all built in grassland environments (Evans 1971a; Evans and Jones 1979; Evans 1984; Evans *et al.* 1985; Allen 1997a). More detail on chalk grassland environments at 2950–2350 cal BC (I-4136) is provided by macroscopic plant remains and insects preserved in anaerobic conditions from a palaeosol and turf stack beneath Silbury Hill (Williams and Robinson in Whittle 1997b, 32–47). Most mosses and seed-producing plants recovered are found in chalk grassland at the present day, while wood remains were mainly of scrub species such as hazel. The insects, which include Scarabaeoid dung beetles, are almost entirely related to herb-rich grassland maintained by light grazing: so-called "unimproved pasture" (Robinson in Whittle 1997b, 43). Nevertheless, Mike Allen's work on the Stonehenge landscape (summarised in Allen 1997a) suggests that grassland formed just one – albeit the majority – element in a mosaic that also included primary and secondary woodland, and small arable plots. Coneybury henge is the one notable exception to the model of Late Neolithic monument construction on land devoid of woodland (Bell and Jones in Richards 1990, 154–8), but then this feature seems to have had a somewhat unusual use (Allen 1997a).

The data reviewed above suggest that clearance on the Wessex chalkland occurred earlier in lowland locations than on the tops of the Downs. Indeed Mike Allen (in RJC Smith *et al.* 1997, 183–4; French *et al.* 2003), following arguments originally put forward by Bush (Bush and Flenley 1987; Bush 1988; 1993), has tentatively suggested that the lower areas may have been partially cleared of woodland in the Mesolithic or otherwise did not support mixed deciduous woodland by the Middle Holocene. Earlier Neolithic clearance seems to have been primarily for pasture, although palynological evidence suggests cereal cultivation was also carried out, but it was on a small scale and may have been used as a supplement to wild foods, or even grown for "ritual" reasons (Fairbairn in Whittle *et al.* 1999, 139–56; Fairbairn 2000a; Robinson 2000 but see G Jones 2000 for a contrasting view in relation to Hambledon Hill). By the Late Neolithic the area of pasture had been expanded, although there is only limited evidence for a corresponding expansion of arable agriculture. Cultivation only seems to have been carried out on a large scale in the Early Bronze Age, after which notable volumes of colluvium begin to accumulate in dry valleys as a result of valley-side soil destabilisation (Allen 1995).

3.3.2 Jurassic uplands (The Cotswolds and Mendip)

Despite the fact that Neolithic monuments are well-known on both the Cotswolds and Mendip, very little palaeoenvironmental work has been conducted on stratigraphy of this period – in part due to a lack of archaeological excavation of sites of this period in these areas. Most palynological data for Neolithic environments in the Cotswolds come from the Severn or Thames valley (as reviewed by Goudie and Parker 1996, 54–9; Parker and Chambers 1997), and in the latter case largely from Oxfordshire (for example, Preece and Day 1994; Parker 1995). Similar data for Mendip are derived from work on the Somerset and Severn levels (see Section 3.3.5 on page 70). The river valleys of the Cotswolds seem to have supported alder woodland throughout the Neolithic, while the limited evidence available suggests that lime woodland characterised the limestone uplands with oak and hazel woodland on the Lias and gravel terraces (Parker and Chambers 1997). Where dated by radiocarbon, tufaceous deposits from both Mendip and the Cotswolds have been found to be Late Mesolithic or earlier (Willing 1985; Davies *et al.* 2001). Nevertheless it is likely that the woodland indicated by associated mollusc assemblages continued into the Early Neolithic.

By far the most detailed palaeoenvironmental work carried out on a Neolithic site from the Gloucestershire Cotswolds is that at Hazleton North (Saville 1990). A combination of soil, plant macrofossil, pollen and mollusc analysis (Macphail, Straker, Scaife and Bell respectively in Saville 1990, 215–27) suggests that clearance of the primary lime woodland had occurred before 4080–3800 cal BC (dated by Bayesian analysis of the radiocarbon dates, Meadows *et al.* 2007, 51). The clearance appears to have been for cereal cultivation, which seems to have been undertaken in small, shifting plots (Macphail in Saville 1990, 225). A midden sealed by the barrow contained large quantities of charred plant remains and indicates that Einkorn (*Triticum monoccocum*), emmer (*T. diococcum*) and bread wheat (*T. aestivum*) were the main crops that were grown (Straker in Saville 1990, 215–8). Nevertheless, the cultivation episode seems to have been short-lived and by the time of barrow construction in 3695–3650 cal BC (Meadows *et al.* 2007, 53), hazel scrub occupied the site (Straker and Scaife in Saville 1990, 215, 218–9). Mollusc analysis of a pit associated with construction of the (undated) Chedworth barrow suggests that this monument was also built in a shaded environment (Mike Allen, pers. comm. 1999). It has similarly been suggested from mollusc analysis carried out on ditch fills from Condicote henge, that this monument was constructed before 2900–2150 cal BC (HAR-3067) in woodland (Bell in Saville 1983a, 39–46). However, the majority of the shade-loving molluscs recovered are also characteristic of long, ungrazed grassland and it is possible that such an environment was current at the time of henge construction (Cameron and Morgan-Huws 1975; Carter 1990). Whichever explanation is correct, it would seem that Condicote henge was built and used in an unfarmed landscape. This situation contrasts with the Priddy Circles on Mendip where Dimbleby's (in Tratman 1967) pollen analysis indicates that this area was grassland at the time of construction (see also the discussion of Dorset and Wiltshire chalkland above).

3.3.3 Moorland (Bodmin Moor, Dartmoor and Exmoor)

Bodmin Moor, Exmoor and particularly Dartmoor are upland areas of granite (Devonian sandstones and slates in the case of Exmoor), characterised through the Middle Holocene by the development of blanket (ombrogenous) mire. The peat that resulted developed where rainfall exceeded evapotranspiration, and in theory provides useful sequences for palynological and plant macrofossil study. Dartmoor is undoubtedly the most fully studied of the three and the most recent reviews of the pollen database have been made by Chris Caseldine (Caseldine and Hatton 1996; Caseldine 1999). Studies at a number of sites such as Bellever demonstrate that by the Late Mesolithic, oak, elm and hazel formed the major components of the Dartmoor woodland (Caseldine and Hatton 1996). However, the woodland appears to have contained patches of heath containing open birch woodland, while alder occupied the valleys. It also appears that Mesolithic people had been very active in the area; almost every pollen sequence examined contains large quantities of microscopic charcoal resulting from their activities (Simmons 1964; Caseldine and Hatton 1993). However, of the Neolithic, Caseldine (1999, 579) states that it "probably remains the most poorly understood period for Dartmoor in the whole of prehistory with many important questions to be answered. Palaeoecologically the period is a 'black hole' with remarkably little chronologically sound evidence". In other words, there are no pollen spectra of Neolithic age that are confirmed by radiocarbon dating. Nevertheless, there is limited evidence of woodland manipulation in the Neolithic (possibly associated with the construction of chambered tombs) and tentative (but undated) elm declines, but generally human activity seems to have been focused largely on the fringes of the moor (Fleming 1988, 94–100). Caseldine and Hatton (1996) suggest that the disappearance of trees from Dartmoor occurred in the Late Neolithic/Early Bronze Age as a result of the expansion of peat caused by a damper climate, and that the open landscape was maintained by browsing. Certainly the landscape was largely open before construction of the reaves in 1300–1100 BC (Fleming 1988).

Until recently, palaeoenvironmental studies on Bodmin Moor had largely been confined to examination of the Late Glacial and Early Holocene stratigraphy (for example, AP Brown 1977). More recent work by Ben Gearey and Dan Charman (Gearey *et al.* 2000a;b) has focused not only on the Middle Holocene, but on two sites (Rough Tor and East Moor) associated with Neolithic archaeological remains (Johnson and Rose 1994). The palynological data from Rough Tor and one of AP Brown's sites, Dozmary Pool, both suggest significant depletion of the upland hazel, birch, oak and elm woodland *c.*5400 BC (AP Brown 1977; Gearey *et al.* 2000a;b). Thereafter, and except for a minor recolonisation of hazel between 2330–3340 cal BC (OxA-6009) and 1680–1440 cal BC (OxA-6008), conditions at Rough Tor were largely open, and are suggestive of grassland (Gearey *et al.* 2000a;b). In the absence of further detailed work on Middle Holocene sequences from Bodmin Moor, it is uncertain how typical Gearey and Charman's (2000a; 2000b) data are, although AP Brown (1977) also concludes that environments were largely open by the end of the Late Mesolithic.

Palaeoenvironmental studies carried out on Exmoor prior to 1995 have been summarised by Straker and Crabtree (1995). The Chains is the most studied site, having been separately examined by Merryfield and Moore (1974), and by Crabtree (Straker and Crabtree 1995). The sequence is poorly dated, but appears to begin at about 3000 BC (although the oldest radiocarbon date, 0.4m from the base of the sequence, gives an age of 2910–2500 cal BC, UB-821). At this time both oak-hazel and alder woodland were present, with areas of heath also being of importance. Coincident with the previously quoted radiocarbon date (UB-821), grasses, sedge and heather expand, an episode that Merryfield and Moore (1974) attribute to humans, but Straker and Crabtree (1995) to the spread of blanket bog due to wetter climates (as previously discussed for Dartmoor). Human impact on the vegetation is only seen after 1000 BC (Straker and Crabtree 1995). A further upland site at Hoar Moor (Francis and

Slater 1990) also contains Neolithic pollen spectra dating from 4460–3980 cal BC (I-15549). These have higher percentages of tree pollen that at The Chains, although birch (perhaps indicative of heathland) is the most common taxon. Humans do not appear to have impacted the Hoar Moor vegetation until about 1000 BC (Francis and Slater 1990).

Since 1995, the focus of palaeoenvironmental studies has shifted to the periphery of Exmoor. Analysis of deposits on one of the main axial drainages through Exmoor, the river Exe, has been undertaken by Ralph Fyfe *et al.* (2003a). Their analysis of a palaeochannel at Brightworthy demonstrates that alder woodland occupied the valley throughout the period 4460–4250 cal BC (Beta-142643) to 2280–1940 cal BC (Beta 142642) after which sedges colonised as water tables rose. Both here and on the edge of Exmoor at Exebridge the surrounding Exmoor upland was characterised by oak woodland with an understorey of hazel. There is considerable evidence for Mesolithic burning within the woodland to create local clearance, but Neolithic people seem to have had a minimal impact. Investigations at Porlock and Minehead focused on intertidal peats and clays dating to between 5500 and 4300 BC which provided data for the vegetation of northern Exmoor (J Jones *et al.* 2001; 2004; Jennings *et al.* 1998; Straker *et al.* 2004).

3.3.4 Triassic and Devonian hills and valleys (south Somerset, Devon and Cornwall)

Whereas Neolithic environments of present moorland and intertidal areas of south Somerset, Devon and Cornwall have been studied in some detail, there are few palaeoenvironmental studies of the remaining parts of these areas. The main problem is a lack of suitable contexts for palynological sampling, whilst the acidic nature of the mainly Palaeozoic and early Mesozoic rocks mean that bone and shell are rarely preserved. Nevertheless, Fyfe *et al.* (2003a) have investigated Neolithic deposits in a buried palaeochannel at Lower Chitterley in the lower Exe valley using palynology. By the Early Neolithic, lime-oak-elm woodland had developed in this location, with alder characterising the adjacent floodplain. The first Neolithic disturbances are manifested by the middle of three elm declines, the first dated by interpolation to *c.*5500 cal BC, i.e. in the Late Mesolithic, the second to 3640–3370 cal BC (UtC-8502) and an undated third. All are accompanied by expansion of grasses and ruderals, while cereal pollen is associated with the last, which also sees widespread woodland clearance. Fyfe *et al.* (2003a) suggest the last coincided with monument construction and the establishment of field systems in the area during the Early to Middle Bronze Age.

Several palynological studies have been conducted on and around the Lizard peninsula in Cornwall. As part of a study of the lithostratigraphic succession of coastal sequences, Healey (Healey 1993; 1995) has examined Middle Holocene peats and soils buried beneath dunes at Marazion Marsh (Mount's Bay) and Praa Sands respectively. His results demonstrate the presence of oak-hazel woodland on dry ground and alder woodland lower down. Tinsley's (1999b) examination of peats from Porthallow, dating to approximately 5100–4550 cal BC (GU-8238), also suggests oak woodland with an understorey of hazel on the hills surrounding the site, while alder carr lay in the lowland. It is unclear whether any of these sequences extend into the Later Neolithic and therefore at present there is very limited evidence from Cornish palynological data for impact of Neolithic, or indeed Early Bronze Age people on the environment.

3.3.5 Coastal lowlands (Somerset, Severn and Avon levels)

Martin Bell has recently reviewed Holocene palaeoenvironmental data recovered for the whole Severn estuary levels area (Bell 2001). Earlier similar reviews of the Somerset Levels data by Astrid Caseldine (1984b; 1988b) and the local pollen zonation scheme of Beckett and Hibbert (1978; 1979) have not been superseded by published data (see Coles and Coles 1998). Woodland within the Severn levels and Avon levels was dominated by alder carr throughout the period under review, while reed and herbaceous plant communities were located in coastal locations. Sea level rises during the Neolithic transformed the alder carr to reed swamp and then tidal mud flats. In the central Somerset Levels, marine clays of Late Mesolithic date were succeeded by Phragmites peat from 4710–4480 cal BC (OxA-11233, Tinsley 2002), which developed in a freshwater fen characterised by sedges and rushes such as *Cladium*, *Juncus* and *Chara* (Beckett 1979). These fen waters were calcareous and mollusc analysis from Shapwick Heath and at Glastonbury indicate that the habitat comprised large expanses of shallow, well-vegetated water (Wilkinson 1998a;b). Both insects and molluscs indicate that the fen water was running and therefore may have been stream-fed, while the former also indicate that it was well oxygenated (Girling 1979; Wilkinson 1998b). Wood peat developed after 3800 BC, by which time birch had colonised the marsh as water levels dropped. Raised bog with acidic waters then formed after 2860–2470 cal BC (SRR-879) and was characterised by Sphagnum moss and heather (*Calluna* sp.). Throughout these changes alder is thought to have fringed the fen and is a major constituent of the pollen spectra (Beckett 1979). Early disturbances to lowland woodland areas are recorded at Burnham-

Zone	Start	End	Characteristics	Notes
A	4350 BC	3450 BC	Elm, oak, lime	Very few herbs – closed woodland
B	3450 BC	2900 BC	Oak	Elm decline and expansion of herbs
C	2900 BC	2550 BC	Elm, oak	Elm recovers, herbs reduced
D	2550 BC	1950 BC	Oak, hazel	Second elm decline, hazel fills in, few herbs
E	1950 BC	1700 BC	Hazel	Oak and elm also plentiful, very few herbs

Table 3.1: *Neolithic and Early Bronze Age vegetation changes on "drylands" around the Somerset Levels (modified from Beckett and Hibbert 1978, 86–7)*

on-Sea (Druce 1998) from 4350–4040 cal BC (Wk-5299), in Central Bristol (Wilkinson *et al.* 2002) soon after 4230–3790 cal BC (Wk-10947) and from the Late Mesolithic onwards at Westward Ho! (Balaam *et al.* 1987). Likewise the Early Neolithic trackways (most famously the Sweet Track, dendrochronologically dated to 3807/6 BC, Coles and Coles 1986, 52–6; Hillam *et al.* 1990) of the Somerset Levels seem to have been associated with localised clearance of alder carr – although much of the track ran through reed swamp. Pollen diagrams from the various levels also record vegetation from surrounding "uplands". Such upland areas were characterised by various combinations of lime, oak, elm and ash woodland, and these appear to have been impacted by human forest clearance at various times during the Neolithic and Bronze Age. As has been previously discussed, elm declines are another manifestation of Early Neolithic woodland disturbance, and in the case of data from the Severn, Avon and Somerset levels they indicate activities in adjacent upland areas. Several have been noted in pollen diagrams, for example:

1. immediately before the construction of the Sweet Track in 3807/6 BC (Beckett 1979; Hillam *et al.* 1990) but radiocarbon dated to soon after 3640–3370 cal BC (SRR-882, Beckett 1979)

2. *c*.3660–3370 cal BC (SRR-542) at the Abbots Way (Beckett and Hibbert 1979)

3. soon after 3640–3360 cal BC (NZA-12530) at Avonmouth (Scaife in JP Gardiner *et al.* 2002, 20)

In the last case the elm decline was marked by the expansion of grasses and ruderals, and the discovery of cereal pollen, all suggesting that the elm clearance was for cultivation. Nevertheless, woodland regeneration took place after *c*.2900–2800 BC and there was no permanent clearance until the latest Neolithic or Bronze Age (Scaife in JP Gardiner *et al.* 2002, 20–1).

The classic Somerset Levels vegetation sequence for the Neolithic and Early Bronze Age is based on palynological examination of peat sequences associated with the Abbots Way, Meare Heath and Sweet Tracks and is shown in Table 3.1 (Beckett and Hibbert 1978; Beckett 1979; Beckett and Hibbert 1979). The elm decline appears to have opened up the oak, elm and lime "wildwood", resulting in the expansion of herbs. Beckett and Hibbert (1978) suggest this was caused by woodland clearance on the Burtle Beds (marine sand strata of Ipswichian age, Kidson *et al.* 1978) for the purposes of pasture (Zone B, Table 3.1). Woodland regeneration had occurred by 3030–2700 cal BC (SRR-880) at the Sweet Track site (Beckett 1979), but ash (*Fraxinus*) was a new colonist into former clearings, although it was then succeeded by elm, oak and finally lime (Zone C, Table 3.1). A further elm decline took place at 2860–2470 cal BC (SRR-879, Zone D, Table 3.1), but the other tree species were unaffected, suggesting that the surrounding limestone uplands were being cleared of their elm. Elm and hazel later recolonised the cleared areas after 2130–1820 cal BC (SRR-878, Zone E, Table 3.1), and lasted until more extensive woodland clearance took place after 1700 BC (Beckett and Hibbert 1978; 1979).

Several palaeoenvironmental investigations of Neolithic strata have been carried out on the Somerset Levels since the end of the Somerset Levels Project in the 1980s. For example Julie Jones and Heather Tinsley have investigated two sites to the east of the raised bog area: Walpole and Woolavington Bridge on the Huntspill River (Tinsley 2003; J Jones 2004). Data from the former, a Lias island, suggest a complex series of vegetation and sea level interactions spanning the Late Mesolithic to Early Bronze Age period. As in the central Somerset Levels, this area was a marine embayment between 4690–4240 cal BC (Wk-9020) and 3520–3080 cal BC (Wk-9019), after which the area became saltmarsh (compare the freshwater fen in the central Somerset Levels, see above). In upland areas the oak, hazel, elm and lime woodland may have been subject to localised clearance by the latter date, but more definitive evidence of clearance is found after 2300–1890 cal BC (Wk-9018), when oak declines and herbs indicative of human activity expand. After this episode, rising sea levels once more led to the inundation of the site.

North of the Somerset Levels, Tinsley's (in Wilkinson *et al.* 2002, 17–27) analysis of pollen from the Avon levels at Deanery Road, Bristol suggests that prior to 3550–3050 cal BC (Wk-10946) the surrounding "uplands" supported lime woodland just as they do today at Leigh Woods (Rackham 1982). Indeed palynological analyses from the Severn levels north of Bristol at Pucklechurch, west at Avonmouth and south in the Vale of Gordano, all highlight the importance of lime woodland in the raised areas bordering the river valleys (Jefferies *et al.* 1968; Gilbertson *et al.* 1990; Tinsley 1999c); Scaife in JP Gardiner *et al.* 2002). In contrast, outline palynological work at Marshwall Lane, Avonmouth suggests that between 2860–2460 cal BC (AA-30868) and 2470–2190 cal BC (AA-30865) oak-hazel woodland was the local "upland" vegetation (Carter *et al.* 2003). By 4110–3645 cal BC (interpolation of Wk-10946 and Wk-10947) from the base of the organic sequence), clearance of the lime woodland at Deanery Road was underway, but the peat sequences end at *c.*3000 BC and therefore the continuance of this trend cannot be traced.

3.3.6 Isles of Scilly

There are now three palynological studies of Neolithic and Bronze Age environments from the Isles of Scilly (Ratcliffe and Straker 1996, 32). The longest and best known pollen sequence is from Higher Moors on St Mary's (Scaife 1984). The Higher Moors peat sequence begins at 5490–5050 cal BC (HAR-3695) and indicates oak woodland with an understorey of hazel. At some point prior to 1650–1050 cal BC (HAR-3694) there was small-scale woodland clearance; cereal and ruderal pollen suggest this was for cultivation. Later on in the Bronze Age the woodland regenerated and birch rose to dominance, although cereal and herbaceous pollen were still present, indicating continued cultivation. Organic deposits associated with a radiocarbon date of 4230–3940 cal BC (GU-5061) were investigated at Higher Town Beach, St Martin's in the early 1990s (Ratcliffe and Straker 1996, 19). These contain pollen spectra indicative of hazel-oak woodland during the Earlier Neolithic. Later (but before 3380–3010 cal BC, GU-5060) birch had colonised and replaced much of the hazel, but unlike at Higher Moors there is no evidence of forest clearance. Palynological examination of a later coastal peat exposure at Porth Mellon, St Mary's which dates to 3100–2700 cal BC (GU-5394), suggests a local woodland dominated by birch, with a lesser component of hazel and oak (Ratcliffe and Straker 1996, 25). After 2900–2200 cal BC (GU-5396) lime appears and oak becomes a more prominent element of the local woodland, but once more there is no evidence of clearance.

The picture of the Neolithic environment from these diagrams is of localised disturbance of woodland, while the main phase of clearance, eventually leading to the present heathland environment, dates from the Late Bronze or Early Iron Age (Dimbleby *et al.* 1981; Scaife 1984; Ratcliffe and Straker 1996, 33). The importance of birch in the Neolithic flora of the Isles of Scilly is notable, especially given that it is a minor component of woodland elsewhere in the South West at this time. Nevertheless, given that most studies have been carried out on St Mary's, it is at present uncertain how widely any of these interpretations can be applied to other islands in the archipelago. Even on St Mary's there are many local variations in the vegetation despite its small area.

3.4 Conclusions

The very fact that this review has stretched to so many pages demonstrates the diversity of environments that existed during the Neolithic and Early Bronze Age in the South West region. Therefore, although the regional models reviewed earlier are attractive in their simplicity, they do not adequately explain the landscape changes that took place during the period 4000–1600 BC. Nevertheless the task of this conclusion is to generalise by drawing together the data under thematic headings.

3.4.1 The "wildwood" and human impact on it prior to the Neolithic

It was not so long ago that the conventional archaeological wisdom was that "climax" Holocene woodland existed in an all but virgin state until the beginning of the Neolithic. Thereupon woodland clearance began and the rest "is history" (for example, Darvill 1987a, 49–51). Data collected from the South West now demonstrate a much greater impact by Mesolithic people on the "wildwood" than had been supposed. Indeed almost every new pollen diagram – and mollusc analysis – of Mesolithic strata from the region contains peaks in microscopic charcoal or other floral/faunal indicators of clearance. Such episodes have been known from Dartmoor and Bodmin Moor from the 1990s and earlier (for example, AP Brown 1977; Caseldine and Hatton 1993; 1996), but are now evident (although not published) on the Somerset, Severn and Avon levels (for example, Druce 1998; Wilkinson *et al.* 2002; J Jones 2004) and even beginning to appear on the Wessex chalkland (for example, Green and Allen 1997; Allen and Green 1998). It would therefore seem that Neolithic culture in the South West did not emerge onto a virginal stage, but rather one that had been subjected to ongoing modification by at least two millennia of Mesolithic hunter-gatherers.

3.4.2 Woodland clearance in the earliest Neolithic

Clearance of primary woodland evidently took place in order to make space to construct certain Early

Neolithic monuments, for example Maiden Castle causewayed enclosure (*c*.3550 BC) and the Dorset Cursus (*c*.3300 BC). However, it is notable that on many more Early Neolithic sites, construction took place in environments that had been cleared some time before, and that frequently this clearance was for cultivation. South Street long barrow (built *c*.3500 BC), with its clear ard marks, is a good example of this phenomenon (Ashbee *et al.* 1979), but there are many more. Indeed in many cases not only had cultivation been carried out prior to monument building, but arable plots had subsequently been abandoned allowing secondary woodland to colonise, as at Hazleton North, for example (Saville 1990). Also worthy of note are the various elm declines which are now accepted as being at least partially caused by people. These date from perhaps as early as 4000 BC in eastern Dorset and before 3800 BC on the Somerset Levels. In many pollen diagrams (for example at Rimsmoor, Waton 1982) there is evidence of cultivation before the elm decline. These various lines of evidence suggest that Neolithic people were cultivating the landscape – perhaps on a very limited scale – for several centuries before the earliest monuments were built. However, sites from this early phase have yet to be found (or recognised).

3.4.3 Upland and lowland environments in the Early Neolithic

All of the South West region lies within the lowland zone of Britain excepting the westernmost part of Cornwall (Roberts 1998, 202). These terms are therefore used in a relative manner here, for example the Somerset Levels are "lowlands" adjacent to the Mendip "uplands", the Bodmin Moor, Dartmoor and Exmoor "uplands" contrasting with the surrounding "lowlands" of coastal and valley Cornwall and Devon. The Wessex chalk can also be viewed in this way, with the "uplands" being the hilltops on which causewayed enclosures were built, the "lowlands" the combes and river valleys. In this last area a pattern has already been highlighted for the Early Neolithic: uplands remained wooded (except where clearance was undertaken to construct causewayed enclosures) and lowlands were cleared to create grassland for pasture. The opposite pattern can be observed in western Somerset, Devon and Cornwall where the lowlands remained well vegetated (albeit with localised clearance) and the uplands (perhaps with the exception of Dartmoor) became more open, although it is likely that humans were not the sole cause for the latter. The data for areas of northern Somerset and Gloucestershire are less clear, but large areas of woodland do not seem to have been cleared in the earlier Neolithic. Robinson (2002, 68) argues of southern England generally that "much of the Neolithic landscape was probably a mosaic of relatively small clearances, abandoned clearings in various stages of scrub to woodland succession and relatively undisturbed, perhaps even primary, woodland." His insect data also suggest, on the basis of rising abundance of dung beetles during the Neolithic, that domesticated animals would have browsed in woodland environments.

3.4.4 Regional environment divisions in the Later Neolithic

By 3000 BC the Wessex chalklands were intensively exploited. All Later Neolithic monuments (with the exception of Coneybury henge) in this area are associated with grassland environments, while colluvium resulting from arable activities had begun to form in dry valleys. Forest had also been heavily reduced on the three moors by 3000 BC, although it seems likely that this was the result of climate change (perhaps "aided" by human forest clearance) leading to the formation of raised bog. However, elsewhere there is little in the palaeoenvironmental record to indicate significant landscape change from the Early Neolithic.

3.4.5 Landscape change in the Early Bronze Age

More widespread environmental change occurs in the Bronze Age. Most of the "lowland" pollen diagrams that span this period indicate woodland clearance and the expansion of ruderal elements. It would therefore seem that from *c*.2000 BC in the east of the region and *c*.1700 BC in the west, a significant change in the economy occurred to a subsistence based on cereal cultivation. Robinson (2002, 55) has suggested on the basis of insect evidence, that while much of the South West remained woodland throughout the Neolithic – even though there is evidence from many assemblages for the presence of openings in the tree canopy – by the Bronze Age, open-country species are usually the major component of the terrestrial fauna.

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Radiocarbon dates

Table 3.2: *Details of radiocarbon dates used in the text. Calibrated ranges are at 2σ (95.4%) and were calculated with OxCAL 3.10 (Bronk Ramsey 2005) using the probability method and the IntCal04 calibration curve (Reimer* et al. *2004).*

Lab. Ref.	^{14}C age BP	Cal BC	Material	Context	Reference
AA-30865	3860±50	2470–2190	Peat (humin fraction)	4.16m AOD	Carter *et al.* (2003)
AA-30868	4045±50	2860–2460	Peat (humin fraction)	3.61m AOD	Carter *et al.* (2003)
Beta-142642	3700±50	2280–1940	Peat	77–82cm down core	Fyfe *et al.* (2003a)
Beta-142643	5500±50	4460–4250	Peat	114–115cm down core	Fyfe *et al.* (2003a)
BM-356	4760±130	3800–3100	Oak charcoal	Two patches on buried soil	Ashbee *et al.* (1979)
GU-5060	4510±60	3380–3010	Peat	basal 5cm of exposed peat, -0.21m OD	Ratcliffe and Straker (1996, 127)
GU-5061	5210±50	4230–3940	Peat	basal 1cm of exposed peat, -2.02m OD	Ratcliffe and Straker (1996, 127)
GU-5394	4310±60	3100–2700	Peat	basal 2cm of exposed peat	Ratcliffe and Straker (1996, 129)
GU-5396	3980±100	2900–2200	Peat	basal 2cm of exposed peat	Ratcliffe and Straker (1996, 129)
GU-5615	5830±50	4800–4540			Gearey *et al.* (2000a)
GU-8238	5950±90	5100–4550	Alder	25–38cm down core	Tinsley (1999b)
HAR-3067	3970±100	2900–2150	Oak charcoal	Post in secondary ditch deposits	Saville (1983a)
HAR-3694	3100±100	1650–1050	?peat		Scaife (1984)
HAR-3695	6330±100	5490–5050	?peat		Scaife (1984)
HAR-3919	5150±70	4230–3770	?peat	*c.*11.2m below surface	Waton (1982)
HAR-3920	4690±70	3640–3350	?peat	*c.*10.8m below surface	Waton (1982)
HAR-3921	3820±80	2480–2030	?peat	8m below surface	Waton (1982)
HAR-8349	4830±60	3760–3370	Red deer antler	In construction debris from cairn	Saville (1990, 236–7)
HAR-9161	4960±80	3960–3630	Charcoal		RJC Smith *et al.* (1997, 167)
I-4136	4095±95	2950–2350	Twigs etc	On buried soil beneath monument	Atkinson (1969)
I-15549	5410±110	4460–3980	Peat		Francis and Slater (1990)
NZA-12530	4683±55	3640–3360	?peat	Base of pollen zone AWK 2	JP Gardiner *et al.* (2002)
OxA-624	4570±120	3650–2900	Animal bone	Base of ditch	Green (2000, 153)
OxA-2382	4800±70	3710–3370	Wood charcoal	In colluvium with Neolithic artefacts	RJC Smith *et al.* (1997, 177)
OxA-6008	3275±50	1690–1440			Gearey *et al.* (2000a)
OxA-6009	4710±80	3660–3340			Gearey *et al.* (2000a)
OxA-7987	5275±50	4240–3970	Red deer scapula	Level 7	Allen and Green (1998)
SRR-542	4774±50	3660–3370	Peat	Zone AB 2	Coles and Dobson (1989); Orme (1982)
SRR-878	3600±40	2130–1820	Peat	*c.*0.5m below surface	Coles and Dobson (1989); Orme (1982)
SRR-879	4054±45	2860–2470	Peat	*c.*2m below surface	Coles and Dobson (1989); Orme (1982)
SRR-880	4278±45	3030–2700	Peat	*c.*3.2m below surface	Orme (1982)
SRR-882	4744±45	3640–3370	Peat	*c.*8m below surface	Coles and Dobson (1989); Orme (1982)
UB-821	4170±75	2910–2500	Peat	240cm down core	Merryfield and Moore (1974)
UtC-8502	4720±40	3640–3370	?peat	61–62cm below surface	Fyfe *et al.* (2003a, 164)
Wk-5299	5370±70	4350–4040	?peat	-0.17m OD, Layer A	Druce (1998)
Wk-9018	3710±70	2300–1890	Peat	2.19–2.20m AOD, base 3rd peat band	J Jones (2004)
Wk-9019	4570±60	3520–3080	Peat	1.88–1.89m AOD, base 2nd peat band	J Jones (2004)
Wk-9020	5580±100	4690–4240	Peat	0.92m AOD, top of 1st peat band	J Jones (2004)
Wk-10946	4594±63	3550–3050	Peat	7.32–7.34m below surface	Wilkinson *et al.* (2002)
Wk-10947	5174±61	4230–3790	Peat	8.15–8.17m below surface	Wilkinson *et al.* (2002)