‘Patches of the endless forest’.

Monuments, landscape and remote perception in the Early Neolithic of southern Britain.

Volume 1: Background and Key contexts

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i. Abstract

Archaeologists have long noted that Early Neolithic long barrows tend to occupy topographic settings that afford distant views over the landscape, conversely making them conspicuous from particular areas. When Early Neolithic causewayed enclosures were eventually recognized in the 1920s, similar expectations were mapped onto them. From the 1970s, archaeologists increasingly interpreted the visual 'orientation' of a particular monument as an indicator of its associated territory. More recently, GIS-based viewshed analysis has facilitated demonstrations of the areas with which specific monuments were potentially intervisible. But this technical advance has impeded more sensitive thinking about the circumstances surrounding acts of vision, often by implying that views were fixed in space and time. This thesis starts from the premise that there is much more to be said about how contemporary lifeways afforded opportunities for remote perception; about the character and extent of Neolithic forest and clearings; and about how circumstances changed through time. In so doing, it offers a more nuanced, holistic and dynamic exploration of remote visual perception.

I argue that perceptions of monuments were intimately linked to short-range transhumance – the practice of distancing livestock from crops throughout the summer in forest clearings, with access to water to support dairy production. In largely forested landscapes, monuments would only become visible on the final approach, though heralded by distinctive sounds and smells. Corridors of lower vegetation along watercourses, which herders would follow, might afford occasional glimpses of the clearing itself, represented in upland settings by a notch on the skyline. Over time, grazing would increase the size of clearings, affording more distant reciprocal views. In low-lying regions, watercourses themselves provided summer grazing and boat travel would afford remote views. In short, though monuments were visually linked to specific communities, these links operated in more varied and complex ways than usually acknowledged, and changed through time.

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v. Acknowledgements

I have taken more than a decade to complete this thesis, so a complete list of the people to whom I owe my thanks would simply be too long. I must, of course, acknowledge the role played by the members of my excellent advisory panel, Professor Jon Finch and Dr Kevin Walsh, along with my examiners, Dr Penny Bickle and Professor Duncan Garrow, of the University of Reading. Many of my fellow students at York, but above all Constance, Roger, Caitlin, Paul-Edward and Margot, formed my safety-net, while Aubrey, Pat and the fondly-remembered Don Henson additionally offered useful advice on specific issues. And I must single out a few others who supported me in crucial ways.

My parents: my mum for leading me along the winding woodland paths of the Weald every day through my most formative years; my dad for teaching me how to forage for wild fruit and mushrooms in autumn, how to tell one tree species from another in winter, and how to use an axe all year round; and to them both for their unstinting encouragement and support throughout my career.

My BFF, Jonny, for decades of enthusiasm and encouragement.

My early mentors, Barry Cunliffe and Chris Evans, for showing me the lasting value of thoughtful fieldwork in a world where academic theories slip in and out of fashion.

My supervisor, Mark Edmonds, for igniting my interest in the Neolithic, a generation before I began this PhD; for agreeing to supervise me long after his departure from York; and for continuing to inspire me.

My former colleagues Dave McOmish and Dave Field, with whom I began archaeological field survey, and Stewart Ainsworth, with whom I continue to pursue it. We have shared many discussions about Early Neolithic monuments and landscapes.

My friend Dr Helen Goodchild (Hen) for guiding me through technical crises and being a sympathetic collaborator on many projects unrelated to my PhD over eleven years.

Members of the Map Anomalies and Curiosities Facebook Group, who have been my remote collaborators since ‘Lockdown’, especially Mark Byrne, Brian Drury and Clifford Bob Hayes.

vi. Declaration

I declare that this thesis is a presentation of original work, and that I am the sole author. This work has not previously been presented for an award at this university, or any other. All sources are acknowledged as references. All photographs, maps and drawings are by the author, unless otherwise credited.

I have previously authored all but two chapters of the following book, which laid the foundations for this thesis, but the material and thinking presented here are based on new fieldwork and desk-based research.

Oswald, A., Barber, M. and Dyer, C. (2001). *The Creation of Monuments: Neolithic causewayed enclosures in the British Isles*. Swindon: English Heritage.

The following guidance document was written in 2011 and reissued in 2018:

Oswald, A. (2018a). *Causewayed Enclosures: Introductions to Heritage Assets*. Second edition. Swindon. Historic England.

In the course of writing this thesis, I have also authored the following related works, but neither impinges directly on the material presented here.

(various contributions to) Roberts, D., Valdez-Tullett, A., Marshall, P., Last, J., Oswald, A., Barclay, A., Bishop, B., Dunbar, E., Forward, A., Law, M., Linford, N., Linford, P., López-Dóriga, I., Manning, A., Payne, A., Pelling, R., Powell, A., Reimer, P., Russell, M., Small, F., Soutar, S., Vallender, J., Winter, E. and Worley, F. (2018). Recent Investigations at Two Long Barrows and Reflections on their Context in the Stonehenge World Heritage Site and Environs. *Internet Archaeology* 47. https://doi.org/10.11141/ia.47.7.

Oswald, A. and Edmonds, M. (2021). 'Weird and atypical, even degenerate'… or then again, maybe not? Early Neolithic enclosures in the North. In G. Hey and P. Frodsham (Eds.). *New Light on the Neolithic of Northern England.* Oxford: Oxbow Books, 53-71.

I have given two separate presentations, based on Chapters 7 and 10, to meetings of the Neolithic Studies Group, but have not offered written versions for the ensuing publications.

Part 1: The background

Frontispiece: View south-eastwards from the front of West Kennet long barrow, in mid-September.

Figure 1.1: View southwards towards West Kennet long barrow, across the valley of the River Kennet.

1. Introduction

Far from depicting vision as a timeless and neutral act, the act of looking in the Neolithic being the same as looking today, it should instead be depicted as a highly contingent act, imbued with power and deeply political.

- Mark Gillings & David Wheatley 2001, 13

1.1 The aims and objectives of this thesis

This thesis concerns the remote perception of monuments in the Early Neolithic of southern Britain, spanning the 39th to 34th centuries BC. Archaeologists have long noted that the communal burial mounds known as 'long barrows' tend to occupy topographic settings which afford distant views over the landscape and which, conversely, make the monuments conspicuous from particular areas (Figure 1.1). When the somewhat later gathering places termed 'causewayed enclosures' were recognised as being Early Neolithic in the 1920s, similar expectations were mapped onto them. Since the 1970s, archaeologists have interpreted the visual 'orientation' of enclosures as an indicator of their associated territories. Since the 1990s, increasingly sophisticated modelling in GIS has facilitated depictions of viewsheds (Lock & Pouncett 2017, 133). But technical advances have overshadowed thinking about how different life-ways might afford opportunities for remote perception and give meaning to the act of seeing; about the supposedly unknowable character and extent of Neolithic forest[1], and the cleared patches that hosted monuments; about the specificities of individual monuments and their settings; and, crucially, about how circumstances changed through time.

This thesis aims to produce a more nuanced, holistic and dynamic exploration of remote perception. An underlying theme is that while remote sensing and GIS are in vogue, traditional field survey and the intellectual approaches of the early 20th century can still elucidate past embodied experience. I retain the traditional emphasis on vision, but also discuss sound and smell where appropriate. To achieve my overarching aim, I address three main objectives, which broadly correspond to the three parts of the thesis:

1. to understand why and how remote visual perception has come to play such an important role in the interpretation of these types of monuments, by thoroughly examining past thinking on the issue.
2. to explore, in depth, some key aspects of Early Neolithic experience that afforded opportunities for remote perception, including the scale, temporality and mobility of Neolithic inhabitation; the environment; and livestock husbandry (particularly cattle).

[1] The term 'forest' is widely used by ecologists in relation to the early Holocene, but Howard (2011, 125) argues that 'woodland', the term preferred by many archaeologists, is more correct. 'Forest' is used throughout this thesis, in part because, despite its medieval connotations, it conveys a stronger sense of the unfamiliar qualities of the Neolithic environment.

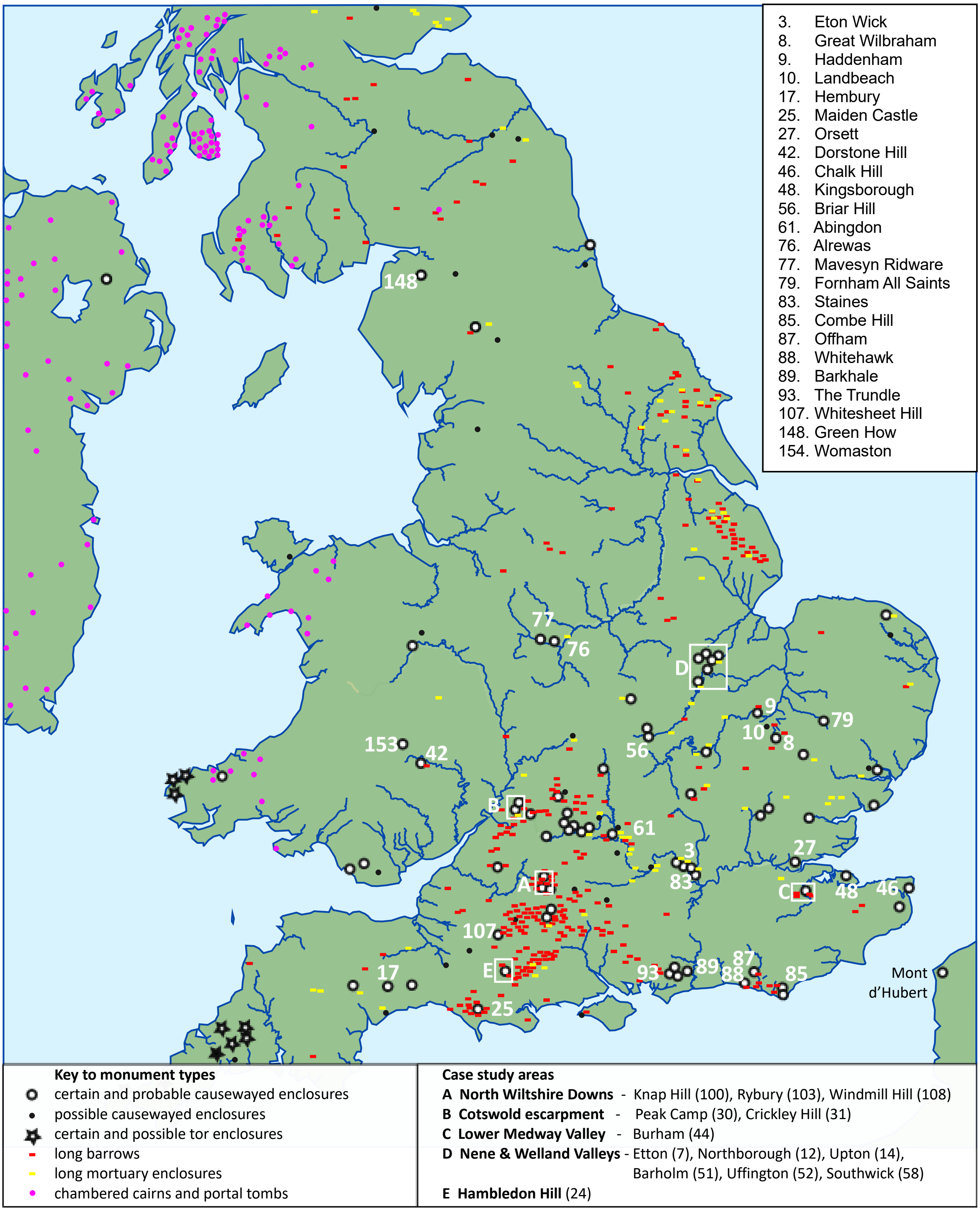

Figure 1.2: Map showing the distribution of selected Early Neolithic monuments in part of the British Isles and the Pas-de-Calais, highlighting those referred to in this thesis. The white frames surrounding the five case studies analysed below correspond to the areas covered by lidar images that preface Chapters 7 to 11. Other causewayed enclosures mentioned in the text are numbered, the numbers corresponding to the gazetteers in Oswald *et al*. 2001 and Whittle *et al.* 2011. The distribution of funerary monuments is derived from Field 2006a, figs. 48 & 49. For further information about the rivers shown, see Figure 4.2.

3. to work through a series of case studies of different landscapes in the light of the insights gained from Section 2. All include long barrows and causewayed enclosures, but the balance of emphasis differs. The inclusion of sites rarely mentioned in the literature shifts attention away from 'the usual suspects', while radical re-interpretations of some well-known causewayed enclosures are proposed.

The thesis adopts a conventional structure. Following on from this introduction, Chapter 2 presents a detailed literature review, examining how and why remote visual perception has come to occupy such a prominent place in studies of Early Neolithic monuments. Unlike most such reviews, I have dwelled on intellectual developments prior to Chris Tilley's (1994) *A Phenomenology of Landscape*. Chapter 3 presents a methodology that directly challenges the mechanistic approach of GIS-based studies and argues that archaeologists need to borrow what might be termed 'middle range theory' from beyond their discipline to flesh out the bones of the surviving material evidence. Chapter 4 addresses questions related to movement, particularly how the 'first farmers' may have moved around their agricultural taskscapes. Chapter 5 – arguably the heart of the thesis – represents a 'posthumanist' (Nayar 2013, 13) exploration of the nature of Neolithic forest. The unusual emphasis on the ways in which natural agents of change would shape affordances for remote views contrasts with the widely accepted picture of humans systematically felling expanses of forest. The process of deliberate clearance is also explored, however, highlighting problems with conventional assumptions. Chapter 6 considers the process of transhumance, examining the distances and routes likely to have been involved. The profound impacts of grazing practices on the environment are discussed, demonstrating that livestock would probably, over time, bring about the greatest changes in affordances for remote views.

Chapters 7 to 11 are five case studies. The first four deal with different topographic settings, ranging from the steep escarpments of the North Wiltshire Downs and the Cotswolds, where maximal visibility might be expected; to the sides of the Medway Valley in Kent, where the highest ground was emphatically avoided; to the lower reaches of the Nene and Welland Valleys, on what later became the East Anglian fen edge. Here, and at the sites at Haddenham and Great Wilbraham, in Cambridgeshire, the low-lying topography means that remote visual perception must have operated differently, if at all. The final case study, of Hambledon Hill in Dorset, dwells on questions relating to diachronic change. The topography here is comparable to the first case study, but the well-dated sequence of monuments allows more detailed consideration of how affordances and motivations for remote visual perception may have changed through the lifetime of the complex. The final discussion, in Chapter 12, draws together the diverse strands running through the thesis, concluding that emotions stemming from routine encounters with monuments in the course of annual transhumance potentially influenced perceptions more than conspicuous demonstrations of ancestral power and territoriality.

Figure 1.3a: The 'horned' forecourt of Belas Knap long barrow, Gloucestershire, seen from the west. The unusual orientation of the mound, to the north-north-west, runs parallel to a precipitous scarp on the east, suggesting that its long profile was designed to be seen from the hospitable valley beyond the scarp. Intervisibility in that direction is now blocked by deciduous 'ancient' woodland, formerly coppiced.

Figure 1.3b: The impressive view northwards from a point 400m north-north-west of Belas Knap, along the only gentle approach to the forecourt. Note that the tree-line is over 300m distant from the viewpoint; if it were half that distance away, the view afforded over the landscape would be reduced to a narrow glimpse.

1.2 The monuments of the Early Neolithic: long barrows and causewayed enclosures

1.2.1 Chronology

Neolithic practices, including arable agriculture, animal husbandry, and the manufacture of pottery and new types of stone tool, were introduced into south-eastern England from continental Europe in 4,035-3,990 cal BC (Bayliss *et al*. 2011, 683-90)[2]. They then took 310-475 years to spread across southern Britain. The earliest surviving monuments, as in much of western Europe, are long barrows. In south-eastern and central England, the first examples of long barrows and causewayed enclosures were built 10-115 and 15-145 years respectively after the first appearances of Neolithic practices. The first long barrow was probably built 80-190 years before the first causewayed enclosure. From its inception, a decade or two before 3,700 cal BC, the idea of enclosure spread rapidly across southern Britain, over the course of three or four generations. The building of new causewayed enclosures spanned 140-195 years, some taking generations to construct (*ibid.*, 690-719). Some were abandoned after a generation, while others were used for 400-455 years. The last enclosure ceased active, primary use in 3,305-3,245 cal BC, but burial monuments continued to be built and remodelled throughout the 4th millennium. The first *cursus* monuments were built 100-200 years after the first causewayed enclosures and, in some cases, seem to have remained current into the 3rd millennium (*ibid.*, 719-55). This thesis focuses on the two earlier monument types[3], particularly causewayed enclosures.

1.2.2 Long barrows

Long barrows are elongated burial mounds, often appreciably broader and higher at the front end, which usually covered the primary burial chamber. Some are quite precisely trapezoidal, while others had 'horns' projecting from their front ends, suggesting that their external forms held symbolic significance. The tombs are often compared to domestic longhouses and excavations have revealed examples directly overlying house-like timber buildings (Barclay *et al*. 2020; see also J. Thomas 2013, 331-2). Three[4] different trends have been identified in their lengths: so-called 'short long barrows' of less than *c.*30m; 'standard' long barrows of up to *c.*75m; and 'bank barrows'[5]. 'Short' long barrows are common on Cranborne Chase, with one on Hambledon Hill in Dorset (see Chapter 11). Excavation has shown that some 'standard' long barrows encapsulate smaller monuments, often round or oval. The eventual mounds were typically made of earth and rock[6] quarried from lateral ditches, which sometimes joined at the rear of the mound to

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[2] Dates in this chapter are based on a recent review of the Early Neolithic (Whittle, Healy & Bayliss 2011a). They are calibrated against dendrochronological records (cal BC) and are given at 68% probability.

[3] Flint mines and axe factories could be treated as monuments, but I have necessarily declined that option.

[4] It is difficult to distinguish statistically between 'short' and 'standard' long barrows; they form part of a continuum and only the much longer bank barrows are clearly separable (Kinnes 1992, fig. 2.2.4).

[5] The longest of these, at Maiden Castle in Dorset, is 546m long. This last category, which may have had more in common with *cursus* monuments, does not feature in this thesis.

[6] In regions where the rock is too hard to quarry easily, long cairns were often constructed, using stones gathered from the ground surface or nearby rivers, but none of these feature in this thesis.

Figure 1.4a: The broad view northwards across The Weald from Combe Hill, East Sussex. In the foreground, the low sun highlights part of the inner circuit of the causewayed enclosure.

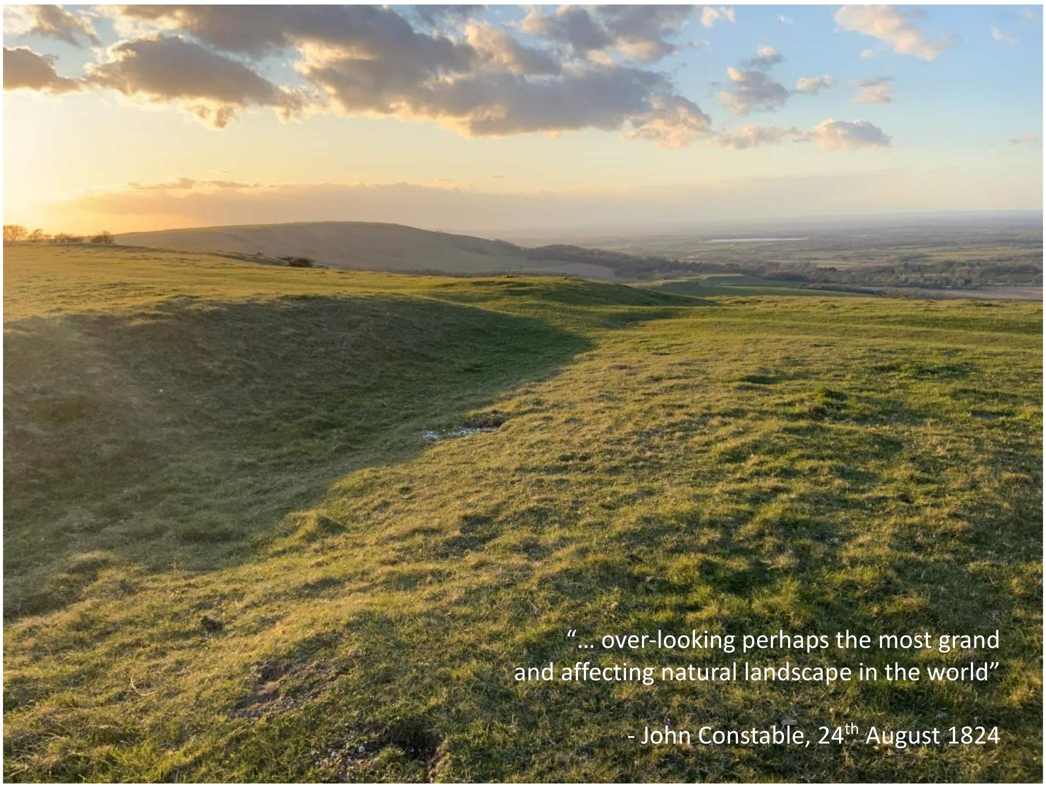

Figure 1.4b: The view towards Combe Hill from Wannock, 1.5km to the north. Straddling a stream, the village occupies a hospitable locale that may have been settled in the Early Neolithic, although archaeological investigations in the area have produced no supporting material evidence. Note that the telegraph poles are only one-third to one-quarter the height of larger tree species present in Neolithic forest.

form a U-shape; offerings were sometimes placed in these ditches. The perimeter of the earthen mounds was often reveted using turf walls, upright timbers or rocks. The frontal revetment might be enlarged to form a tall, impressive façade, sometimes with a well-defined central entrance into the burial chamber[7]. Even where no entrance existed here, because the chambers were accessed from the side, the 'forecourt' was evidently a focus for ceremonial activities (*e.g.* Belas Knap in Gloucestershire; see Figure 1.3a). There were, then, two aspects to the visual impact of barrow architecture: the long profile of the mound was potentially impressive when seen at considerable distances from the sides (Field 2006a, 69), while the façade around the entrance (even if 'false') was impressive when approached from the front, but from shorter distances.

This thesis addresses in depth the placement of long barrows in relation to local topography. It is worth noting here, however, that while examples surviving as earthworks are often in eye-catching locations, a significant proportion occupy less prominent positions, often near watercourses (Field 2006a, 102-6). Their front ends generally face broadly eastward[8] and sometimes more precisely towards midwinter sunrise, suggesting that cosmological concerns also influenced the choice of location.

1.2.3 Causewayed enclosures

The heyday of causewayed enclosures spanned 135–170 years beginning in the first quarter of the 37th century BC. Most of the *c.*80 examples currently known in Britain are found in the 'Lowland Zone'[9] of southern England (Fox 1932), but there are outliers, notably on either side of the Irish Sea (Whittle *et al.* 2011, fig. 1.2; Oswald & Edmonds 2021). They occupied a range of topographic settings, many showing a close affinity with watercourses, some apparently overlooking expanses of low-lying ground, which are usually themselves river valleys (Oswald *et al.* 2001, 91-106).

Unlike long barrows, only a few causewayed enclosures remain visually striking monuments, in part due to millennia of erosion. In plan, the simplest examples comprise a single approximately circular circuit of discontinuous ditch, accompanied by an internal

[7] Burial chambers are not directly relevant to the thesis; they are not discussed at length. Their forms varied, while a few examples appear to have contained no chamber. Single chambers might be constructed using two or more standing stones to support a horizontal roof-slab; for example Kit's Coty in Kent (Chapter 9). Multiple chambers might be arranged on either side of a central covered passage, usually accessed through the façade, *e.g.* West Kennet in Wiltshire (Frontispiece) In regions that lacked suitable stone, trees of great size might be split to make similar structures, the best-preserved of these at Haddenham in Cambridgeshire (Chapter 10). Where detailed analysis of the human remains has been possible, it seems that the people placed in the tomb do not represent a careful selection - perhaps the founders of a particular community (J. Thomas 2013, 329). Nor, usually, do the remains represent the whole skeleton. Skulls and long bones are over-represented, and sometimes marks on the bones suggest that before burial the bodies were defleshed ('excarnation'), either by exposure to natural agents or through deliberate cutting. Once entombed, the bones might be carefully arranged and rearranged. New chambers were sometimes added.

[8] This observation has a long pedigree: *e.g.* Stukeley 1743, 46; Ashbee 1984, 21-4; Kinnes 1992, 68-9 & figs. 2.2.8-11; Lynch 1997, 25; Field 2006a, 69-70.

[9] This distribution pattern is not entirely an artefact of biases in prospection (Oswald *et al.* 2001, 84-5).

Figure 1.5: Excavation of the ditch of a causewayed enclosure discovered in 2017, in advance of gravel extraction near Datchet in Berkshire. Well-preserved, finds-rich deposits have led archaeologists to focus on ditches at the expense of the accompanying upstanding features. Image reproduced with permission © Wessex Archaeology.

bank, generally with fewer interruptions (causeways). Some of the more complex, or more long-lived, enclosures have four or more circuits, some formed by double ditches (perhaps flanking single banks in between). Excavation suggests that widely-spaced circuits usually represent different developmental phases, but many enclosures remain unexcavated. Excavation also shows that banks sometimes had turf and/or timber elements that formed barriers comparable to Iron Age ramparts. Ever since the 1920s, however, the relatively well-preserved ditches and their artefactual contents, which are sometimes plentiful, have attracted more attention (Figure 1.5).

Some argue that there was no 'blueprint' for the design of causewayed enclosures (*e.g.* Garrow 2006, 150; Whittle *et al.* 2011a, 12; *pace* Piggott 1954, 20). Yet there are so many examples of near-circular plans (Oswald *et al.* 2001, fig. 4.6) that, in the context of the rapid uptake of the idea of enclosure, the majority of designs might represent local variations in the execution of a shared conceptual ideal, compatible with a pre-literate society (Rapoport 1976, 20; C. Evans 1988c, 88; Edmonds 1999a, 83).

Despite the persistent belief that all causeways offered ways through the circuit (*e.g.* Tilley 1994, 166; Bradley 2007, 72; Whittle, Healy & Bayliss 2011b, fig. 1.3), some enclosures evidently had a single primary entrance (Oswald *et al.* 2001, 49-53; 2018a, 3). In many cases, potential approaches were limited by topography. On the other hand, the few sites well-preserved as earthworks contradict the suggestion that banks were continuous (*contra* Piggott 1954, 24; Darvill 1987, 59; Mercer & Healy 2008, 772). Continuous banks would be more straightforwardly explicable, in turn allowing the segmented form of the ditches to be explained away as an unfamiliar, but essentially pragmatic, quarrying technique (*e.g.* Curwen 1929a, 74-5; Whittle 1977b, 337; Mercer 1990, 28). It appears, however, that the segmented form of both ditch and bank was meaningful (Evans & Hodder 2006, 319; 333). It has repeatedly been suggested that each stretch may represent the contribution of a social unit to the overall communal project (*e.g.* Field & McOmish 2016, 54). At some sites, the ditch segments were settings for rituals involving 'structured deposition' of various offerings. Others contain negligible cultural material, so the monuments were not constructed exclusively for this purpose (*contra* Edwards 2012, 96). Deliberate infilling of the ditches, apparently using the bank material, is widespread[10].

What went on within the enclosed spaces remains a matter of conjecture and debate. The potential functions usually listed include seasonal occupation, livestock management,

[10] This is perhaps most clearly attested at Maiden Castle, Dorset, where a mass of clean chalk (presumably from a bank running between the twin ditches) was pushed into the outer ditch. This occurred before all the features were sealed by the construction of a 'bank barrow', no more than 150 years later (Healy *et al*. 2011, 188). Elsewhere, the causewayed perimeter is buried beneath the Early Iron hillfort ramparts, but this is the only point where the form of the earthwork was protected from erosion and dissolution relatively quickly, implying that the levelling of the bank was rapidly and deliberately undertaken.

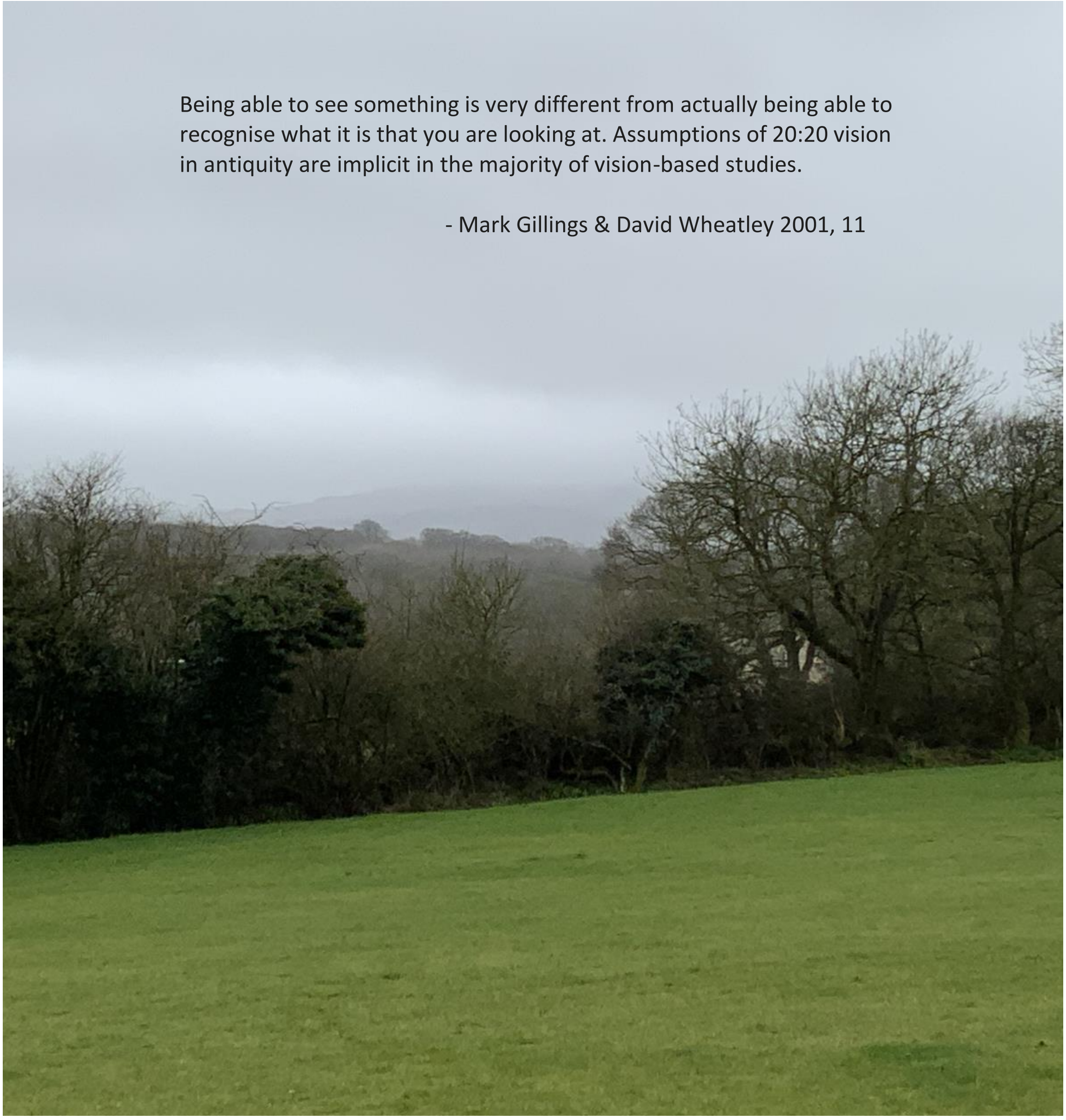

Figure 1.6: Combe Hill, seen from 7.6km to the north on a rainy March day. Despite the low cloud, the distinctive profile of the hill is recognisable, which may have been more important than clarity and detail. This highlights the difference between simple 'vision' and the culturally-embedded act of 'perception'.

defence, social transactions, ritual and ceremonial activity, treatment of the dead, trade and exchange (Mercer 1990, 28-64; Oswald *et al.* 2001, 123-30; Whittle, Healy & Bayliss 2011b, 5-12). In short, every dimension of earlier Neolithic life seems to be represented (Mercer 1990, 5; Edmonds 1997, 104; Whittle *et al.* 2011a, 11; Anderson-Whymark 2012, 196; Cummings 2017, 134-6). Theories aired in the 1930s, and distilled in Piggott's (1954) synthesis *The Neolithic Cultures of the British Isles*, remain widely accepted, namely that episodic, perhaps autumnal, gatherings at the enclosures served, like more recent rural fairs, to unite small, scattered social units (*ibid.*, 29-30). The process of constructing and modifying perimeters was perhaps an end in itself, serving to consolidate and express social ties[11], the on-going project more important than activities in the interior (Mercer 1980, 36; Bradley 1984, 28; C. Evans 1988b).

1.3 The nature of vision

This thesis distinguishes between 'vision' and 'perception'. Scholars recognised long ago that, in addition to optics – *i.e.* the neutral physical ability to see – vision encapsulates a cognitive component contingent on the eye of the beholder; on wider social customs; on movement; and on interaction with other senses[12]. Some suggest that archaeologists' long-standing preoccupation with the visibility of monuments originates with the Renaissance 'gaze'[13]; that the act of seeing was culturally embedded and not accorded more importance in antiquity than other senses, especially hearing and smell (J. Thomas 1993, 21-3; Lemaire 1997; Wheatley & Gillings 2000; Gillings & Wheatley 2001, 13). Unquestionably, the utility of any one sense is contingent on the action being undertaken and the circumstances pertaining (Gosden 2001, 163; Tilley 2010, 29; Noble 2017, 72). However, Woodward's (2000, 128) claim that <u>many</u> cultures afford hearing and smell greater <u>general</u> importance is untenable[14], given the human physical and genetic predisposition towards vision (Pinker 2002, 87-97; 199-201). Nevertheless, the underlying point about variable cultural emphasis on vision, and the culturally-embedded significance of seeing something, is well made (Wheatley & Gillings 2002, 201-2). Consequently, this thesis accepts that vision is inevitably 'a highly contingent act' (Gillings & Wheatley 2001, 13). It is contingent upon a spectrum of variables, including the physical characteristics

[11] A similar interpretation had previously been applied to long barrows (Fleming 1972, 62).

[12] *E.g.* Wright 1947; Gibson 1950; 1960; Lowenthal 1961; Berger 1972; Pylyshyn 1999; Cosgrove 2008.

[13] 'The gaze' (usually male) denotes a culturally specific way of looking adopted by 15th-century and later artists, in which the viewer has an effectively voyeuristic relationship to the subject (*e.g.* Berger 1972).

[14] A rapid (and incomplete) survey of ancient texts shows the widespread primacy of vision even amongst pre-literate societies, along with a sophisticated understanding of the involvement of mental perception in vision and the other senses, which foreshadows 20th-century thinking. In *Gilgamesh* composed in the 3rd millennium BC, seeing and wisdom are linked (Lewis-Williams & Pearce 2005, 156). The earliest of the *Vedas*, written down *c.* 1,500 BC, give primacy to vision over hearing and neglect to define the other senses (Jutte 2005, 20-5). Later Vedic thinking understood the five senses to be governed by a sixth 'super-sense', translatable as 'perception'. In pre-Socratic Greek thinking, 'reason' dominates vision and hearing, which in turn control the other senses (Jutte 2005, 31-4). In the Homeric oral tradition, the verb 'to see' is often cognate with understanding (as in modern English). It could be added that the vocabularies of Classical Latin, Greek and Sanskrit are permeated with visual metaphors, which indicate that the primacy of vision cannot be written off as a post-Renaissance phenomenon.

and social identity of the beholder, the historic context, the qualities of the physical environment in which the act of seeing takes place, the character of the habitual use of space by the beholder and, of course, the connotations of the thing that is viewed. Of these, the physical context can be understood more readily than the explicitly culturally or ideologically conceptualized elements (Hoskins 1955, 19; Relph 1976, 15; Moore 1986). Yet as Hoskins also points out, even the physical qualities of a landscape are subject to diachronic change at both micro and macro levels, making fine-grained analysis essential.

2. Monuments, landscape and remote perception reviewed

The modern landscape fanciers come across as Romantics, pursuing vistas because the tors and the hills are still there, but the people have gone.

- Madeleine Hummler (2008, 1157)

2.1 Introduction

Over the past 150 years, understandings of the Early Neolithic have changed repeatedly, and sometimes profoundly, yet the belief that monuments were designed to be 'read' from afar as visual signs has persisted throughout. For long barrows, the assumption has rarely been questioned. Isobel Smith (1971) proposed that the builders of upland causewayed enclosures had also selected landforms and carefully positioned the circuits so that each monument was intervisible with a lower-lying area, perhaps equating to its territory. This too has become part of current orthodoxy. Remote visual perception has been involved in changing thinking about the character of settlement, social structure, the environment, and farming, outliving every challenge. For example, Austin (2000, 65) concluded that since knowledge of spatial and temporal variation in the character and extent of Neolithic vegetation will always be imprecise, discussion of remote visual perception is futile. Yet most subsequent academics have skated over questions surrounding forest cover and remain prepared to discuss remote visual perception[1]. This chapter traces how the idea became so deeply ingrained.

2.2 Early discussion of remote visual perception in prehistory

Ideas about the role of monuments in the landscape circulated for centuries before they were cemented by rigorous 19th-century studies. Stukeley (1740, 44; see also Piggott 1950, 71) noted the brightness of freshly-quarried chalk and the deliberate 'false-crest' siting of long barrows, observations repeated more recently[2]. With 'the Neolithic' newly-coined (Lubbock 1868, xxiii-ix), Thurnam's (1869) synthesis of his research into chambered tombs in Wessex likened them to watch-towers and noted their continued usefulness as landmarks (Thurnam 1869, 171-2; 203). In arguing that they were designed to command 'extensive views over the adjoining valleys, and so as to be visible at a great distance', he implied that their visual signification operated dually, relating to nearby lowland communities who built the monuments, and to distant areas potentially belonging to others; he also considered views from and towards the monuments[3]. Thus, he encapsulated the issues debated down to the present day[4].

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[1] *E.g.* Julian Thomas, Vicki Cummings and Susan Greaney on BBC Radio 4's *In Our Time*, 2 March 2023, who all discussed the visibility of monuments without mentioning their forested settings (see Figure 2.13).

[2] *E.g.* C. Evans 1985, 84; Tilley 2010, 61; Loveday 2006a, 23; Field & McOmish 2016, 51.

[3] The terms 'projective' and 'reflective', coined by Loots (1997), seem unnecessary jargon.

[4] *E.g.* Jewitt 1870, 4; Fox 1947, 22; Dunn 1988, 37; Lynch 1997, 63; Allen & Gardiner 2004, 72; Loveday 2006a, 23; Cummings 2009a, 61; Field & McOmish 2016, 48-62.

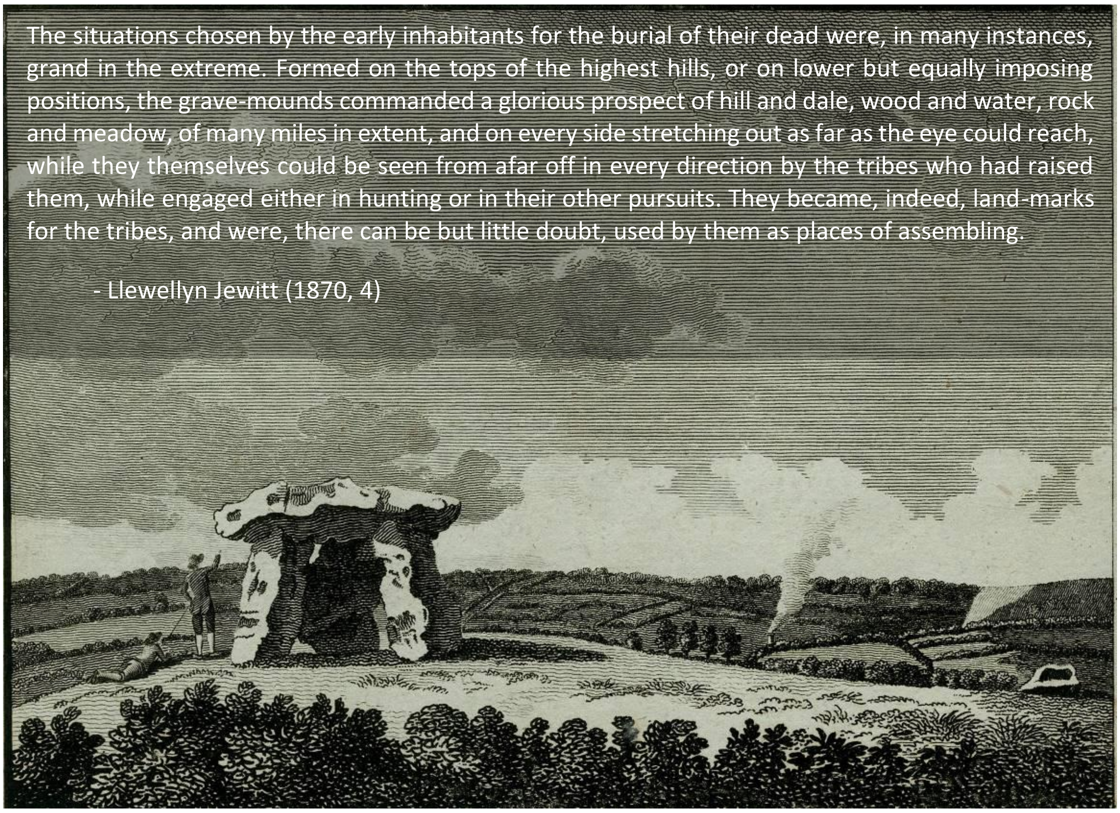

Figure 2.1a: Wilson Lowry's 1786 etching of Kit's Coty**,** Kent. Lowry produced a range of marketable images, including antiquities from the Grand Tour. This one, which shows the vista across the Medway Valley, resembles his views of great houses and designed landscapes. Image: author's own collection.

Figure 2.1b: John Akerman's (*c.*1846) drawing of Wayland's Smithy, Berkshire. Unusually, his report did not comment on the distant views from the monument, for obvious reasons. Image: Akerman 1847.

In the same volume of *Archaeologia*, Pitt-Rivers (1869) described Sussex hillforts in similar terms. He also stated (*ibid*, 28) that England's chalklands were already deforested by the Neolithic, an oft-repeated assumption (Fleure & Whitehouse 1916, 111; Crawford 1921, 109-12, 155-6; Fox 1947, 54-5). The Lieutenant-General, whose career influenced his interpretations, was certain that military strongholds have always been sited wherever possible on high ground with good visibility (*e.g.* Pitt-Rivers 1869, 36; Bowden 1991, 67-9; see also Wheeler 1943, 49-51). His portrayal of farmers living and working in the shadow of visually dominant centres of power implicitly equates military dominance, and thus the use of conspicuous, elevated sites, with socio-economic dominance (Bowden & McOmish 1987; see also Sumner 1913, 1; Topping 1997b). Pitt-Rivers suspected that hillforts might be Neolithic and, although his own excavations in Sussex eventually indicated Iron Age origins (Pitt-Rivers 1876; 1881), uncertainty persisted for decades (Williams-Freeman 1915, 155; Curwen 1930, 22; 1931). Causewayed 'camps' were teased apart from hillforts through a series of surveys and excavations in the later 1920s (Curwen 1929a, 72-5; 1930; Kendrick & Hawkes 1932, 161). Thereafter, hillforts were generally agreed to represent 'proto-towns': defended, permanently settled nuclei, located to dominate surrounding tribal territories, partly through visual prominence (*e.g.* Crawford & Keiller 1928, 8; Fox 1932, 46; 1947, 54; Wheeler 1943, 14-15; Cunliffe 1971a, 305; 1971b; Lock & Harris 1996; I. Brown 2009; 2021). In an epistemic environment still dominated by 'cultural evolution', the observations that causewayed camps were enclosures, and apparently almost all on high ground, sustained an assumption that they were ancestors of hillforts (Oswald *et al.* 2001, 9-11)[5]. For example, Wheeler (1943) referred to the Neolithic earthworks at Maiden Castle as 'town ditches'[6]. As supposedly nascent hillforts, the enclosures were assumed to be conspicuous symbols of security, which also commanded extensive views. Although some argued that Early Neolithic populations were relatively mobile (see Appendix A), similar baggage accompanied the concept of 'territory' (Curwen 1938, 37; Childe 1940, 35). Consequently, 19th-century thinking, about long barrows on one hand and hillforts on the other, coloured perceptions of causewayed enclosures from the outset.

[5] Overtly, it was this equation that gave rise to the re-application to causewayed enclosures of the term 'camp', which had long been used to refer to hillforts, notably by the Ordnance Survey (Crawford 1953, 132), reflecting the traditional belief that all early enclosures could be ascribed to the Roman army.

[6] In the early 1900s, there was certainly bewilderment about both the existence of so many apparent defensive weaknesses created by the slight, discontinuous earthworks (Cunnington 1909; Curwen 1929a, 73; Williamson 1930, 87) and the often 'sub-optimal' tactical use of the topography (Williamson 1930, 57). Usually, however, this gave rise to elaborate speculations about Neolithic warfare (*e.g.* Cunnington 1909; Curwen 1929a, 74; 1930, 50). This represented a recognition of the culturally-embedded nature of warfare, and so an advance from Pitt-Rivers' cross-cultural generalisations, but not any fundamental questioning of the underlying assumption that enclosing earthworks must be defensive. Similarly, in the absence of the pits found at hillforts and widely believed to represent dwellings, the ditch segments themselves were initially thought to have served as dwellings (Curwen 1931, 108-9; 1934, 168-9 (*contra* Williamson 1930, 87); Crawford 1933, 344; Leeds 1927, 463-4; 1928, 477; see also C. Evans 1988c).

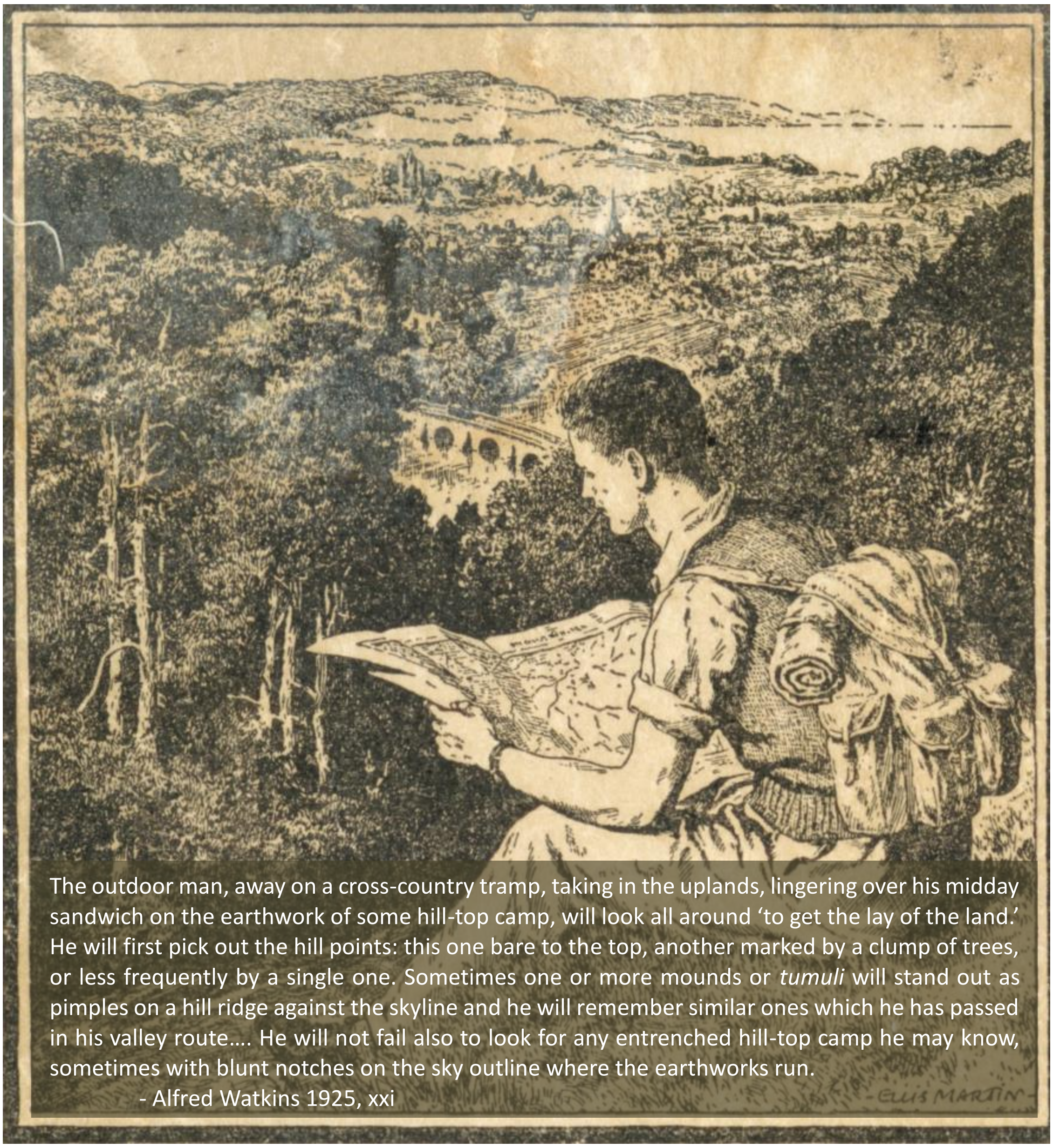

Figure 2.2: Ellis Martin’s 1919 cover design for the OS ‘popular’ 1-inch scale map series. The landscape background was re-used throughout the 1920s, though the original cyclist was changed to a walker (shown here). The image captured the post-World War I spirit of ‘countryside discovery’ that gave rise to the ‘Right to roam’ and, indirectly, to Watkins’ obsession with distant views, which began suddenly on 30 June 1921. (Image: Ordnance Survey/Wikimedia Commons).

In the 1920s, academics became more reluctant to mention the visibility of Neolithic monuments, although hillforts were still being discussed (*e.g.* Harrison 1928, 280; Fox 1932, 46; 1947, 54; Wheeler 1943, 14-15). This may, in part, reflect the early recognition that the topographic placement of causewayed enclosures differed from contour forts (*e.g.* Curwen 1930, 48-9; Williamson 1930, 57).[7] Similarly, Fox (1932, 55, footnote) contrasted the false-crest siting of Bronze Age barrows with the more heterogeneous placement of Neolithic barrows. He excused this 'error' because 'in forest one cannot judge where the dominant positions are' (*ibid*., 49). His belief (*ibid*., 22; see also Field 1998, 315-6) that the viewsheds of Bronze Age barrows could be used to infer the likely locations of contemporary settlements was known to Piggott (1950, 71). Yet even in a popular account, Piggott (1949, 75; 115) refrained from explicitly linking remote visual perception of monuments and settled territories, merely describing all barrows as 'conspicuous'.

Crawford's reticence may also reflect the controversy that followed Alfred Watkins' (1925; see also 1922; 1927) publication of his ideas about 'ley-lines'. While the book attracted public acclaim, Crawford, the most influential landscape archaeologist of the day[8], regarded it as 'crankery' (Crawford 1921, 173-4; Hauser 2008, 211-3; Stout 2008, 183-4). Thereafter, academics met Watkins' claims with determined silence[9], afraid to lend credence to his fantasies. But Watkins (1933; 1945; 1948) relentlessly promoted his theory, ensuring that it endured (*e.g.* Robb 2013). Consequently, rigorous discussion of the underlying issues was thwarted for decades.

Begun in 1939, Piggott's (1954) overview of the Neolithic perpetuated ideas current in the 1920s, including about the importance of elevated sites. In contrasting well-drained, sparsely wooded chalk uplands with densely forested 'undrained morasses' in the river valleys (*ibid*., 18[10]), he echoed earlier environmental determinism (*e.g.* Sumner 1913, 1; Fleure & Whitehouse 1916, 106; Crawford 1921, 157; Allcroft 1927, 23; Fox 1923; 1947, 55-7). The supposed avoidance of forest and marshland relegated defence, but

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[7] Pitt-Rivers' (1869, 40; 47) had presciently observed that both Whitehawk Camp and the outer Neolithic circuit at The Trundle puzzlingly occupied slopes rather than summits. Mercer (1990, 20) has pointed out that Stukeley's comment in 1719 that the outer circuit of the enclosure on Windmill Hill appeared 'unfinished' shows that the antiquarian had noted the causewayed form of the earthworks; it also seems that in describing the circuit as 'cast up one half of ['the pretty round apex']', he was, like Smith 250 years later, drawing attention to the enclosure's distinctive relationship to the topography.

[8] Hauser (2008, 212-3) points out that Crawford was, ironically, partly culpable for the development of 'crankeries' because he promoted amateur fieldwork (like Watkins) and deliberately stimulated the interest of *Antiquity*'s readership in folkloric myths. However, Hippisley Cox (1914; revised 1923) had foreshadowed the theory of ley-lines some years before Crawford achieved prominence. Further crankeries certainly erupted after the publication of *The Old Straight Track* (see Allcroft 1927; 1930; Maltwood 1935).

[9] In 1927, Crawford, as editor of *Antiquity*, refused to review Watkins' book or even to publish a fully paid-for advertisement for it (Shoesmith 1990, 132). Later, Crawford (1951, 9) claimed that this tactic had succeeded, but with longer hindsight, his satisfaction is questionable.

[10] Piggott had previously listed the main risks of the poorly-drained valley floors as malaria and liver fluke (following Matheson 1933); he also saw marshes as impediments to movement (Piggott 1949, 64).

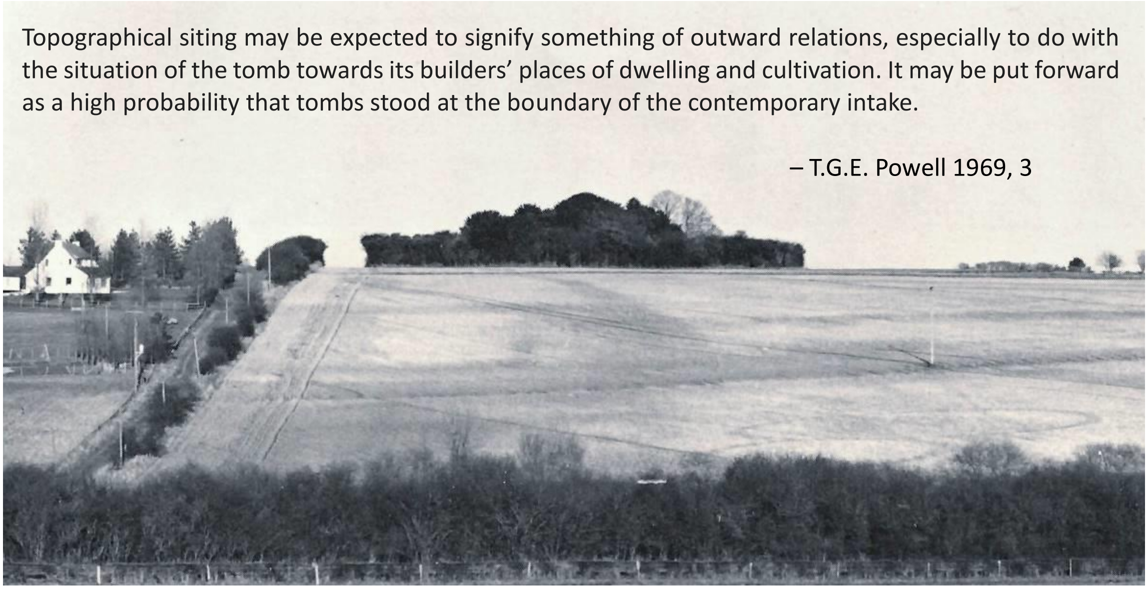

Figure 2.3a: View of the clump of trees enclosing Duck's Nest long barrow, Hampshire, from a spur forming the opposite side of a dry valley, 1.6km away. According to Isobel Smith, this demonstrated 'the dominating situation of the long barrow on the sky-line from view-points to the South and West'. Anticipating later interest in intervisibility between monuments, her chosen view-point was next to two other long barrows, whose presence evidently influenced the choice. Image: RCHME 1979, Plate 33.

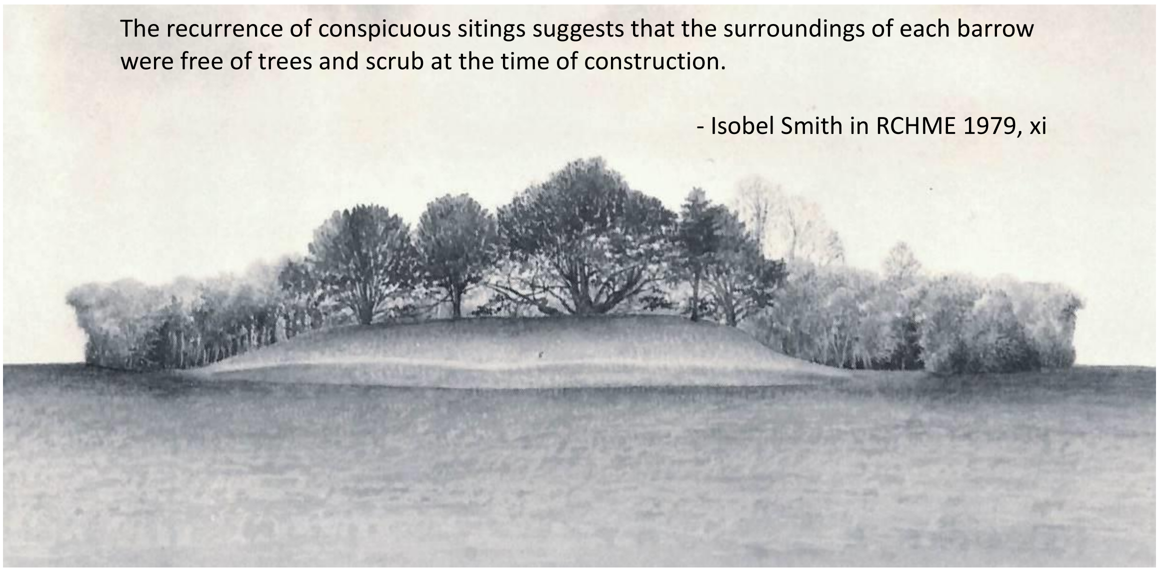

Figure 2.3b: A.L. Pope's pre-Photoshop visualization of Duck's Nest, reflecting Isobel Smith's thinking about the environmental setting of the monument. The slope on the west is deforested to support her opinion that the monument was meant to be seen from that direction, but the topography would allow it to be equally visible in profile from the east, if the trees on that side were absent. Image: RCHME 1979, Plate 32.

still reinforced the expectation that settlements and monuments would occupy elevated, open positions, where remote visual perception was inevitable if the chalklands were deforested, as generally believed. Daniel's (1950, 30-31) warning that 'The notion that Neolithic man only settled in open country receives no support from a study of chamber tomb distribution… few… could have been built without forest clearance' was disregarded (see also J.G.D. Clark 1945, 65). Piggott played down variation in causewayed enclosures[11], stating that most occupied 'rounded hill-tops' (Piggott 1954, 22). This accurately characterized only a quarter of the twelve sites and contradicted Curwen's more sensitive observations (1930, 48; 1954, 71). Perpetuating his pre-War reticence, he again described burial monuments as simply 'conspicuous'[12], although he mentioned the proximity of some long barrows to springs and other water-sources, which he suspected were likely settlement locales (Piggott 1954, 51-2; see also Daniel 1950, 33; Field 2006a, 102-6). This diminution of the importance of variation in the topographic settings of the enclosures, along with the promotion of their supposedly homogenous form and socio-economic or political function, complemented his emphasis on a single, exemplary 'type-site': Windmill Hill, in Wiltshire[13]. This, in turn, extended the impact of Smith's later observations about the visual qualities of that site.

2.3 Isobel Smith: viewsheds, territories and landscapes

From the 1950s, the adoption of techniques borrowed from other disciplines (J.G. Evans 1977, 3-5), including systematic field-walking, aerial and geophysical survey, reinvigorated interest in 'landscape', 'territory' and, consequently, remote visual perception. For example, Powell's (1969, 2-5) discussion of the placement of Early Neolithic burial monuments in relation to settlements, topography, soil types and forest stressed the importance of intervisibility with inferred settled territories, proposing that tombs stood at the edges of farmed clearings (*ibid*., 3; see also Childe 1942, 141; Corcoran 1969, 29). The standard work on long barrows implied that the role of visibility might be overestimated given the extensive forests (Ashbee 1970, 13)[14], but Fleming's (1971, 155) counter-arguments proved more influential.

Into this fertile ground, Isobel Smith (1971) sowed her idea of linking monuments and territories through intervisibility. She had previously echoed Piggott in describing Windmill Hill as 'a centre or rallying point for the population of a fairly wide area' (Smith 1965, 19; Piggott 1954, 29), and Curwen in characterizing their relationship to the

[11] He eventually softened this stance and began to acknowledge variability (see Piggott 1973).

[12] Stone went further, stating that all causewayed enclosures 'crown well-defined chalk hill-tops commanding extensive views' and describing long barrows as 'prominent landmarks' (Stone 1958, 21; 29).

[13] This was undoubtedly the 'rounded hill' that he had in mind when describing the settings of the whole class. Since all but one of the sites were on chalk, which tends to produce rounded landforms, it is unsurprising that Piggott did not dwell on topography, even though his stance was explicitly deterministic.

[14] Ashbee maintained this reticence, the second edition of his book again referring only to the 'commanding positions' occupied by some long barrows (Ashbee 1984, 9).

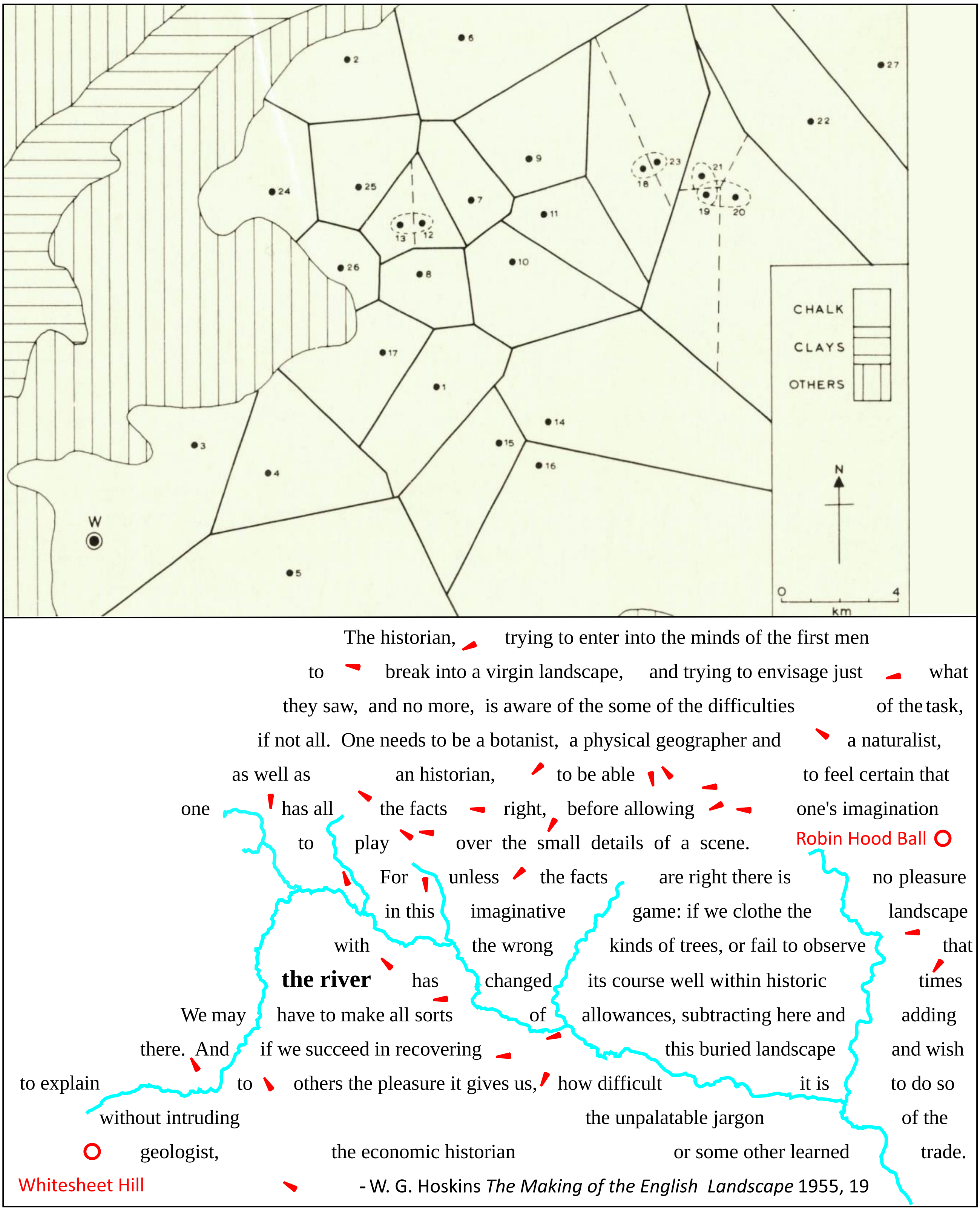

Figure 2.4: Colin Renfrew's model of territories on western Salisbury Plain imposed Thiessen polygons in place of all natural features except the underlying geology. This reflected his belief that soil types were of critical importance to arable agriculture. He even omitted the River Wylye and its tributaries, to which the locations and orientations of many long barrows clearly relate (Field 2006a, fig. 56). Robin Hood Ball causewayed enclosure and nearby long barrows, which complicate the proposed pattern, were also cropped out of the diagram. Image: Renfrew 1973a, fig. 1.

topography as 'unconformable'[15] (Curwen 1930, 48-9; see also A. Fox 1964, 3). She now went further, arguing that 'the enclosures were designed to face a particular direction.' (*ibid*). Later authors used different phrases to describe this phenomenon[16] (N. Andersen 1997, 246; Oswald *et al*. 2001 *passim*), but alternative explanations are unconvincing[17]. Without elaborating, she immediately refers to the proximity of springs and watercourses, considered prerequisites for settlement (Daniel 1950, 33; Piggott 1954, 52). More philosophically, contemporaries reflected that 'landscape serves as a vast mnemonic system for the retention of group history and ideals' (Lynch 1973, 303; see also Lowenthal 1975, 9; 11). Smith then interpreted the siting of Hampshire long barrows similarly, concluding that their prominent sitings must show that they were built on deforested land (RCHME 1979, xi). Smith's interpretation of causewayed enclosures already had a long pedigree, which became further sedimented into orthodoxy[18].

Renfrew's (1973a; Figure 2.4) attempt to identify territories in Wessex drew upon 'New Geography' (Kohn 1970; Clarke (Ed.) 1972) and Fleming's (1971) emphasis on the importance of good arable land[19]. Smith commented on the draft (Renfrew 1973a, 557), but he disregarded her idea that viewsheds could indicate territories[20]. When he applied the model to the Orkneys, however, visibility did feature (Davidson *et al.* 1976, 360; Renfrew *et al*. 1979, 13-20). Soon, Drewett (1975, 137-42; 1977, 226-8) interpreted Neolithic Sussex as a series of small territories containing long barrows, with several such units served by a causewayed enclosure (Figure 2.5a). Unlike Renfrew, he suggested that both types of monuments might be located at the margins of territories because of their association with death[21] (Drewett 1975, 139-40; 1977a, 227). All this two-dimensional spatial analysis approach appeared modern, but was arguably still founded on the long-standing assumption that monuments on high ground were symbols of power.

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[15] Chris Evans (1988b) misreads this as 'uncomfortable' - with equal validity. Smith clarified her meaning: '...the appearance of predetermined plans carried out regardless of the topography' (Smith 1971, 92)

[16] Mallory *et al.* (2011, 6) accept hillfort-based prejudice by using the term "displaced" in quotation marks.

[17] For example, the observation that hill-slope settings would have allowed cosmological events to be observed against a distant horizon (A.G Brown 2000, 50; Lawson 2007, 53; Hammond 2007, 377-8) is undermined by the lack of consistency in the orientation of enclosures. Suggestions that the builders avoided summits to prevent the earthworks being sky-lined, or because they respected high-points as sacrosanct (Ottaway 1990, 423; Pryor 1998a, 50; D. Field 2006a, 109) fail to account for why many enclosures do - just - enclose summits. The suggestion that sloping sites may have been chosen to facilitate close-range appreciation of an enclosure's circularity related to Briar Hill in Northamptonshire, but few other circuits are precisely circular (C. Evans 1988b; see also Allcroft 1927, 70). Such objections question the supposition of a causal link between visibility and the chosen sites (Wheatley & Gillings 2002, 209). In other words, many monuments may well occupy sites with unusually good visibility (at least in today's landscape), but that observation falls short of proving that visibility was the builders' prime motivator, or even a consideration at all (Tilley 1993, 49; 1994, 1; Llobera 1996, 614; Barrett & Ko 2009, 283-4).

[18] *E.g.* Simpson & Megaw 1979, 80; Mercer 1990, 28-9; Pryor 1998; Whittle *et al.* 1999.

[19] At that time, Fleming was Renfrew's colleague at the University of Sheffield.

[20] Although he (1973b, 135) almost refers to visibility in his study of Arran and Rousay. Eventually, Lock and Harris (1996, 223-5) used GIS to explicitly compare viewsheds and Thiessen polygons.

[21] Human remains at Offham were interpreted as evidence for excarnation.

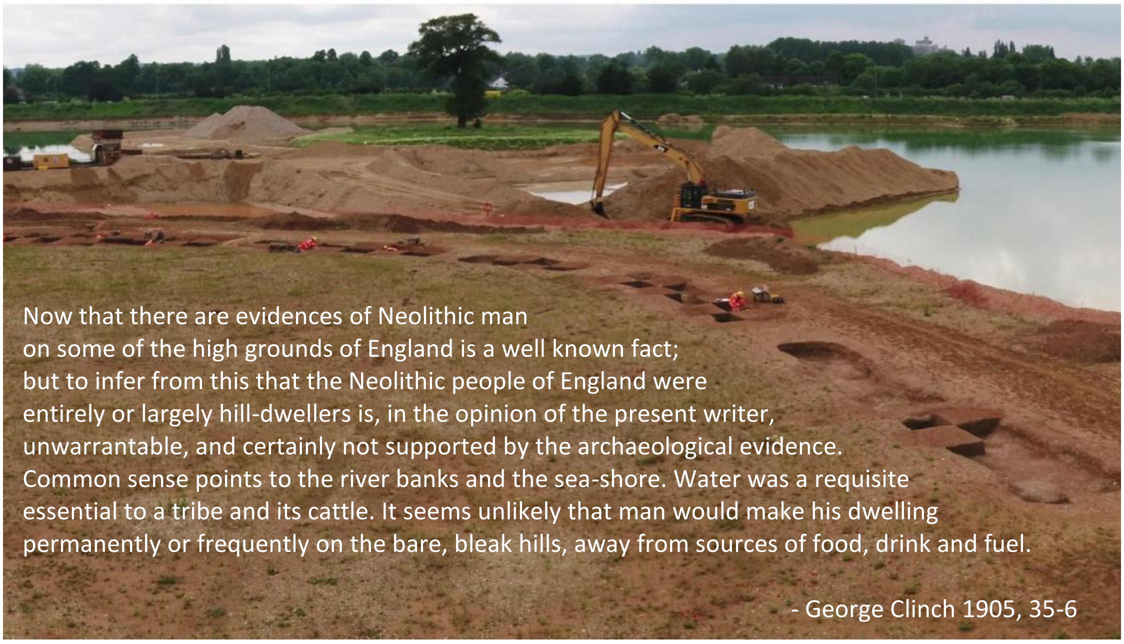


Figure 2.5a: Excavations in progress at the causewayed enclosure discovered in 2017 near Datchet, Berkshire. Note that even though the photograph is taken from a drone flying at a height of *c.*10m, the distant trees still delimit the viewshed. Image reproduced with permission © Wessex Archaeology.

Figure 2.5b: Oblique aerial photograph of the causewayed enclosure near Datchet, illustrating its wider landscape setting. The builders chose a low gravel rise on the margin of what became the Thames floodplain, although Windsor Castle, only 2.0km away on the opposite side of the river, occupies a knoll 30m high. Image reproduced with permission © Wessex Archaeology.

2.4 Challenges to the plausibility of remote visual perception

Smith disregarded the implications of the two proven causewayed enclosures on the margins of flood-plains (Abingdon and Staines), but the tally of suspected ploughed-down examples in similar locations already outnumbered those surviving as earthworks on higher ground (St Joseph 1966, 116). The overall distribution was therefore manifestly incompatible with long-accepted assumptions that monuments were generally elevated and that river valleys were hardly exploited.[22] Yet the belief in that dichotomy remained so entrenched that doubt persisted for another decade as to whether 'interrupted ditch enclosures' belonged to the same class (St Joseph 1970, 145; Wilson 1975, 184-5; Palmer 1976). Likewise, it took a decade to compare the ploughed-down mortuary enclosure at Dorchester-on-Thames with monuments surviving as earthworks on higher ground (Atkinson *et al.* 1951, 58; 60; Vatcher 1961, 170-1; Ordnance Survey 1963, 27-9)[23]. Aerial survey continues to reveal long barrows, so their eventual distribution may cling to watercourses more than to high ground (Field 2006a, 102-6).

Since it remained widely accepted in the 1960s that valley-floors were forested, it should have been obvious that remote visual perception, as conceived for monuments on higher ground, required rethinking. Furthermore, most of the newly discovered sites were on alluvial gravels, where earthworks could never be as conspicuous as chalk banks (Figure 2.5). Yet nobody suggested that the preoccupation with visibility might be an artefact of the exceptional survival of monuments on higher ground (St Joseph 1966, 113; C. Taylor 1972; Field 1998, 317-8; Evans & Hodder 2006, 13)[24]. The traditional bias towards sites surviving as earthworks was so strong that this point was first made decades later (Oswald *et al.* 2001, 105-6; Evans & Hodder 2006, 16-17). Far from the recognition of lowland sites prompting a rethink of remote visual perception, no serious re-evaluation occurred until it emerged that many upland sites were potentially no more visible than their lowland counterparts.

[22] C.W. Phillips, whose job involved use of aerial photographs, accurately predicted the impact of aerial reconnaissance and survey on perceptions of Early Neolithic land-use (Ordnance Survey 1963, 33-4).

[23] In fact, the writing was on the wall, for Crawford had made the connection, decades earlier, between cursus monuments surviving as earthworks and as crop-marked sites in the Upper Thames Valley (Leeds 1934; Crawford 1935). Had Major Allen's *Discovery from the Air* been published posthumously, either by Crawford or by Bradford (Bradford 1957, 4, footnote), his demonstration of the density of crop- and soil-marked features in low-lying areas might have eroded the infatuation with upland sites, although both Allen and Bradford were primarily concerned with the methodological implications for aerial survey. In the event, the book was not published until long after its greatest impact could have been achieved (Riley *et al*. 1984). Allen's (1938) plot of the Dorchester mortuary enclosure was incomplete and overwhelmed by the wealth of other sites, so it is unsurprising that he failed to make a connection with long barrows then.

[24] A.H. Allcroft (1927, 23) expressed the earliest inklings that ploughing had greatly distorted the impression of prehistoric use of the landscape, but by 1927 he had lost much of his academic credibility.

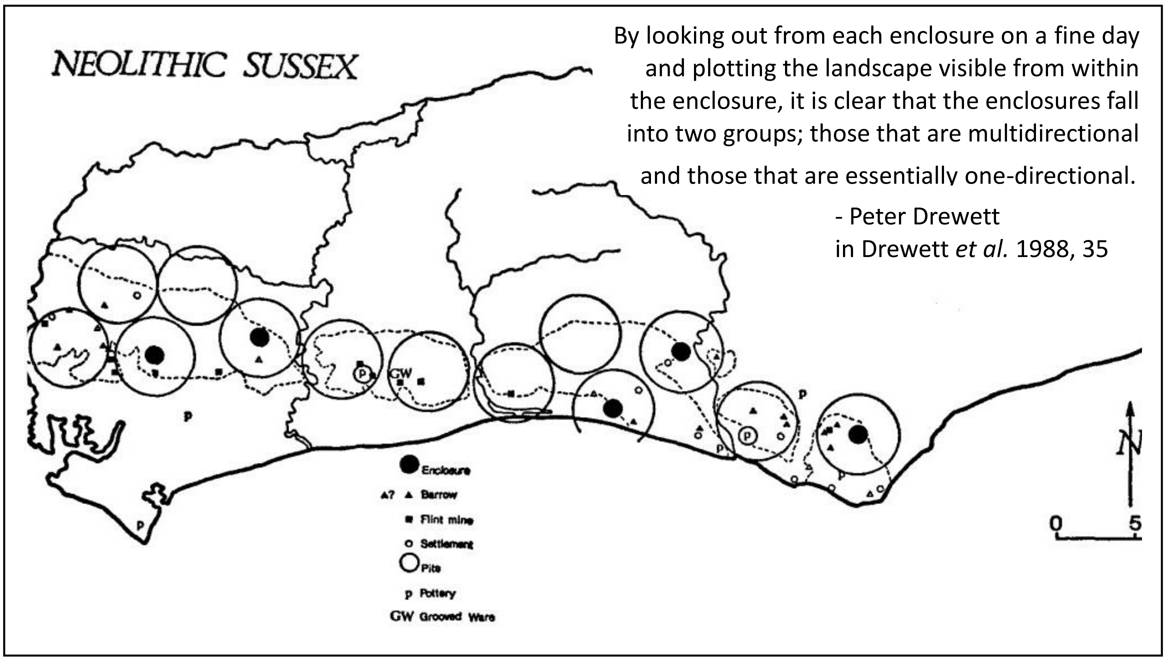


Figure 2.6a: Peter Drewett's 1977 model of monuments and territories on the South Downs. His evolving ideas about territories owed much to Renfrew's (1973) Thiessen polygons and in turn heavily influenced his student Mike Allen (Richards & Allen 1990, fig. 155). Image: Drewett 1977a, fig. 12.

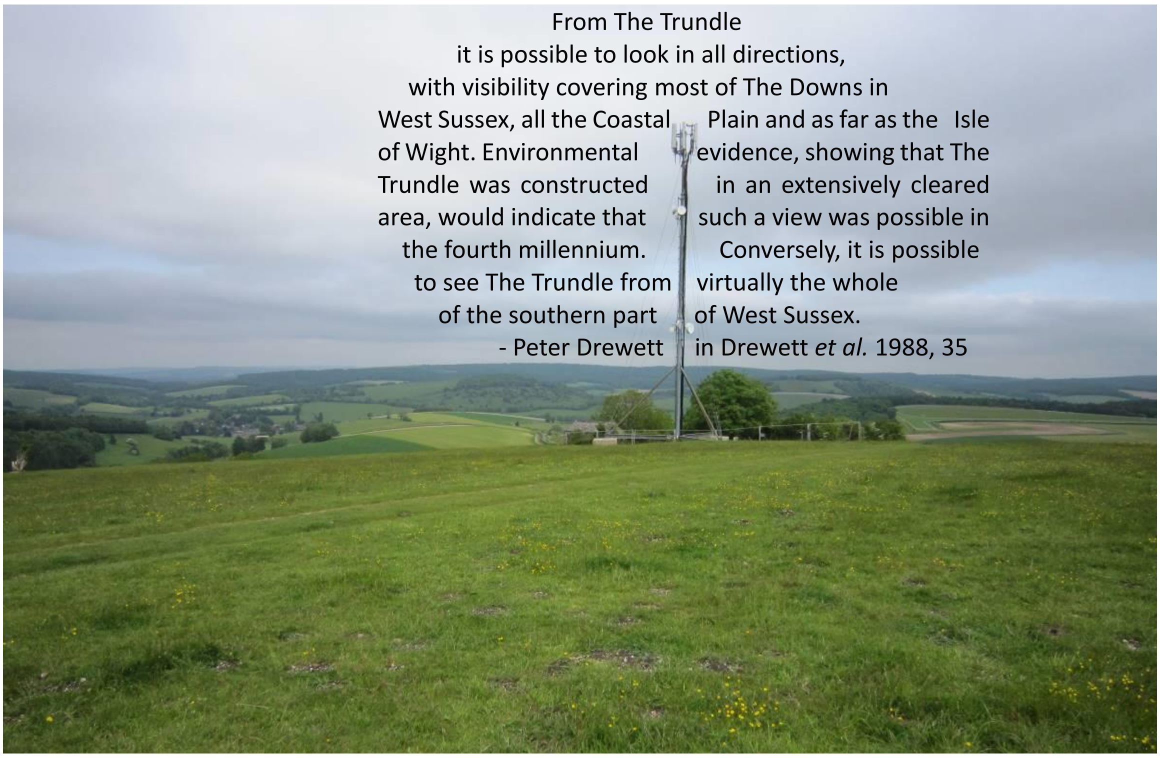


Figure 2.6b: View from the centre of The Trundle, West Sussex, looking north in sympathy with the 'tilt' of the causewayed enclosure. Note that the centre of the enclosure is just below the summit; the rampart of the Iron Age contour fort defines the near horizon. Drewett's conclusion that the enclosure was built in a large clearing relies on *mollusca* from the 'spiral ditch' (K. Thomas 1981), which is unlikely to be the earliest element of this complex site. Note how low scrub around the mast almost obscures the view, while mature trees would be as high as the 25m-high mast, which stands near the molluscan sampling point.

From the mid-1970s, analyses of *Mollusca* from the Sussex enclosures indicated that most, unlike Windmill Hill[25], were built in small, isolated forest clearings (Drewett *et al.* 1988, 24-31; Allen & Gardiner 2009, 61). This new picture of the chalklands obviously threatened to invalidate reconstructions based on modern viewsheds (Drewett *et al.* 1988, 36). Nevertheless, belief in the importance of remote visual perception remained so ingrained that Drewett's assessment of the potential viewsheds of the Sussex enclosures was ultimately affirmative. Making the best attempt to date to quantify the requirements for visibility, he suggested that The Trundle had panoramic intervisibility from its inception, while other enclosures would have acquired oriented viewsheds if the forest was cleared to 15m[26] beyond the circuit (*ibid.*, 35-6). Surrounded by forest yet supposedly visible from afar, the monuments were apt places for 'socially dangerous rituals' (J.G. Evans *et al.* 1988; Sharples 1991, 255; Mercer & Healy 2008, 755).

David Fraser (1983, 301-2; 1988; see also C. Evans 1985) commented that because people would know 'their' landscapes intimately, monuments did not have to be either permanently visible or perfectly clear for the act of seeing to retain power. Or, as art critic John Berger (1972) had expressed it, "The process of seeing… is less spontaneous and natural than we tend to believe. A large part of seeing depends upon habit and convention". It took years for GIS-based studies to move beyond strictly binary products, and even the resulting 'fuzzy viewsheds' relate simply to optics (Ogburn 2006; Alberti 2017). Fraser (1983, 54-7) also accepted that evidence of the chronological inter-relationships between supposedly contemporary monuments and settlements is insufficient (Childe 1942, 142; Davidson *et al.* 1976, 356). Despite advances in dating (Whittle *et al.* 2011), this serious issue remains largely unresolved.

2.5 *A Phenomenology of Landscape*, and its aftermath

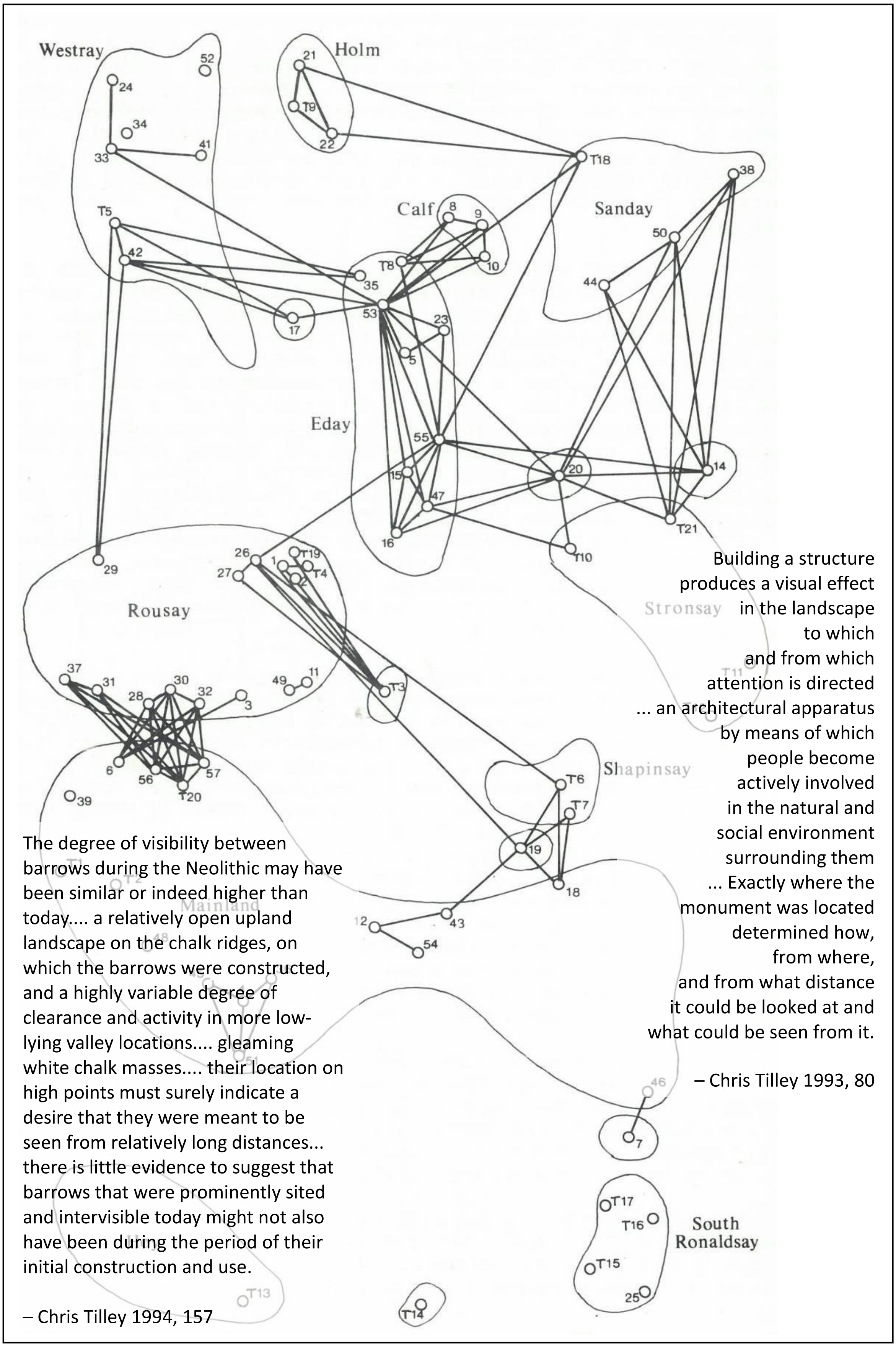
With objections to remote visual perception mounting, the emergence of post-processual archaeology validated site-specific studies[27] that disregarded wider patterns (Tilley 2010, 28). Though its themes had been rehearsed previously[28], Tilley's (1994) *Phenomenology of Landscape* reignited interest in visual qualities and ultimately reframed the debate. The embodied approach he and others adopted rejected 'objective' landscape analysis, typified by Renfrew's (1973a) study**,** as 'simply dots in a

[25] J.G. Evans' (1966; 1972, 242-8) reappraisal of the *mollusca* from the buried soil and bank of the outer circuit at Windmill Hill pointed to the whole enclosure (*n.b.* not just the outer circuit) having been built in much more open conditions than had been suggested in the recently-published report (Smith 1965). Indeed, he tentatively suggested that the forest had been cleared well before construction began.

[26] Mike Allen claimed that his reconstruction of Wiltshire's vegetative landscape was 'systematic' (Richards & Allen 1990, fig. 155), but imposing 1km-diameter clearings on the monuments was also arbitrary.

[27] A contextual, embodied approach to landscape also evident beyond archaeology (*e.g.* F. Harrison 1986).

[28] E.g. Lynch (1975) reacted similarly to the prevailing academic stance 20 years earlier; see also C. Evans 1985, 82-4; Ingold 1993; Tilley 1993; Bradley 1993, 26-9; Edmonds 1993, 107-8; papers in Bender 1993b.



Building a structure produces a visual effect in the landscape to which and from which attention is directed ... an architectural apparatus by means of which people become actively involved in the natural and social environment surrounding them ... Exactly where the monument was located determined how, from where, and from what distance it could be looked at and what could be seen from it.

– Chris Tilley 1993, 80

The degree of visibility between barrows during the Neolithic may have been similar or indeed higher than today.... a relatively open upland landscape on the chalk ridges, on which the barrows were constructed, and a highly variable degree of clearance and activity in more low-lying valley locations.... gleaming white chalk masses.... their location on high points must surely indicate a desire that they were meant to be seen from relatively long distances... there is little evidence to suggest that barrows that were prominently sited and intervisible today might not also have been during the period of their initial construction and use.

– Chris Tilley 1994, 157

Figure 2.7: David Fraser's 1983 study of intervisibility between tombs on the Orkneys. Fraser's research anticipated that of Tilley (1994, fig. 5.5), but was not referred to by Tilley. Image: Fraser 1983, fig. 15.10.

two-dimensional space' (Tilley 1994, 3[29]). Tilley builds on the premise that pre-capitalist societies harness the symbolic value of natural phenomena, especially visually striking topographic features (*ibid*. 1994, 24; see also 2010, 26). Others discussed the role of trees and forest in shaping human experience (Rival (Ed.) 1988). Through an unending dialogue between people and landscape, Tilley argued, natural terrain becomes encultured, areas and specific features fusing with meanings, which are often encapsulated in placenames, and reflected in patterns of movement and the superimposition of monuments. Yet the veneer of post-processual modernity wears thin when arguing that long barrows around the Dorset cursus were designed to be seen from afar[30], for he unconsciously echoes Jewitt, writing 125 years before (Tilley 1994, 157)[31]. Nevertheless, he also channels Berger: '...an unfamiliar landscape remains invisible. You do not know where, or how, to look. This process of observation requires time and a feeling for the place.' (*ibid*. 1994, 75; 2010, 30-31[32]).

Tilley's lead, which invited fine-grained, embodied studies of landscape, was followed by many prehistorians[33]. For analytical field surveyors like myself, who had previously felt constrained to use pseudo-objective descriptions that suppressed even the most striking qualities of monuments[34] and their settings, Tilley's value-laden, sensory evocations of place were emancipating and stimulating (Topping 1997a, ix[35]; Bradley 1995, 38). Thomas (1993, 19-20; 25-6) refers disparagingly to the 'highly empirical' tradition of analytical field survey, perhaps justifiably (*e.g.* Curwen 1929c, 148), but fieldwork[36] is arguably 'real physical engagement', not mere 'intellectual contemplation' (Barrett & Ko 2009, 823). Tilley seemed to agree that analytical field survey could elucidate prehistoric

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[29] Others have made the same point *e.g.* Devereux 1991; Ingold 1993; Tilley 1993, 56; 2008, 271-2; J. Thomas 1993, 25; Edmonds 1999, 92-3; McFadyen 2008, 122-3; Brophy 2009, 7.

[30] Curiously, in observing that many long barrows in Cranborne Chase lie just below the highest ground, so that visibility is restricted in one or more directions, Tilley (1994, 149) neglects remote visibility, arguing only that the fronts of the monuments were meant to be approached from specific directions.

[31] Tilley (1993, 81) had previously made the same point in less measured language, stating: 'The process for siting a megalith is analogous to siting a contemporary sculpture or hanging a picture. You may put the picture where it will be seen best. You don't hang a picture in bad light or put potted plants in front of it <u>if you want to look at it</u>.' (my emphasis). The rider that 'Different types of pictures, with different associations and meanings, of course, need different settings.' has the tone of an after-thought; of course, many priceless artworks are owned anonymously and looked at by a tiny number of individuals.

[32] In June 1996, Tilley terminated my analytical field survey of Leskernick after less than a day, on the grounds that at least two seasons of familiarization with the landscape were essential before starting.

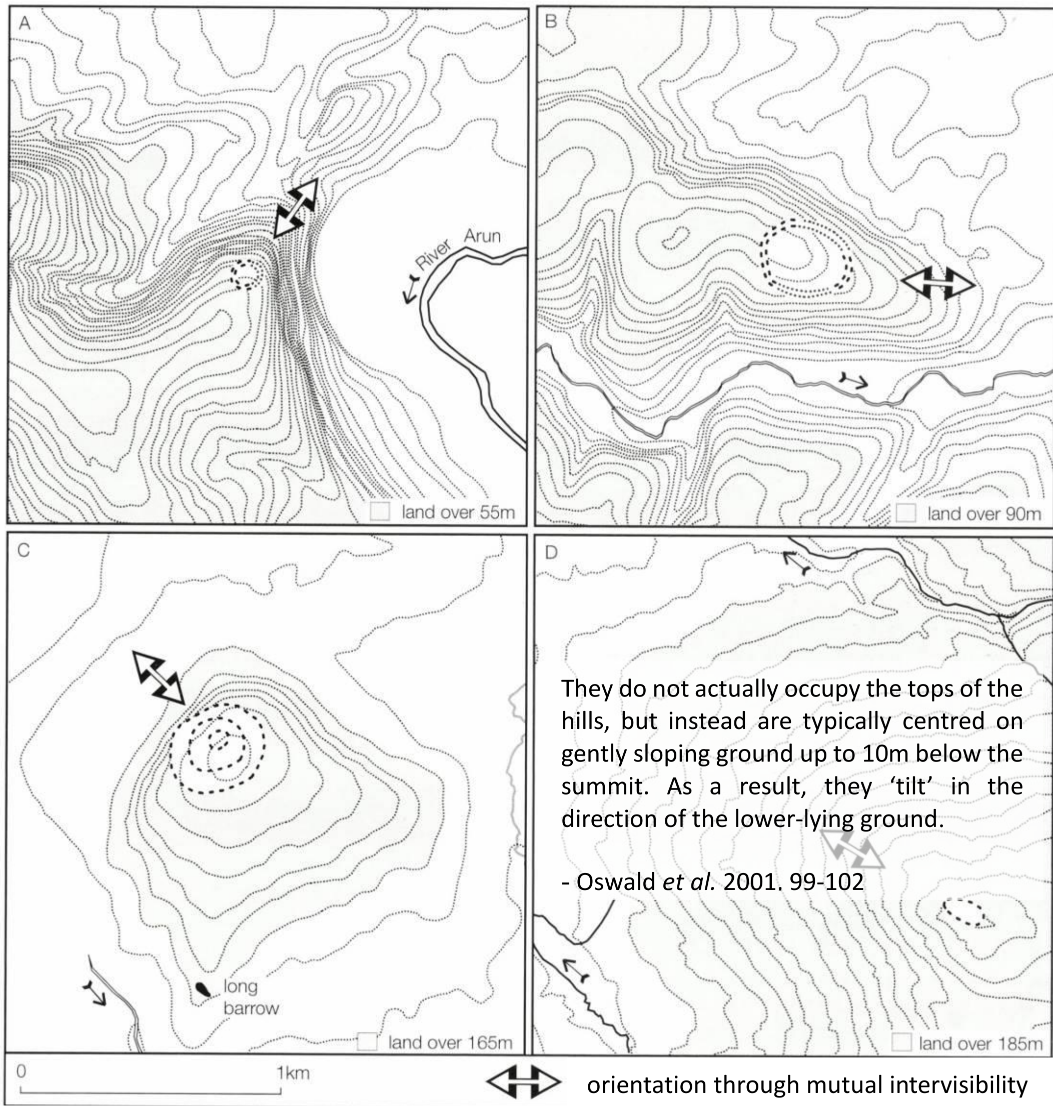
[33] *E.g.* Cleal & Allen 1995; Wheatley 1995; 1996; Woodward & Woodward 1996; Ozawa *et al.* 1995; Lock & Harris 1996; Fisher 1996; Gaffney *et al.* 1996; Llobera 1996; 2001; 2003; 2007; Fisher *et al.* 1997; Lake *et al.* 1998; Woodward 2000, 312-9; Tschan *et al.* 2000; Wheatley & Gillings 2000; 2001; H. Chapman 2003; Hamilton 2003; Cummings & Whittle 2003b; 2004; Ogburn 2006; Cummings 2009a; 2010.

[34] Earlier stirrings of more explicitly phenomenological thinking in field survey are to be found in discussions of the visual qualities of hillfort ramparts (Bowden & McOmish 1987; 1989).

[35] The list of topics at the November 1994 Neolithic Studies Group meeting were all from Tilley's book.

[36] The term 'fieldwork' is used in its original sense, as coined by O.G.S. Crawford (1953). I took part in detailed field surveys of ten causewayed enclosures surviving as earthworks, requiring intensive, prolonged, physically demanding engagement with those places, working and conversing with colleagues in all weathers, sometimes camping on the sites to take advantage of dusk and dawn light.

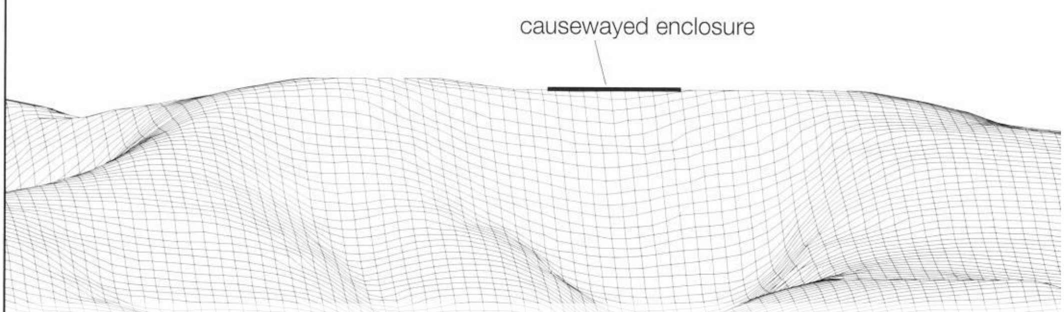
Figure 2.8a: 'Lowland-oriented' causewayed enclosures exhibit the apparently simple reciprocal intervisibility first noted in North Wiltshire. (A Offham Hill, East Sussex; B Maiden Castle, Dorset; C Windmill Hill, Wiltshire; D Green How, Cumbria). Image: Oswald *et al*. 2001, fig. 5.24.



They do not actually occupy the tops of the hills, but instead are typically centred on gently sloping ground up to 10m below the summit. As a result, they 'tilt' in the direction of the lower-lying ground.

- Oswald *et al.* 2001. 99-102

Figure 2.8b: A 'wire-mesh' model of Combe Hill generated from Ordnance Survey 5m contours, viewed from the north. Comparison with Figures 1.3b and 3.2b) will show that the perimeter could not have been visible from this angle. Image: Oswald *et al*. 2001, fig. 5.26.



Often there was a close play with local topography. Some monuments would be visible at a distance, yet hidden when close at hand, only revealed by the final climb. Approached from below, they could stand out on the skyline and provide a vantage from which to look out across the woods and clearings of familiar country. They could be passed and visited on a seasonal basis by others moving stock or travelling to collect stone. - Mark Edmonds 1999, 65 choices[37] (Crawford 1921, 112-3; Palmer 2013, 82). Against this background, in the mid-1990s, I participated in detailed field surveys of upland causewayed enclosures for the RCHME, generating 'phenomenological' observations[38] and expectations that I carried into the next project phase: rapid inspections of cropmarked sites. Based on these encounters, I refined Smith's observations about viewsheds (Oswald *et al.* 2001, 96-102). The supporting evidence was unsystematically gathered, but the model has been described as 'persuasive' (Mercer 2008, 766; Whittle *et al*. 2011, 12) and reapplied to various sites[39]. But these, all on higher ground, are inevitably amongst those most susceptible to viewshed analysis, forest cover notwithstanding (*contra* Lawson 2007, 52).

Yet my attempts to convey physical contexts in print yielded limited success, lacking both technical sophistication and empathy with those who experienced monuments in everyday life (Oswald *et al.* 2001, 91-102). Digital ground modelling, then in its infancy, allowed only basic depictions (Figures 2.8-2.9). Though I noted that the environment was of critical importance to remote visual perception, time did not allow thorough research into that question. In discerning patterns in viewsheds, I was, therefore, guilty of side-stepping the specificities of individual places (Evans 1985, 83; B. Edwards 2012, 78-9).

Tilley also inspired researchers who felt that his lack of methodological rigour could be countered through intelligent use of GIS to encapsulate and test 'cultural qualities' (Wheatley 1993; 1995; Llobera 1996). Wheatley proved that the positions chosen for long barrows on Salisbury Plain had more extensive viewsheds and more frequent intervisibility than a random sample of locations[40]. Yet even for the historic past, few GIS studies situate vision in lived landscapes, as opposed to topographic models, and the few that incorporate mobility concentrate on unusual journeys rather than everyday practice (*e.g.* Whitley 2004; Efkleidou 2019). Tilley himself moved further towards embodied, subjective, present-day experience (Bender *et al.* 2007, 231-6; Tilley 2010, 34), apparently believing that GIS-derived depictions of landscape missed the point of phenomenology and therefore improved little on two-dimensional analyses (Haraway 1991, 189; Wheatley & Gillings 2000, 13-14; Tilley 2010, 477; Gillings 2017, 122).

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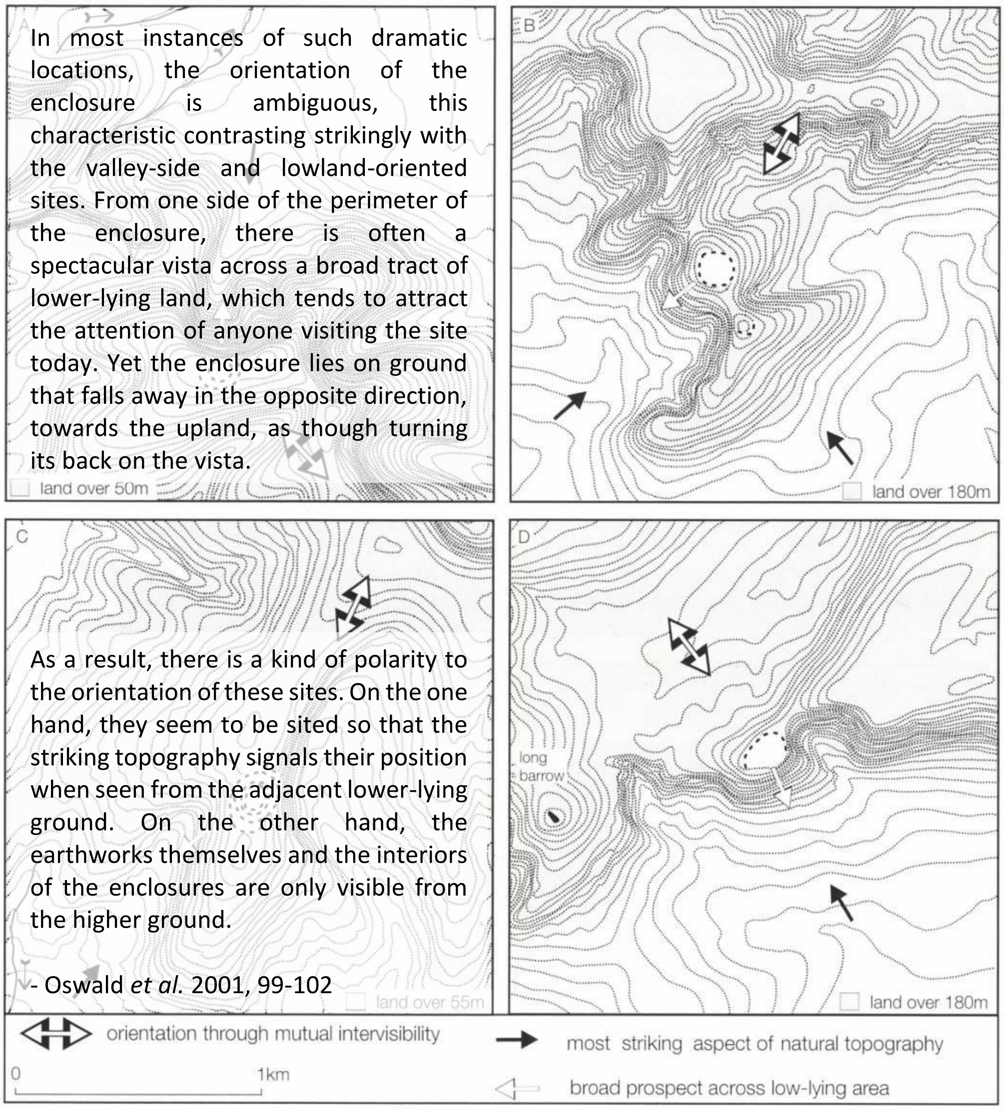
[37] 'The mute agency of the landscape' (Tilley 2010, 485) refers to its capacity to inspire cosmographies, but the most recognizable patterns relate to pragmatic adaptations by farmers and other rural practitioners.

[38] When *The Creation of Monuments* was in draft, viewshed analysis in a digital environment was a specialist activity and the necessary software and extensive ground models were not straightforwardly available within RCHME. 'Wiremesh' models of the more striking topographic settings were explored (*e.g.* Oswald *et al*. 2001, figs. 5.22, 5.26, 5.28) as a means of stripping away post-Neolithic features which inevitably impinge, but, lacking more sophisticated VR technology, these were of little worth.

[39] Including Hambledon Hill, Windmill Hill, and Kingsborough in Kent (Healy 2004, 31; Hammond 2007, 377-8; Allen *et al*. 2008, 277; 308-12). Accounts of burial monuments in the same vein have also been reinvigorated (Cummings & Whittle 2003; 2004; Cummings 2009a; b; 2010, 121).

[40] Since a random sample of locations would inevitably include lower lying areas, such as coombs, this tells us is that most long barrows occupy relatively high ground: arguably a nut cracked by a hammer.

Figure 2.9: Examples of the 'ambiguous' orientation of 'upland-oriented' enclosures. My enduring puzzlement with this phenomenon was one of the factors that encouraged me to undertake this thesis. (A Combe Hill, East Sussex; B Rybury, Wiltshire; C Whitehawk Camp, East Sussex; D Knap Hill, Wiltshire). Image: Oswald *et al*. 2001, fig. 5.25.



In most instances of such dramatic locations, the orientation of the enclosure is ambiguous, this characteristic contrasting strikingly with the valley-side and lowland-oriented sites. From one side of the perimeter of the enclosure, there is often a spectacular vista across a broad tract of lower-lying land, which tends to attract the attention of anyone visiting the site today. Yet the enclosure lies on ground that falls away in the opposite direction, towards the upland, as though turning its back on the vista.

As a result, there is a kind of polarity to the orientation of these sites. On the one hand, they seem to be sited so that the striking topography signals their position when seen from the adjacent lower-lying ground. On the other hand, the earthworks themselves and the interiors of the enclosures are only visible from the higher ground.

- Oswald *et al*. 2001, 99-102

Fleming (1999) found the visual relationships between monuments and topographic features claimed in Tilley's non-Wessex case studies unconvincing[41] and argued that the siting of some monuments was susceptible to other interpretations, including the familiar idea that tombs might be designed to be viewed from lower-lying settlements (Fleming 1999, 121; see also Field 1998, 315-6). With his final sentence, he damningly compares Tilley's approach to ley-line hunting (Fleming 1999, 124; see also Hummler 2008). This accusation could be levelled at more recent studies (*e.g.* Cummings 2010). Yet Fleming's attack[42] is not based on scepticism about the potential significance of natural topographic features[43]. Rather, he demonstrates that Tilley, despite stressing the importance of familiarity with particular landscapes (2010, 30-31) and claiming to be less 'abstract' and 'paper-based' than earlier researchers (*ibid*., 470), actually betrays ignorance of particular places[44] and the practicalities of rural life. While Tilley (2010, 479-80) castigates the 'common sense' approach of others, his inductive logic concerning remote visual perception is indistinguishable from the empiricism of traditional field survey. Yet he focuses so strongly on symbolic aspects of landscape that he neglects pragmatic concerns that more experienced fieldworkers recognise as important (*e.g.* Fleming 1999, 123; Daniel 1950, 31; Fraser 1983, 298). This is emphatically not to argue for any separation between symbolism and pragmatism. Tilley has declined to address these problems (Tilley 2010, 471-86), but archaeological thinking has emerged more concerned to construct narratives sensitive to spatial and temporal variety in lived experience (Barrett 1994a, 93; Edmonds 1999a, 92-3; b; Pollard 1999, 76-7).

Tilley's (1994, 73) assumption that the topographic 'bones' of the landscape remain essentially unchanged, even where its 'skin' has changed, is problematic. His claim that 'only the coastline has been radically altered' is invalid for low-lying regions beyond his study areas, where many rivers, lakes and wetlands have changed significantly, due to both natural events and human interference. Despite paying lip-service to 'historical mediations' (Tilley 2010, 34), such as the impacts of later industrial and agricultural processes, his interpretations continue to depend on surviving material evidence[45] (Field 1998, 316-8; 2006, 99-102). Consequently, the emphasis on present-day experience is sometimes unfounded (Hoskins 1955, 19; Lemaire 1997, 9; Fleming 1999, 120).

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[41] Tilley's (1994, 48) claim that today, it is <u>often</u> possible to see between causewayed enclosures is wrong.

[42] See also Chadwick 2004, 22; Bruck 2005, 63; Edmonds 2006, 171-2; Hummler 2008; Barrett & Ko 2009.

[43] Long before *A Phenomenology of Landscape*, Fleming's investigations of Dartmoor's reaves highlighted their alignment, in many cases, on striking tors (Fleming 1988; revised 2007). Many of the conclusions Tilley presents as novel recall those of earlier fieldworkers whose work he has overlooked or ignored.

[44] Hence Fleming's (1999, 121) observation that Tilley mis-spells the placename Cusop is more than nit-picking: it suggests that Tilley's self-proclaimed familiarity with the landscape is superficial.

[45] Tilley's subsequent field investigations at Leskernick (Tilley 1996; Bender *et al.* 2007, 42-4) overlooked numerous post-medieval drill-holes which testified to the removal of a large volume of the tor around which he built his discussion of prehistoric monumentality (McOmish & Oswald 1996 unpublished). Cummings' (2010) discussion of the visibility of megalithic monuments shows a similar tendency to underestimate post-prehistoric 'taphonomy'.

Figure 2.10: Mounds 7 and 3 of the cluster of mid-4th millennium burial monuments at Sarnowo, central Poland, photographed in summer and autumn respectively. The more extensive woodland in many parts of eastern Europe today has encouraged academics living there to give greater thought to the environment's role in shaping the experience and perception of monuments. Image: Wikimedia Commons.

Another problem, eloquently acknowledged by Tilley (1994, 73), relates to the long-recognised problem of our continuing ignorance of the prehistoric environment. Although he occasionally alludes to the limited scientific evidence, and points to the apparent longevity of Mesolithic sites which may equate to sizeable pre-Neolithic clearings, his response is ultimately an assertion that the form and siting of the monuments themselves betray the builders' intention to make them visible, regardless of any evidence to the contrary (Tilley 1993, 81; 1994, 157). This argument, made both before and after Tilley[46], was critiqued in early uses of GIS to map viewsheds (Fisher *et al*. 1997, 587; Chapman & Geary 2000; Wheatley & Gillings 2000, 5-6; Gillings & Wheatley 2001, 11; H. Evans 2008, 15). The character of the vegetative environment, then, and its changing diachronic character, present serious challenges, which have not been tackled satisfactorily by subsequent studies[47].

Criticised for over-promoting vision, Tilley argued that whereas Mesolithic forests limited vision to short-range, making hearing and smell important, Early Neolithic clearance allowed remote views, prompting a revolutionary fashion for visually oriented architecture (Tilley 2007; 2010, 29; 43-7; see also Thomas 1993, 37-8; Barclay *et al*. 2003, 240; Cummings & Whittle 2003b; Noble 2017, 115-29). Forest clearance thus becomes the prime transformative act, each clearing effectively as significant as a built monument, despite being almost undetectable archaeologically (*e.g.* Fleming 1972; Tilley 1993, 80; Bradley 1993; 1998). This conclusion subverted the emerging consensus that an emphasis on vision was essentially a post-Renaissance development (*e.g.* Bender 1993, 1) and Tilley's own (1994) characterization of forest as part of the 'skin' of the landscape. However, his argument moves away from the idea that perception necessarily involved movement arising from routine practice; now, the mere act of seeing something from afar becomes perception, simply because remote views were unprecedented. Tilley does not discuss the impact of the passage of time on the environment.

[46] *E.g.* RCHME 1979, xi; Drewett *et al.* 1988, 35-6; Lock & Harris 1996, 221-2; Brown 1997, 133 Cummings & Whittle 2003, 260[46]; Roughley & Shell 2004, 2.3; Allen & Gardiner 2009, 56. Cummings & Whittle's (2003, 255) contention that prior to their work there was a generally 'negative supposition' about the potential for remote visual perception and that 'trees … are often simply taken to have blocked the feasibility of any extensive views' seems to be a 'straw man'. On the contrary, the general supposition was the opposite, with the potential impact of trees on remote visual perception seldom acknowledged at all.

[47] As an extreme example, McManama-Kearin (2013, 10) explicitly chooses to ignore the potential effects of vegetation, whilst acknowledging that this leaves her conclusions fundamentally suspect.

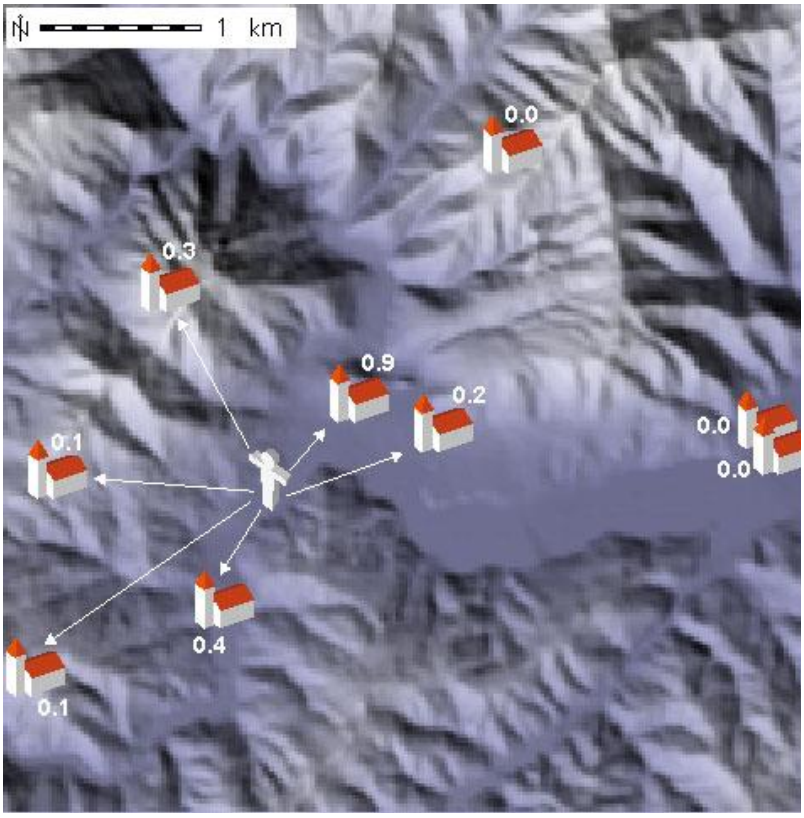

Figure 2.11a: GIS-based model of the 'soundscape' of churches in the wooded, mountainous, terrain of Polhograjsko hribovje in central Slovenia (from Mlekuz 2004, fig. 6). Despite acknowledging that 'affordances can only be recognised in the context of practical action', the study is ultimately no more than a demonstration of the technical process of modelling the transmission of sound, analogous to many GIS-based visibility studies. The lone, static listener in this image symbolizes a fundamental problem.

Figure 2.11b: Engravings of two bulls in the Fezzan region of southern Libya, dating to the later 7th or earlier 6th millennia BC. A small proportion of the thousands of domesticated cattle depicted, of both sexes, have collars with objects hanging from them, usually in pairs. These might be wooden or bone 'clappers' *i.e.* precursors to metal bells. Other images show more detail of hide markings, suggesting that these were significant. Image: author's photo, reproduced by permission of Tertia Barnett (see Barnett 2019, 282; 285: panel GSC 122A).

2.6 The rise of the non-visual senses

Tilley's research prompted a counter-swing towards non-visual senses[48], though this was not new (von Fieandt 1958). Despite this recalibration, moving beyond truisms and groundless speculation has proved challenging (Barrett & Ko 2009). Edmonds (1999) has accompanied traditional archaeological analyses with a series of tantalising stories, suffused with sensory experience, beliefs and emotions. Where monuments[49] are involved (*ibid*., 87), views are implicitly products of patterns of movement stemming from pastoral practice, replete with the lowing of cattle and the smell of woodsmoke, with mythopoesis and memory. This thesis embraces Edmonds' concern to evoke a dynamic, lived experience of landscape, where practice and symbolism are fused.

The term 'soundscape'[50] arose through an arguably over-zealous promotion of the auditory qualities of certain Neolithic monuments (Lawson *et al.* 1998; Watson & Keating 1999; Watson 2006; Devereux 2001; 2009). Some recent experiments therefore lack credibility (*e.g.* Mays 2009), but relevant past research includes, for example, the heightened sense of sound of forest-dwellers in Papua New Guinea (Gell 1995; Fled 1996) and the use of drums to communicate in woodland over distances up to *c*.11km (Carrington 1949, 25). The discovery of a bone flute fragment of *c.*3700 BC at Penywyrlod chambered tomb in South Wales is also significant (Megaw 1984). Mills (2005, 80; 2013) has commendably emphasised 'sounds associated with daily practice'[51], including livestock husbandry. Others have commented on the relative clarity of sound in clearings (Davies[52] 2010, 104; Noble 2017, 72; 79). Yet surprisingly, there has been no systematic research on the transmission of the various distinctive sounds that must have been part of everyday life in the Early Neolithic. Technical steps towards achieving some integration of smell have concentrated on close-range experience (Eve 2014). No targeted research has been done on the remote perception of smells in prehistory (although see Classen *et al.* 1994), despite Mercer's (1980, 63) memorable evocation of the reek of rotting corpses on Hambledon Hill. Roasting meat and woodsmoke (see Chapter 5) were undoubtedly Early Neolithic refrains, so avenues remain to be explored.

[48] *E.g.* Gillings & Wheatley 2001, 13; Rainbird 2008; Hamilakis 2014. In 1994, responding to the Neolithic Studies Group conference organiser's advice to address Tilley's approach, Darvill (1997, 3) echoed Bender's (1993, 1) warning that non-visual senses should not be side-lined. Tilley himself had mentioned hearing, but only rarely (*e.g.* Tilley 1994, 73; 109).)

[49] His chosen exemplar, Knap Hill, is arguably unfortunate, because it returns discussion to upland Wessex, with its surviving earthworks, striking landforms and potentially distant viewsheds (*ibid*. 82).

[50] Against the background of an emerging consensus about the importance of 'synaesthetics', it is not surprising that Llobera's (2003) narrowing of experience to the 'visualscape' has not been widely adopted.

[51] Similarly, the sound of stone-working at Langdale 'axe factory' in Cumbria has impressed those who have experienced it (Edmonds 2004). Such sounds, which were undoubtedly infused with social meaning, have been termed 'soundmarks' (Murray Schafer 1977; Mlekuz 2004).

[52] Davies also nods to non-visual senses by mentioning the texture of tors and the warmth of sun-baked rock surfaces. His observation that the forest would have been sheltered and calm compared to exposed tors is valid (see Chapter 5), but in auditory and general experiential terms, the comment betrays an unfamiliarity with the loud and scary experience of being in forest during storms.

Figure 2.12: Combe Hill, seen from 500m to the south-east. The perimeter of the causewayed enclosure can be seen just right of centre, immediately below the horizon.

2.7 Summary

Several important points emerge from this review. The most striking is the extraordinary persistence of the idea that remote visual perception was important in the Early Neolithic. Like a cork in a stormy sea, it has been repeatedly submerged by waves of fresh evidence and new theoretical approaches, yet after a short while has bobbed to the surface again, remarkably close its previous position. The idea evidently originated long before the recognition of causewayed enclosures or even 'The Neolithic', in landscapes where earthworks are anomalously well preserved, specifically the now largely treeless downlands of Wessex and Sussex. It is entwined with thinking about later types of prehistoric monument, especially round barrows and hillforts. Consequently, the idea has appealed to field surveyors, with positivist outlooks forged through long familiarity with such landscapes. Recent emphasis on the role of the non-visual senses, on diversity of experience, on movement, and on routine practice has 'papered over' these origins, making the idea more palatable to contemporary tastes. Some academics have caricatured field survey as an unsophisticated epistemic process, tainted by both excessive romanticism and excessive utilitarianism. Yet the antiquarian surveyors who propagated remote visual perception were undoubtedly more immersed in the quotidian actualities of living in rural landscapes than their later critics.

Post-processualist approaches have engendered a concern to contextualise and to understand idiosyncrasies. Over the same period, over twenty causewayed enclosures in Britain, and a larger number of burial monuments, have seen their first excavations, or renewed excavations. Theoretically, this should have generated a larger and more diverse evidence-base, promoting richer and more dynamic narratives. Yet interpretations still rely too often, and too heavily, on generalisations extrapolated from a small, heterogeneous selection of sites. A century after excavation began there (Kendall 1923), Windmill Hill remains, in effect, a 'type site', as Piggott advocated. Sites excavated before the 1980s, along with those investigated and published more modestly by commercial archaeological units since 1990, have remained over-shadowed. Sites subjected to little or no excavation have scarcely contributed more than symbols on distribution maps to academic debate.

This review leaves a nagging suspicion that the long-held belief in the universal importance of remote visual perception may be ill-founded. The debate has been underpinned by an assumption, seldom questioned, that the potential to see monuments from afar, and/or, reciprocally, to see expanses of landscape[53], was greatly valued by Early Neolithic people. The reasoning, though not always made explicit, is

[53] Bradley's (2019, 70) generalization that enclosures may have been designed to be intervisible with the places where axes were made seems to refer only to the enclosure on Carrock Fell, Cumbria, which is more likely to be Bronze Age (Oswald & Edmonds 2021, 54-6).

Figure 2.13: St Roche's Hill (The Trundle), seen from 500m to the south-east. The managed deciduous woodland contains few mature trees, yet amply conceals all hint of the large causewayed enclosure centred just to the north of the summit.

usually that the view (in both directions) reinforced the viewer's understanding of 'territory, political allegiance, ownership, and ancestors' (Malone 2001, 107): in other words, their sense of belonging to, or exclusion from, part of the landscape. Various other explanations for the apparently carefully considered placement of causewayed enclosures have failed to win support. These diverse ideas underline that it remains unproven that people would need to have regular visual reminders of the existence of monuments.

Another key point concerns the contingent nature of vision (and indeed other senses), an argument fronted by Gillings and Wheatley (*e.g.* 2001, 13). Though their point has been strongly made and is generally acknowledged, studies of remote visual perception continue to concentrate almost exclusively on what it was physically possible to see: that is, on vision, rather than perception. The character of the vegetative environment – the most obvious relevant context – is critical to understanding whether people looking out from monuments (*i.e.* the simpler question tackled by most viewshed modelling) were able to see anything of the surrounding landscape, as is usually assumed. Conversely, it is critical to understanding whether or not people had to make special efforts to see monuments, for example by travelling to see them, or whether opportunities arose in the course of their everyday lives. Tree cover is repeatedly held up as a potential issue, only to be rapidly 'brushed under the carpet'. Still less consideration has been given to other contextual issues. Whether opportunities to see monuments arose in the context of everyday life or special events, what exactly were those circumstances likely to be? As Gillings and Wheatley rightly point out, those contexts are key to understanding what the physical act of seeing actually meant to people, and whether remote visual perception was really afforded as much importance as archaeologists have believed.

The dominant academic approach in recent decades has been the application of increasingly sophisticated viewshed routines to increasingly high-resolution ground models in a digital (invariably GIS-based) environment. These studies have decisively turned attention back to vision. Yet if we accept that the act of seeing is highly contingent, it is debatable how far such studies have really advanced our understanding of perception.

3. A method for investigating remote visual perception

The exploration of the senses is not merely about bodily experience. It is not about sensory organs and the mechanics of bodily stimuli. It is rather an enquiry into the essence of being.

- Yannis Hamilakis (2014, 112)

3.1 Introduction

Chapter 2 traced the long gestation of archaeologists' unshakable belief in the importance of remote visual perception as a key factor in the location and design of Early Neolithic monuments. Scholars have also begun to consider the roles of hearing and smell, but these remain subordinate to vision - an inequality deliberately retained in this thesis. The enduring belief in remote visual perception is undoubtedly justified for later prehistoric monuments, including round barrows and hillforts. But Chapter 2 questions whether the same understanding should be back-projected onto Early Neolithic monuments, primarily because of the unknowable extent and character of contemporary forest. Since the 1990s, the prevailing methodology has been to apply increasingly sophisticated viewshed routines in a GIS environment. I myself initially intended to follow that path, but, with the benefit of reflection allowed by protracted study, I eventually took a different direction. This has proved to be in step with emerging academic opinion (Gillings 2017; Lock & Pouncett 2017).

The most technically accomplished viewshed-based studies to date, at least for the Early Neolithic, are three doctoral theses, respectively studying chambered tombs and settlements on the Orkneys, the 'tor enclosures' of South-West England[1], and causewayed enclosures in four other study areas in southern England (Kerns 2015; 2016; S. Davies 2010; 2022; Durkin 2020; 2022). Kerns skates over the question of vegetation, quite typically, but demonstrates that at least in today's open conditions, chambered cairns appear to have been deliberately sited so as to be prominently visible from settlements, but not from the rest of the landscape or the sea (Kerns 2016, 44-7). Davies, on the other hand, uses GIS to 'virtually reforest' the terrain, as advocated previously (Chapman & Geary 2000, 316; Conolly & Lake 2006, 8-9). He then compares the views from Helman Tor and Carn Brea[2] with nearby 'round-topped' hills of similar elevation (Davies 2010, figs. 2.29-33). But there are technical problems with his method:

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[1]Davies concludes, in line with earlier studies (Silvester 1979, 188-9; Mercer 1981, 190-1; 1986, 51-2; Oswald *et al*. 2001, 85-90) that tor enclosures are analogous to causewayed enclosures. Whittle *et al*. (2011, 476-520) sometimes prefer the term 'walled enclosure' which effectively reduces the difference between them and classic causewayed enclosures to one of construction materials: a moot point.

[2] These being the only tor enclosures that are proven by modern excavation to be Early Neolithic.

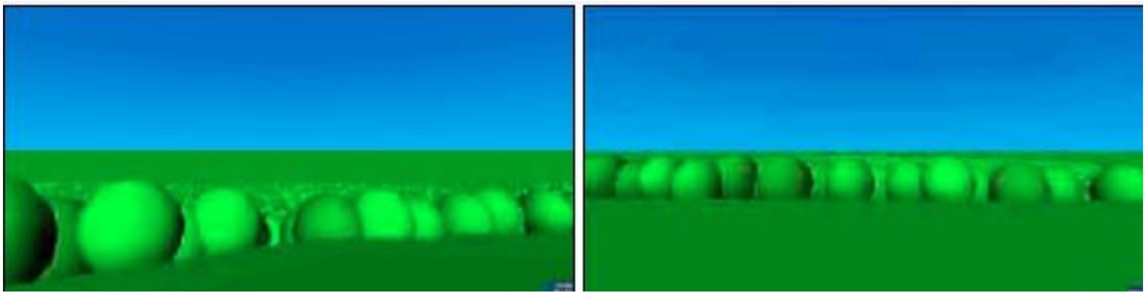


Figure 3.1a: Simon Davies' innovative 'virtual reality' reconstruction of the view afforded from the top of Carn Brea (left) compared with a nearby 'round-topped' hill. The image demonstrates the more extensive view that would have been available over the forest canopy from the summit of Carn Brea Yet the illustration also makes clear that unless there were extensive clearings on the lower-lying ground, a broader swathe of the canopy is all that would be visible. Image: Davies 2010, fig. 2.31.

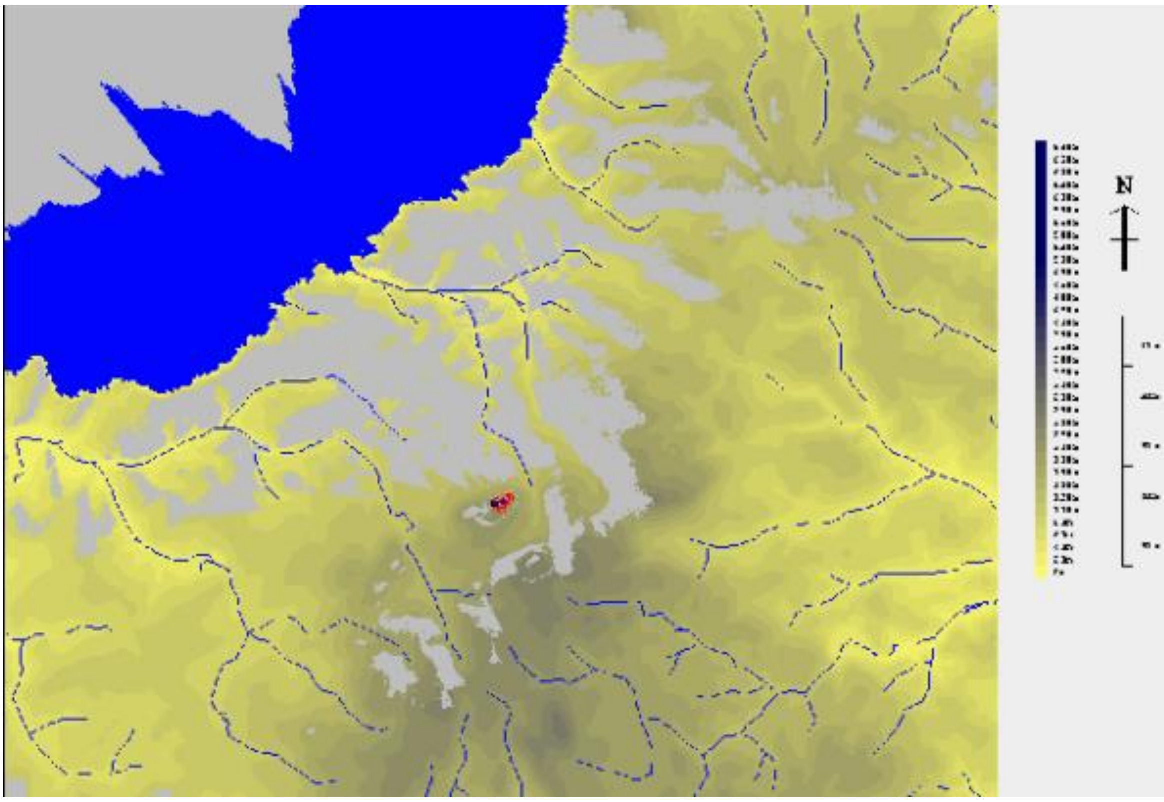


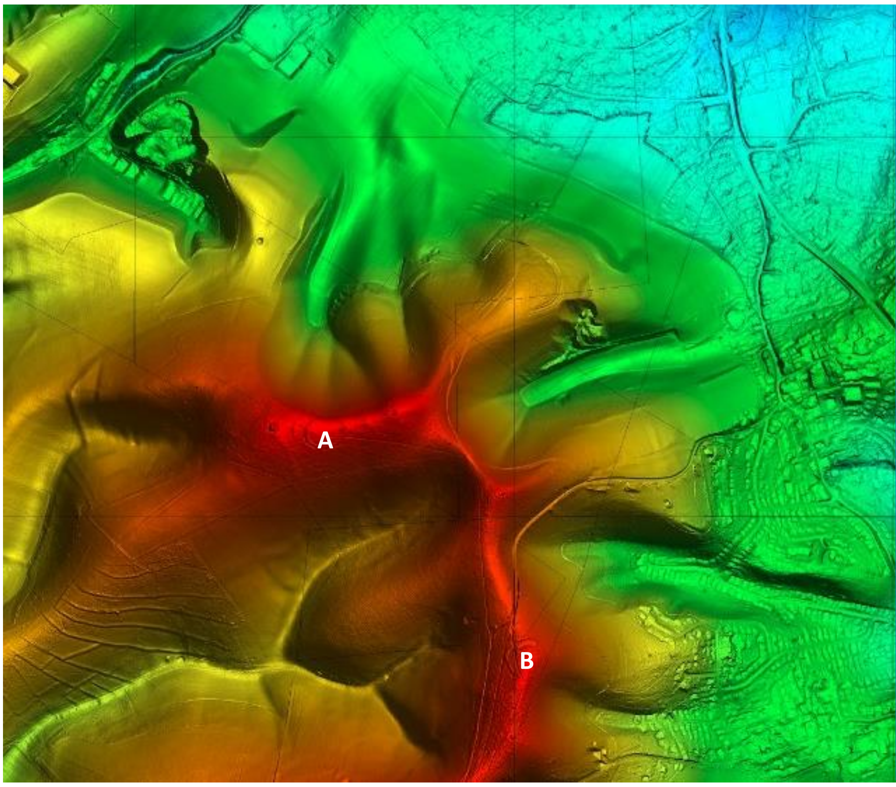
Figure 3.1b: Davies' GIS-based illustration of the landscape visible (in grey) from the summit of Carn Brea. River basins make up the majority of the visible area. The relatively muted colour-ramp used to depict the topography represents a considerable advance from the lurid colours sometimes used. The depiction of the visible area as a flat grey tone, however, suggests visibility to be a binary quality; others have employed more sophisticated 'times seen' models to depict different degrees of visibility.
Image: Davies 2010, fig. 2.32.

variables crucial to the modelling, including the distance between the enclosure and the forest edge, the height of the trees, and the exact viewpoint are left unspecified. Durkin (2022, 169), like Kerns, side-steps the complexities of modelling vegetation, by arguing that establishing what could not be seen from the monuments, even in an entirely deforested landscape, offers a useful start. In effect, this negates the relevance of forest not only to viewsheds, but to Early Neolithic experience more generally. Similarly, rivers are not factored into his cost-distance models, even though he acknowledges their likely role as routeways (*ibid*., 170; 176-7). In contrast, Davies (2010, 76-90) accepts rivers as routeways rather uncritically. While he mentions views towards monuments and the potential significance of tors as remotely recognisable landmarks (*ibid*., 101), Durkin disregards this half of the question. All these technical issues could be resolved with further work, but there is arguably a more serious underlying problem.

The critical flaw in these studies is the unresolved tension between the over-simplified, abstract space of the GIS environment and the multivariate, humanised space of the real world (Lock & Pouncett 2017, 130). All three studies skate over day-to-day circumstances that might allow and encourage people to look at monuments. Davies (2010, 56-7), for example, concludes that 'the near views (0-3km), those where detail in the landscape can be best picked out, are much better from the tor'. 'Better' begs questions about whether it was important to pick out details (or even possible if the land within 3km was forested) and which particular details might be significant to viewers. Calculation of the viewshed seems to represent a conclusion in its own right, without further need for thought: a risk that GIS pioneers anticipated (Aldenderfer 1996, 2). Davies (2022, 38) has recently suggested that people may have been watching grazing herds or game[3], but this seems inconsistent with the small clearings that his original modelling envisaged. The main products of such studies, then, undoubtedly provide novel and apparently definitive imagery of what might be seen under specific physical conditions. But they are ultimately more descriptive than analytical, as even Llobera (2000, 81) has conceded. Indeed, they give a sense of being 'a method in search of a problem' (Gillings 2017, 122; 127). Archaeologists of the earlier 20th century arguably achieved an equivalent - or greater - level of understanding by contemplating what they could see with the naked eye.

A deep divide still separates those who desire to rely on desk-based technologies from those concerned with embodied experience of landscape (Gillings 2009; 2017; Figure 3.2). Yet even Tilley's purportedly embodied studies of vision, which encouraged the deluge of experiential studies, do not explore the details of the circumstances under which people might find themselves looking at monuments. In terms of fieldwork, there have been important advances in highlighting the potential of apparently mundane

[3] Apparently drawing on presentations by myself and others at the Neolithic Studies Group conference on 4th November 2019, entitled 'After *Gathering Time*: new perspectives on Early Neolithic enclosures'.



The subject matter of this book cannot be known or understood simply from publications, from maps, diagrams, photographs and descriptions, because these are only representations. As representations, they necessarily fail in conveying a bodily understanding of prehistoric remains. GIS and simulations are, if anything, far worse.

Chris Tilley 2004, 218

Figure 3.2a: The setting of Combe Hill causewayed enclosure (A), as recorded by lidar. Though a huge advance from earlier ground models, the representation remains devoid of qualities that would make it recognisable to prehistoric inhabitants. Note the enclosure on Butts Brow (B), proven to be Early Neolithic in 2016 (Patton 2021). Image based on Environment Agency 1m lidar.

Figure 3.2b: Oblique aerial view of Combe Hill, created using Google Earth, with the Neolithic banks highlighted digitally. The view is certainly useful in illustrating the careful placement of the perimeter at the head of the natural coomb. Even so, it is obviously not a perspective that would be afforded to people in the Neolithic. Image: created by Brian Drury and reproduced with his permission.

Early Neolithic remains (*e.g.* Garrow 2006), but most prehistorians still prefer to investigate the extra-ordinary (*e.g*. Thomas & Ray 2013; Ray & Thomas 2020). Consequently, most accounts of the period remain overly focused on spectacular monuments and/or too coarse-grained in their treatment of everyday life to give much sense of embodied experience. Few studies, whether GIS-based or more experiential, offer convincing insights into what factors might lead people to want, or need, to look at monuments (and/or landscapes), and in what circumstances. In short, archaeology needs to move beyond mechanical descriptions of viewsheds to understand better the context(s) of why and how remote visual perception occurred.

3.2 A method to counter lip service and compartmentalization

Lefebvre (1974), considering modern urban spaces, argued that academic discussions of landscape generally fail to capture the nature of lived experience for two reasons. First, they only pay lip service to the idea that space is constructed through routine practice. Second, the compartmentalization of knowledge and experience inherent in modern academia mitigates against sufficiently rich and complex insights. Both criticisms can be levelled at even the most technically advanced GIS-based visibility studies. Following the translation of Lefebvre's work, Ingold (1993) introduced the useful concepts of 'taskscape' and 'affordances', defined as 'properties of the real environment as directly perceived by an agent in a context of practical action' (Ingold 1992, 46). Ingold's work inspired fresh thinking about the construction of landscape through routine practice (*e.g.* Edmonds 1997), but this has yet to infuse discussions of remote visual perception.

The method employed here does not totally renounce GIS-based viewshed routines, for they present a means of exploring, testing and illustrating particular points (Richards-Rissetto 2017, 11). But they do not constitute the main thrust of my research. Given the shortcomings highlighted above, this thesis focuses on developing fine-grained understandings of everyday circumstances, which gave meaning to the act of seeing. Hamilakis' (2014, 112) claim that such a study represents 'an enquiry into the essence of being' sounds hyperbolic, but sensory perceptions <u>are</u> inextricably entangled in the web of being-in-the-world. To adequately encompass such breadth is impossible in a thesis, so I focus on key contexts which gave rise to affordances for remote visual perception.

The concept of territory, with which remote visual perception is often linked, implies attachment to place, yet the degree to which people in the Early Neolithic were 'settled' is still contentious. Chapter 4 critically re-evaluates the nature of inhabitation, concentrating on variations in spatial and temporal scales of movement. The question is bound up with the character of contemporary farming. While the spatial and temporal rhythms of animal husbandry are usually tied to those of arable agriculture, there are additional issues attached to keeping stock that warrant separate treatment. And

Figure 3.3: Oliver Rackham (1939-2015), counting tree-rings in Kent, in the wake of the Great Storm of 15th–16th October 1987. Rackham was a rare thing: an ecologist who embraced both archaeological and historical evidence. His close attention to woodland ecologies arguably gave him an advantage over many archaeologists studying the Neolithic. Image captured by Bob Ogley and reproduced with his permission.

even the most sedentary arable farming involves some degree of movement around the landscape. To address the first of Lefebvre's observations, concerning the construction of space through routine practice, it is first essential to establish the character of the taskscape – the mechanisms, scales and temporalities of movements around the landscape - upon which remote visual perception was inevitably contingent.

It is also vital to address Lefebvre's second concern: the unhelpful compartmentalization of knowledge. Archaeologists habitually characterize forest conditions too glibly, often in a few phrases. Chapter 5, therefore, re-examines the character of Neolithic vegetative environments by drawing heavily on the largely untapped wealth of ecological scholarship. With a few notable exceptions (*e.g.* Vera 2000; Rackham 2003; 2006; Figure 3.3), most archaeological studies restrict themselves to the limited palaeobotanical evidence surviving on a particular site or landscape, thereby failing to convey the dynamic qualities of the wider ecosystem. Equally, the clearance of trees has generally been treated as an uncomplicated act that requires little consideration. Furthermore, while the exploitation of a wide range of forest resources is often discussed for the late Mesolithic, the same is not generally true for the Neolithic. This imbalance cements an unhelpful conceptual divide between an environmentally determined Mesolithic and a more dynamic, eventful Neolithic, full of human agency (Conneller 2010, 188-90). It effectively disguises the likely reality that, on the one hand, natural agents must have made significant impacts on Early Neolithic life too and that, on the other, people in the Early Neolithic continued to have 'ecological relations' (Bradley 1984, 11).

Chapter 6 takes a similar approach to animal husbandry. Transhumance is widely agreed to be a key vector of movement around the Neolithic landscape, but usually with only a vague conception of its spatial qualities. The temporal variables involved are also significant to the understanding of remote visual perception, partly because of seasonal environmental changes. As with forest ecology, there is considerable scholarship on historic transhumance and dairying practice that allows us to put conjectural flesh on the bones of the archaeological evidence. It has also long been recognized that grazing and browsing by cattle and sheep play an important role in changing the character of vegetation and there are numerous relevant scientific studies to draw upon. Chapters 4 to 6 illustrate that archaeologists writing in the empirical tradition prevailing until the 1960s made many useful observations that have since become overlooked. This loose confederation of polymath enthusiasts (exemplified by Curwen and Crawford; Figure 3.4), were concerned with field evidence in many forms, having been brought up in closer contact with the countryside and its practices than modern academics (Pryor 1997). Their positivist attempts to explain archaeological observations - often highly perceptive - have been discarded too readily.

Figure 3.4a: E.C. Curwen (1895–1967), a prolific fieldworker in Sussex in the 1920s and '30s, looking at the inner ditch of Whitehawk causewayed enclosure. Stuart Piggott (1910–1996), whose first dig was under Curwen's direction, later glossed over his trainer's more sensitive observations about the topographic settings of causewayed enclosures. Image reproduced by permission of Sussex Archaeological Society.

Figure 3.4b: O.G.S. Crawford (1886–1957), a pioneer of analytical earthwork survey and aerial photography. Like Curwen and Rackham, Crawford was a polymath, who coined the term 'fieldwork' to describe all forms of archaeological investigation short of excavation. Working for the Ordnance Survey, his career was largely spent in the field and forced him to engage with the development of landscapes through time. All these qualities afforded him significant advantages over modern academics. Image: Wikimedia Commons.

Five case studies (Chapters 7 to 11) apply the insights gained in Part 2 to a variety of study areas, ranging from the archetypal North Wiltshire Downs to what eventually became the fen-edge of East Anglia, with its negligible topographic variation. The balance of emphasis between causewayed enclosures and long barrows differs in each study. While causewayed enclosures have been described as 'nodes' in journeys, there have been few detailed studies of how those journeys might be influenced or constrained by the 'the mute agency of landscape' (Tilley 2010, 485; Cummings 2010, 122). The final case study – of Hambledon Hill in Dorset – focuses on the issue of change through time. *Gathering Time* (Whittle, Healy, & Bayliss (Eds.) 2011a) concentrated attention on the duration and sequence of activities at sites and monuments, yet most accounts of the period still present a rather coarse and simplistic picture of change. GIS-based viewshed studies, in particular, invariably depict a snapshot of the landscape at a specific moment. Yet we can assume that human patterns of land-use, as well as environmental conditions, varied not just from generation to generation, but also from month to month.

In each case study, the primary investigative method is the embodied experience generated by rapid, extensive field survey[4], or 'perambulation' as it was first called by O.G.S. Crawford. Though mostly limited to publically accessible land and footpaths, each investigation was more prolonged, thorough, and geographically extensive than a 'phenomenological walk' (Tilley & Bennett 2008). Lidar-derived imagery has been employed in the surveys, not in the increasingly common mode of 'ground-truthing', but as an addition to the traditional toolbox of field surveyors, alongside aerial photography, historic mapping, *etc*. (Ainsworth *et al*. 2013). This method of field survey inevitably generates 'observations with a long currency' (Field & McOmish 2016, 12), which offer a compelling sense of changes and continuities in how particular parts of the landscape were inhabited and exploited in the past (Oswald 2021). Historic land-use, attested both archaeologically and through documentary evidence, offers a lens through which to examine the more remote past, though without offering a direct analogy for Neolithic practices. If affordances are partly products of particular physical landscapes, then it must be informative to consider how the same physical qualities were treated by people engaged in similar forms of land-use in more recent times.

Renfrew's Thiessen polygons may have created 'a picture of past landscapes which the inhabitants would hardly recognise' (J. Thomas 1993, 25), but the garish GIS-based viewshed imagery that has become conventional over the subsequent three decades represents a limited improvement. On the other hand, the grainy, low-contrast, black and white snap-shots used by Tilley (1994; 2010) also do little to enhance his arguments, not least because their static rendering of visibility runs counter to his emphasis on movement. In most archaeological publications, the accompanying figures serve to

[4]At Level 1 standard, as defined by Historic England (2017, 33).

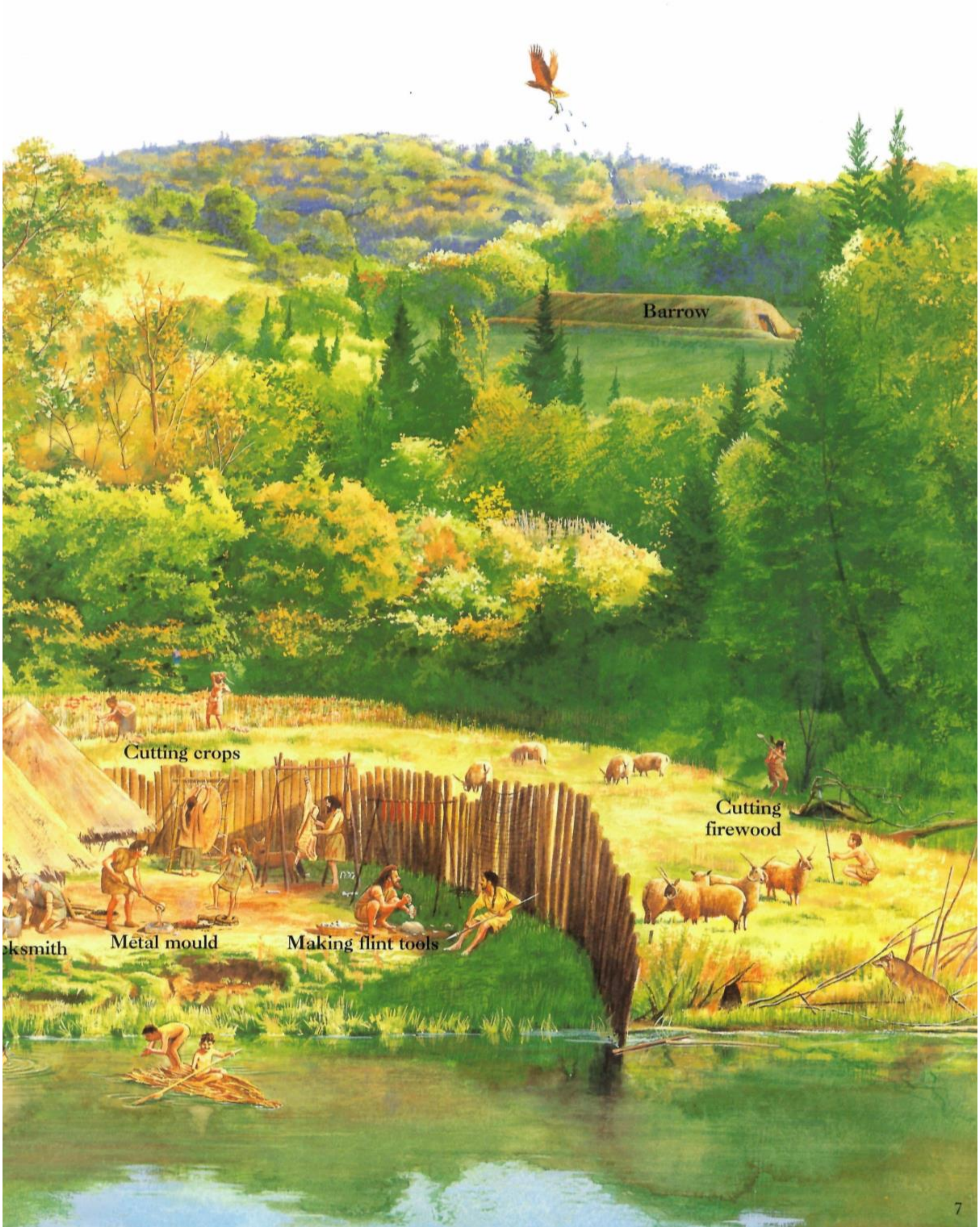


Figure 3.5: A prehistoric scene, combining features of different dates, but arguably capturing the essence of a lived landscape very effectively. Note the long barrow, occupying a nearby forest clearing yet still visible above the trees. Women are harvesting the cereal crop, but are under-represented overall. Image: Noon & Millard (2002) *A Street Through Time: A 12,000-Year Journey Along the Same Street*.

support a particular point in the text. In this thesis, some figures perform that task, but from this chapter onwards, many serve to illustrate relevant aspects of landscapes that their past inhabitants <u>would</u> recognize. The 'collage'[5] of imagery draws primarily on fieldwork undertaken for this thesis. Photographers conventionally await good light[6], but I gathered images regardless of weather conditions, as a reminder of the effects of light on vision. My method is therefore 'a blurred genre of science/fiction'[7] (Pearson & Shanks 2001, 131; see also Pluciennik 1999, 667). It can also be seen as 'posthumanist' (Nayar 2013), in that it shifts the focus away from human agency by considering the other creatures and natural phenomena with which humans interact. It relies on 'thick description' (Geertz 1973, 5-6; 9-10; Ponterotto 2006) to evoke the richness and variety of contexts within which affordances for remote perception arose: topographic, ecological, economic and social. Each case study can be read as a 'deep map': a 'finely detailed, multimedia depiction of a place… inseparable from the contours and rhythms of everyday life… positioned between matter and meaning' (Bodenhamer *et al*. 2015, 3).

[5] Bender *et al*. (1997; 2007) successfully used this as a means of communicating everyday life on a specific project. Alongside my photographs, I could wish for the talents to produce reconstruction drawings and paintings, like another recent evocation of the Early Neolithic (Biddulph & Ritchie 2019).

[6] This is particularly true for low earthworks, which are difficult to represent even under good conditions.

[7] I have also drafted an interlinked series of stories originally intended to preface each chapter, but ultimately not included in the thesis. These paint a vivid, people-centred, alternate picture of the circumstances surrounding affordances for remote visual perception.

Part 2: Key contexts

Frontispiece: A clearing near the causewayed enclosure at Carvin, Pas-de-Calais, in mid-October.

Chapter 4. Mobility in Early Neolithic life and affordances for remote perception

Mobility is walking, running, climbing, rowing, dancing, hunting and herding… pot-making, flint knapping, hoeing, planting and fruit-picking…. There are many different forms of mobility: travelling alone, or in groups, or with animals, on land or on water; and these will have led to different ways of experiencing and perceiving the world.

- Jim Leary and Thomas Kador (2016b, 2)

4.1 Introduction

Part 2 presents an extended preface to the detailed, place-specific case studies in Part 3. The central topic of each chapter – respectively mobility, the environment, and livestock husbandry – represents a key aspect of the lived world in which Early Neolithic monuments were worked on, encountered and made present in the wider landscape. Each has seen considerable academic discussion, but some pertinent early observations have become forgotten, and much can be gleaned by re-evaluating a wider body of evidence for people's practical everyday engagement with landscapes. Each chapter is therefore intended to synthesize and evaluate past research, and then to refine the assumptions which underpin interpretations of remote perception.

Mobility operates at different spatial and temporal scales, with a spectrum of purposes (Leary & Kador 2016b, 2; Aldred 2021). As an elemental component of everyday life, it should not be reduced to 'special' journeys that explicitly involved monuments, however important such journeys may have been. Some modes of movement are more relevant to this thesis than others, however, so Chapter 4 explores scenarios for movement around the landscape, as well as for 'staying put', and thus the circumstances in which affordances for remote perception might arise. As previous chapters have shown, with a few exceptions (*e.g.* Whitley 2004), archaeological explorations of visibility, especially in GIS, are rather static[1], focusing on vistas available from specific points (Howey & Brouwer Burg 2017, 4-5). For the Early Neolithic, this invariably means the monuments themselves. By reviewing current understandings of mobility, this chapter will establish a more dynamic model of landscape inhabitation, within which acts of seeing must be situated. In due course, GIS-based studies will undoubtedly achieve the technical advances needed to build in greater sensitivity along the lines suggested here (Richards-Rissetto 2017). Chapter 6 will explore in detail the character of movements associated specifically with livestock.

[1] Key exceptions for the Neolithic are studies of cursus monuments (*e.g.* Tilley 1994; papers in Barclay & Harding 1999; H. Chapman 2003; Loveday 2012; 2016), whose form implies a vector of movement.

Figure 4.1a: The English coast, 36km away, seen from just outside the causewayed on Mont d'Hubert. The seaward view attracts visitors, but the locally prominent hill is less eye-catching when seen from sea level than chalk cliffs like Cap Blanc Nez (beyond the obelisk 1.1km away). As a typical *epéron barré*, the earthworks did not continue along the ridge's seaward side, so were not conspicuous from that direction.

Figure 4.1b: View from a kayak on the River Vézère in south-west France, illustrating the narrow corridor of remote vision afforded to waterborne travellers. Photographed in late August.

4.2 Movement by sea and inland waterways

Most previous discussion of remote perception relates to terrestrial encounters with monuments, but waterborne movement is potentially important. Recent genetic studies suggest rapid mass-migration into Britain (as envisaged by Case (1969b) and earlier culture historians), implying that 'the first farmers' were also skilled seafarers (Cassidy *et al*. 2020, 384-5; Rogers 2016). With the land largely forested, sea journeys constitute the only indisputable opportunity for people to gain distant views of terrain and night-sky panoramas. Cummings (2009a; b) suggests that 60% of funerary monuments in western Britain and Ireland were designed to be seen from the sea. Monuments in the Morbihan were certainly used as landmarks by seafarers in historic times (Roughley & Shell 2004, 3.3). A few causewayed enclosures, including Whitehawk in East Sussex and Chalk Hill in Kent, now enjoy sea-views. But it is hard to prove that the monuments were originally intended to be seen from the sea (Field 2006, 109; *contra* Rogers 2016, 132), or to command seaward views, because they are set back from the present coast (and further from the contemporary coastline), so vegetation may have intervened. The sweeping cross-Channel views from the enclosure at Mont d'Hubert, Pas de Calais, certainly impress visitors today (Praud 2015; Figure 4.1a), but the more significant views in the Early Neolithic may have been inland, towards fertile stream valleys, ideal for settlement (Ilett 1983, 24).

It has long been assumed that pioneering farmers who arrived by sea must have followed navigable rivers inland in search of hospitable[2] locales (*e.g.* Sherratt 1996). As Chapter 5 will show, vegetation along watercourses was generally different in character and more open than the rest of the largely forested landscape (*contra* Haughey 2016, 110), due to natural agents already present in the Mesolithic, including aurochs and beaver. In time, catchments of watercourses may have become 'territories' (Field 2006, 117-18). Only one probable example of an Early Neolithic boat – an 'expanded' oak[3] dugout, from the mid-40th century BC – has been found in Britain, near the River Vel at St Albans in Hertfordshire (Niblett 2001). At 5.3m long, this was several metres shorter than examples of similar date found at Bercy, on the Seine, which could carry eight people (Arnold 1996; 1998; 2006). The arguments set out by Case (1969b) for the use of hide-covered boats (henceforth termed 'kayaks') for both maritime and inland navigation also remain convincing, despite the lack of surviving examples (McGrail 2007, 445-6; G. Robinson 2013). Objections on technological grounds (*e.g.* Peacock & Cutler 2010) must underestimate the skills of people who routinely worked leather and wood. The shallow drafts of both types of boat

[2] Partly because marine resources apparently held little attraction for them (*e.g.* M. Richards & Hedges 1999; Hamilton & Hedges 2011, 681; Serjeantson 2011, 47-9; Rowley-Conwy *et al.* 2020, 414-5 These dietary studies notwithstanding, large volumes of shellfish were found at Chalk Hill and Mont d'Hubert.

[3] Most Neolithic boats from the European mainland (Robinson 2013; Anderson 1987; Arnold 1996; Glørstad 2013) are also of oak, but people sometimes used lime (light and not prone to cracking) and alder (known for its waterproofness), testifying to the wood- craft of the 'farmer – sailors'.

Figure 4.2a: An alder 'expanded' dugout, dating to *c*.3,500 BC, found in 1945 at Verup in western Zealand, Denmark. At 5.5m long, it is almost the same length as the less well-preserved British example, but considerably shorter than some other European examples. The use of alder, rather than oak, is more common in the Late Mesolithic. Image reproduced by permission of the National Museum of Denmark.

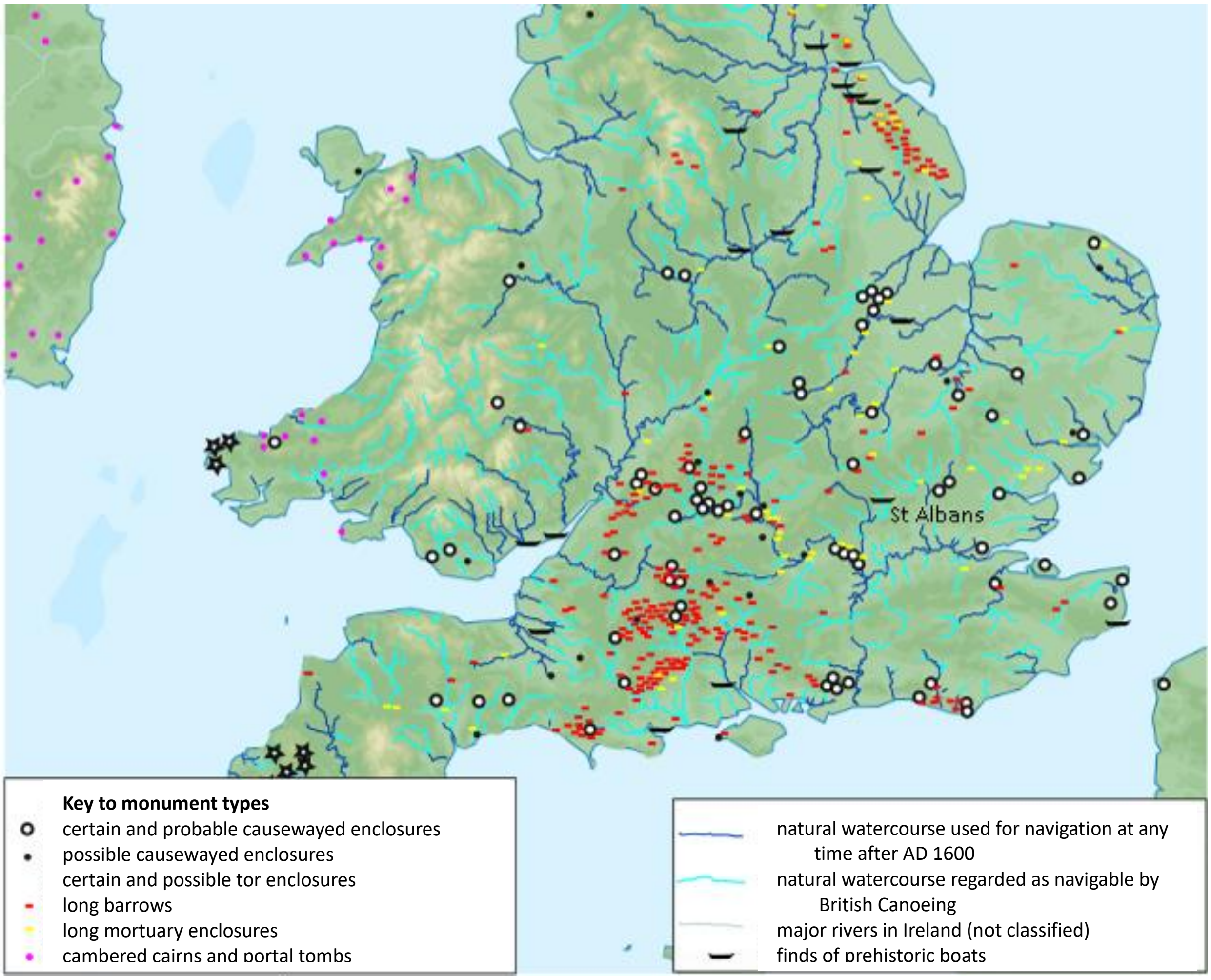


Figure 4.2b: Map showing natural watercourses used for navigation in the post-medieval period, compared with those regarded as navigable by British Canoeing, illustrating the greatly extended reach potentially afforded by small streams to people travelling in dugouts or kayaks. Wholly artificial canals are not shown, but it is likely that some of those largely replicated the courses of small navigable streams. This map is based on research and mapping by CAMPOP (Cambridge Group for the History of Population and Social Structure), available online at https://www.campop.geog.cam.ac.uk/research/projects/occupations/transport/waterways/waterways1947/ and British Canoeing, available online at https://accessmap.riveraccessforall.co.uk/map/rivers/hires.

would enable travel along waterways not classed as navigable today (Oswald & Edmonds 2021, 65). Furthermore, many watercourses were probably deeper and better defined before Bronze Age colluviation (J.G. Evans *et al*. 1988; 1993). Data collected by British Canoeing on the routes considered navigable by its members gives an impression of the access potentially afforded using logboats or kayaks on minor waterways (Figure 4.2a/b). It has long been recognised that many causewayed enclosures lie near rivers and that some could be accessed by boat (Palmer 1976 figs. 1 & 6; Oswald *et al*. 2001, 95-6), but Figure 4.2 shows that almost all Early Neolithic monuments lay close to potentially navigable streams.

Small streams, with slight gradients and trees nearby, are ideal habitats for beavers (*Castor fiber*), which were undoubtedly endemic throughout the Mesolithic and Neolithic, despite their scarcity in the archaeological record (B. Coles 2001; 2006; see Chapter 5.4.4). Beaver dams, typically standing 0.6-2.0m high, probably barred streams intermittently, but by raising water levels, they may also have extended navigability even beyond the limits suggested by Figure 4.2b. Travellers could easily lift kayaks or pivot heavy dugouts[4] over the dams. Where water levels remain reliably high, beavers burrow under riverbanks without building dams, so major rivers would remain unimpeded.

Broad rivers undoubtedly afforded corridors of open sky, while vegetation bordering some smaller streams was perhaps low enough to do likewise. Their courses would be apparent to anyone surveying the landscape from high ground. Yet waterborne travellers themselves must have had restricted opportunities for remote views. Glimpses to either side would be rare, partly due to the low vantage point of boats in which passengers had to remain seated. But straighter reaches of broader rivers, and perhaps smaller streams, would afford prospects along the line of the watercourse itself, either towards monuments in small riverside clearings or, perhaps, to distant monuments in more elevated locations (Figure 4.1b). Sound carries further over still water; for example, talking is audible over 1km away[5], compared to *c*.400m in forest (Trimpop & Mann 2014). Riverside monuments, and settlements such as Runnymede, next to the Thames in Surrey, probably had well-marked landing-places (Needham 2000, 231), which would therefore be visible and audible long before they were reached.

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[4] Longer examples weighed *c.*350kg (National Museum of Denmark 2018).

[5] This is due primarily to the cooler temperature of the water relative to the air: various non-scientific experiments, reported online, indicate that a loud shout can carry for up to 10km on a calm night. Contrary to Haughey's (2016, 115) claim, the flow of the Thames, like many major rivers, is virtually silent.

Figure 4.3a: Reconstruction of a 38th-century BC 'house', one of four or five identified at Horton, Berkshire. Reconstruction by Karen Nichols; image reproduced with permission © Wessex Archaeology.

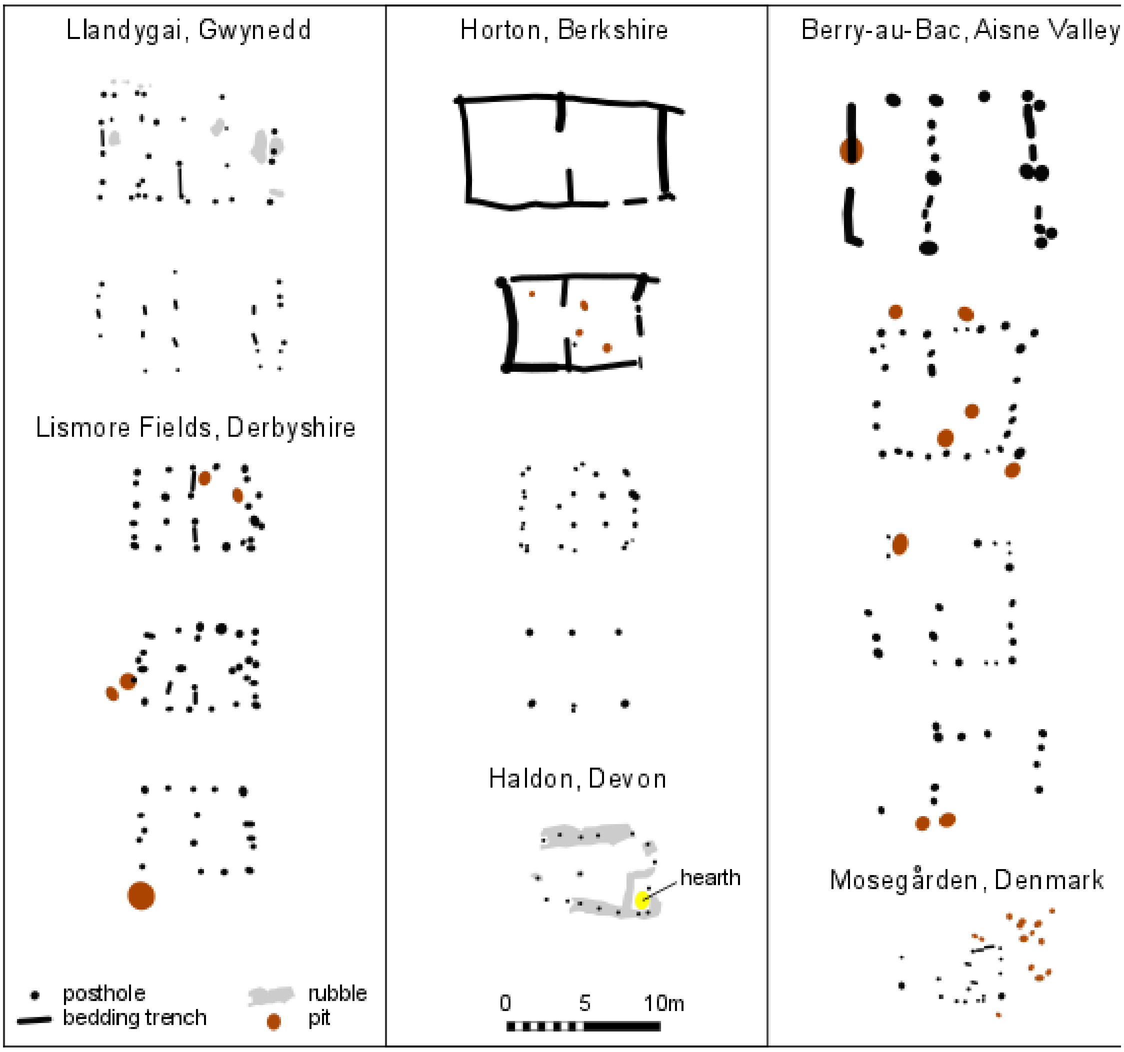


Figure 4.3b: Comparative Early Neolithic house plans. After Kenney 2008, fig. 7; Garton 1991, fig. 1.2; Wessex Archaeology 2019; A. Fox 1964, fig. 5; Dubouloz *et al*. 1988, fig. 11.7; Madsen & Jensen 1982, fig. 4.

4.3 The character of settlement

The phrase 'settling down' is routinely linked to the Early Neolithic. If monuments were designed to be seen from distant settlements or broad territories, then the nature of contemporary inhabitation needs critical re-examination. The population undoubtedly spiked in 4,000-3,300 BC (Woodbridge *et al*. 2014, 219), with Pryor (2003, 158-60) proposing an almost twenty-fold increase from *c.*5,500 in the Late Mesolithic to a maximum in the 38th century BC of *c.*100,000. <u>If</u> – notionally – two-thirds of this number lived in England, and <u>if</u> communities numbered 25 (Barker & Webley 1978, 170), and <u>if</u> these communities were evenly distributed across the landscape, each would have inhabited *c.*49km², an area that comfortably encompasses modern Oxford. In reality, distributions of monuments and pits (representing some form of settlement) suggest that river valleys were more intensively inhabited than elsewhere (Oswald *et al.* 2001, 109-12; Field 2006a, 117-9; Garrow 2006, 26-7; Schauer *et al*. 2020, table 2). Nevertheless, the Early Neolithic landscape was clearly sparsely inhabited, even in the most populous period and the most densely occupied areas.

Since the 1920s, the struggle to identify Early Neolithic dwellings in Britain has fuelled debate about whether people had fixed 'home bases' or moved their abodes around territories (*e.g.* Curwen 1938, 37; Evans & Garrow 2006; Figure 4.3a). If home bases, we might expect remote visual perception to operate in a 'targeted' way, while in the 'no fixed abode' scenario, monuments should be sited and designed to be remotely visible throughout extensive areas. Of course, if monuments related to multiple home bases dispersed across the landscape, or to territories that stretched beyond fixed settlements, their viewsheds might be equally broad. Conversely, single communities might have constructed multiple monuments (Cummings 2017, 113). And, as some of the antiquaries quoted in Chapter 2 noted, monuments were perhaps intended to be remotely perceived by different communities in different ways.

There is sporadic and diverse, but widespread, evidence for buildings in southern England that were apparently sturdy, 'fixed' and potentially just as long-lived as medieval timber-framed buildings (Appendix 1). Some are remarkably close in plan to examples both elsewhere in Britain and on the Continent (Figure 4.3b), suggesting that their designs were more congruent than generally accepted. Communities were apparently small, consisting of a few buildings at most, sometimes clustered together, sometimes dispersed. A range of factors affecting the survival and recognition of this sparse scatter of buildings suggests that many more dwellings may await discovery, or will never be recognized (Figure 4.4a/b). Some – maybe all – the population may, therefore, have dwelled in them for several generations or centuries[6], so that mobility was 'tethered' to dwellings, farmed land and monuments (Whittle 1997; Pollard 1999).

[6] Communities perhaps moved on when an important individual died (Piggott 1954, 92; Noble 2017, 98).

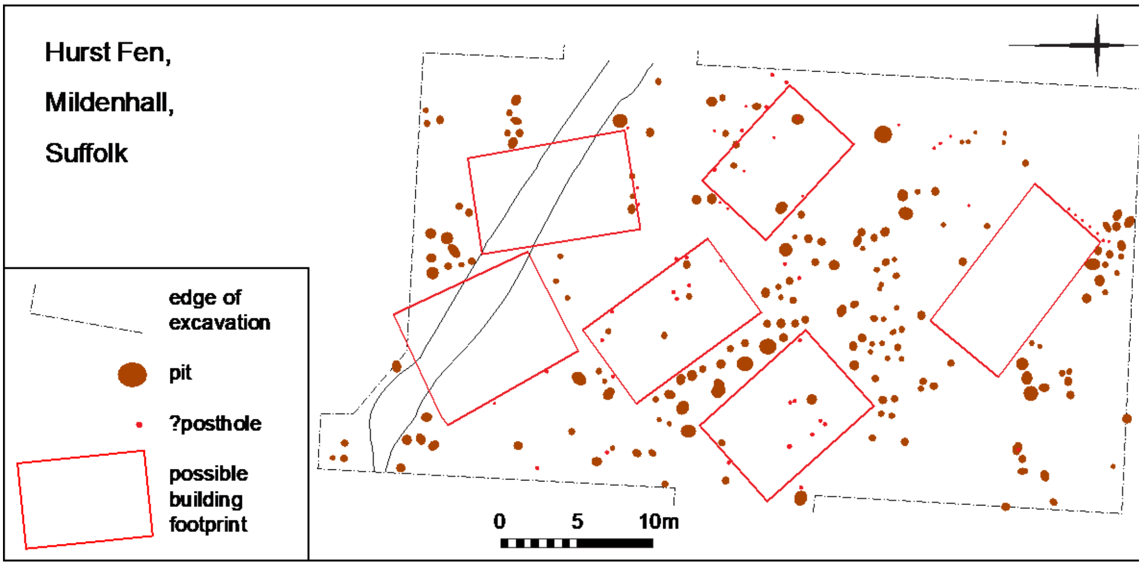
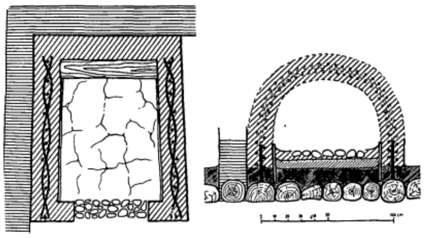


Figure 4.4a: 'Voids' in the distribution of pits at Hurst Fen, Suffolk, perhaps representing the footprints of buildings of similar size and plan to those in Figure 4.3b (Garrow 2006, 55; Bradley 2019, 48 & fig. 2.6; *pace* Bradley 1998a, 10). Clark (1960, 205) accepted that some of the smaller pits might be post-holes (as depicted here), but also suggested that timber-framed houses may have stood on turf sleeper walls. Image based on Clark 1960, plate 26.

Figure 4.4b:
A raised oven from the 43rd century BC lakeside settlement at Aichbühl, south-west Germany. There were concentrations of charcoal and fire-cracked flints at Hurst Fen, but Clark was puzzled by the absence of hearths, a loss which could be accounted for if the hearths were raised. Image: Childe 1949, fig. 6.



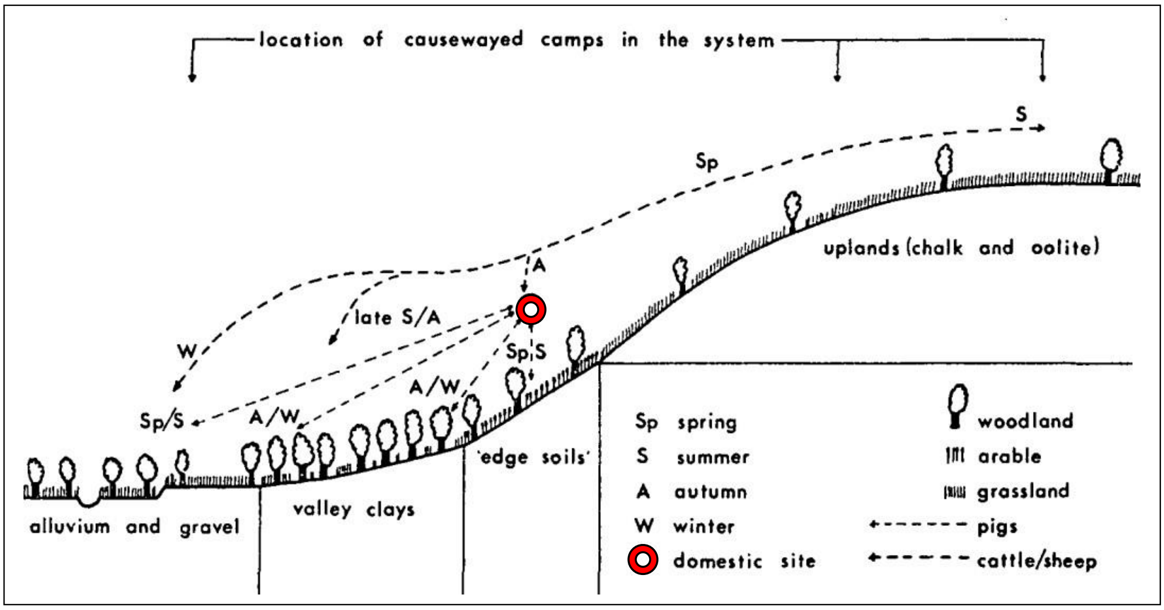


Figure 4.4c: Graeme Barker and Derek Webley's 1978 model of settlement and causewayed enclosure locations in relation to resources afforded by the landscape at different seasons. Though the variation in the physical landscape was schematized, it represented an advance from Renfrew's (1973) purely mathematical model. Image: Barker & Webley 1978, fig. 4.

If inhabitation was essentially sedentary, people would become deeply familiar with particular views. This might support the hypothesis that remote visual perception operated in a 'targeted' way, which might in turn encourage viewshed modelling like that described in Chapter 3. It must be emphasised, however, that even if occupation were very static, spatially and temporally, it would still be unreasonable to infer that remote visual perception was a simple reciprocal operation between two points in the landscape. It is widely acknowledged[7] that the character and extent of mobility within and beyond settled places must have varied between individuals, sections of society, regions and through time, but few accounts progress far beyond this truism. The following Sections and Chapter 6 examine the detail of spatial and temporal variables of the Early Neolithic taskscape, to establish more complex, dynamic and clearly defined models for remote visual perception.

4.4 Mobility in arable cultivation

The Early Neolithic is invariably caricatured as the era of the 'first farmers'. Scrutiny of the practicalities of farming offers another way into the 'home base' *versus* 'no fixed abode' debate, and other mobility issues. Barker and Webley's (1978) model is particularly relevant because it attempts to define the practical requirements of livestock husbandry and arable agriculture as components of an 'integrated system', thus elucidating potential patterns of movement around the landscape (Figure 4.4c). Iversen's (1941) concept of *landnam* ('land-taking') envisaged that incoming groups would have cleared, settled and farmed small patches of the forest, moving on after a few decades when soil fertility declined. This embedded a spatial and temporal dynamism into agricultural practice, on a timescale similar to the socially driven relocations envisaged by Piggott (1954, 92). However, long-term experimental agriculture showed that soil fertility does <u>not</u> decline continuously as Iversen predicted (Barker & Webley 1978, 168; Rowley-Conwy 1981; 1982), inviting the inference that farming was essentially static. The subsequent, protracted debate about the character and intensity of arable agriculture has see-sawed between theoretical poles (Woodman 2000, 219-25; see Appendix 13.1). In contrast, thinking in the 1920s and '30s was more open-minded towards the potential for different forms of farming, settlement and mobility to co-exist. The consensus that eventually emerged was determined to identify regional and temporal diversity in settlement and economic life[8]. A more unfortunate legacy of this compromise is that discussions of mobility in farming, even at the level of individual sites and landscapes, tend to be woolly, as noted above, thus again only paying lip service to the daily and seasonal demands of agriculture. Recent stable isotope studies argue for different scales of mobility (Neil *et al.* 2020, 522-3), but leave distances and timings uncertain.

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[7] For example: Pollard 1999, 81-2; Marshall 2006, 158; Leary & Kador 2016a; Cummings 2017, 84-5.

[8] For example: Barber 1997, 77; Pollard 1999; Bradley 2003, 218; Thomas 2003; 2004; 2007; 2008; 2013; G. Barclay 2009; Edmonds & Seaborne 2001, 47-74; Stevens & Fuller 2012.

Figure 4.5: The traditional rural craft of hedgelaying, generally using hawthorns (*Cratageus monogyna*). Today undertaken mostly for aesthetic reasons and to encourage nesting birds, hawthorn was the original barbed wire. 'Laying' the trees, as opposed to simply pruning them hard, created a barrier with sufficient lateral strength to contain livestock, while also giving some protection to the new shoots. Hawthorn, traditionally known as 'quickthorn' because of its ability to live through this drastic pruning, is also easy to transplant, making it ideal for hedges. Some other species (e.g. hazel; elder) cannot be laid successfully.

Those who believe in 'optimizing' economic strategies, based on sedentary agriculture, have paid most attention to practice (*e.g.* Gregg 1988; Rowley-Conwy 2003; 2004; Jones & Rowley-Conwy 2007; Rowley-Conwy *et al*. 2020). The vision of mobile foraging championed by Julian Thomas (1991) has been dealt a series of body-blows by studies of both faunal assemblages and other dietary indicators[9]. Rowley-Conwy now feels vindicated on all counts, for example stating that 'all the economic activities we can see were restricted to these small clearings' and that 'remarkably little use was made of wild resources' (Rowley-Conwy *et al*. 2020, 414; 416). Even accepting that cereals and dairy products were central to Early Neolithic diet, both these assertions are questionable.

There are good reasons to accept that arable fields would lie adjacent to dwellings, as is usually tacitly assumed, meaning that associated patterns of movement were very localised. First, the tasks involved in cereal cultivation are physically demanding, and ethnographic studies indicate that farmers practicing a 'satisficer' strategy generally dwell within their agricultural taskscape, to minimise effort (Barker & Webley 1978, 168). Second, both the harvested ears and the processed grain are heavy and difficult to transport, making proximity desirable. Third, newly sown and growing cereals cannot be left entirely unattended, for seed-eating birds and mice, rooting boar, nibbling deer, and trampling aurochs[10] could all devastate crops at different stages of growth (Gregg 1988, 133-4). It is doubtful whether fields were enclosed by fences (Lawson 2007, 40) and, in any case, fences less than 1.8m tall would provide negligible protection against red deer. There is slight evidence in the form of L-shaped twigs from the causewayed enclosure at Etton, in Cambridgeshire, for 'laid' hedges (Pryor 1998a, 65; M. Taylor 1998, 147; Figure 4.5), whether deliberately planted or semi-natural. Managed properly, these would provide more protection against red deer and even wolves, but not necessarily against determined boar or aurochs. Yet even if such barriers were used, they are not such effective deterrents as the routine proximity of people and dogs. All this argues that fields were sited close to dwellings in which at least part of the community lived, certainly around sowing and harvest and possibly throughout the growing season, if not year-round (G. Jones 2000, 83).

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[9] For example: Legge 2006b, 311; Serjeantson 2011; see also Murray 1970, 72; M. Richards & Hedges 1999; M. Richards *et al*. 2003; Schulting 2008; M. Richards 2008; Hedges *et al*. 2008; Hamilton & Hedges 2011, 681; Bogaard *et al*. 2007; Bogaard *et al*. 2013; Rowley-Conwy *et al*. 2020.

[10] In 1602, Conrad Gessner (quoted in Vuure 2005, 217) noted that 'In summer, they [aurochs] leave the forests and go into the fields and devour the harvestable grain and when they are satisfied they throw the rest apart with their horns, unless they can be chased away by dogs.'

Figure 4.6a: Photograph of a pastoralist encampment in a woodland clearing in Morocco, first published in 1932. For Curwen and Crawford, the ring of inward-facing tents, with the intervening gaps blocked by stock-proof barriers of brushwood, reinforced the links between causewayed enclosures and semi-mobile pastoralism, and between ditch segments and 'pit dwellings'. Image: Crawford 1933, fig. 1.

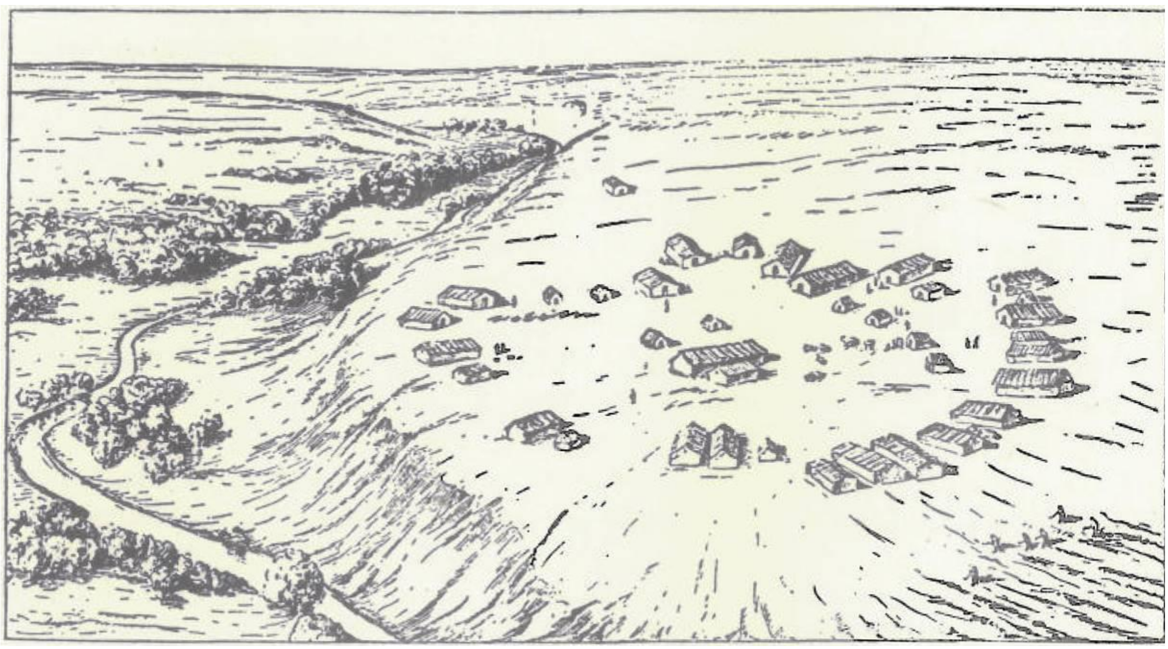

Figure 4.6b: Reconstruction of a Neolithic settlement in the province of Kiev, Ukraine, comprising a ring of inward facing buildings surrounding a central space interpreted as a corral. When news of the discovery reached him in 1936, Crawford (1937; 1953, figs. 21 & 22) immediately drew parallels with causewayed enclosures. Image: Childe 1950, fig. 81.

4.5 Mobility in livestock husbandry

Rejection of economic determinism from the 1980s onwards shifted interest towards the long-recognised symbolic and religious importance of animals, particularly cattle[11]. It is worth observing, in passing, that although sheep were present in significant numbers in the Early Neolithic, they barely figure in discourse about non-economic values, perhaps because cows live twice as long, and humans generally find them more 'relatable' for a range of reasons (Cows Foundation 2019). Some see the herd as an embodiment of human genealogies[12] and non-marital alliances, and thus so intimately linked to particular families or communities that they became a form of 'inalienable' wealth (Edmonds & Seaborne 2001, 50-2; Ray & Thomas 2003, 41; Orton 2010; N. Russell 1998; 2012, 311-20). The deliberately structured linking of human and cattle remains suggests some symbolic equivalence (Whittle *et al.* 2000, 360; Pollard 2006; Field 2006a, 4; 8). Such post-processual approaches are valuable in this context because they suggest that Neolithic herders were not merely hard-hearted exploiters of livestock but would have tended them with care and affection. Arguably, however, aspects of practice and temporality relating to livestock management, to which early archaeologists paid close attention (Figure 4.6), have been neglected by post-processualist approaches, despite explicit aspirations to investigate such issues (Miracle 2006, 63-4).

Firm evidence is now available for manuring to increase soil fertility, a practice long suspected on the grounds of 'common sense' (Bond *et al*. 1995, 127; Bogaard *et al*. 2013). Rowly-Conwy *et al*. (2020, 413-4) point to the same experimental data adduced by Barker and Webley 50 years earlier to prove that manuring increases cereal yields by 200-400% and therefore <u>must</u> have been practiced from the moment communities arrived in Britain, in view of their precarious food security[13]. Their calculation of the volume of manure required explicitly envisages a herd of cattle being present throughout the year in the same clearing occupied by arable fields and dwellings.

The community's bull (or bulls, if younger males were raised in reserve) might stay near the dwellings for most of the year. The bull would certainly need to be with the cows during the 45-60 days in April and May when mating would ensure spring births. Any oxen used by the community for transport and/or traction might also be kept near the

[11] For example: Thurnam 1869, 182-3; W. Cunnington 1889, 105; Ingold 1986, 168; J. Thomas 1999, 28; Edmonds 1999, 27-8; Edmonds & Seaborne 2001, 49-54; M. Richards 2003, 35.

[12] Bridewealth was perhaps a key mechanism by which female hunter-gatherers may have been subsumed into the immigrant farmers' alien way of life, while their kin were rapidly impelled to become consumers and eventually tenders of livestock (N. Russell 1998), a switch described as 'incomprehensible and counter-intuitive' (M. Richards 2003, 32-3). Though it presupposes a desire to integrate on the part of both natives and immigrants, this argument seems more sophisticated than Julian Thomas' (2013, 67) suggestion that the production of a new high-status foodstuff may have proved irresistibly attractive to the natives.

[13] In contrast, Gregg (1988, 64-5), despite her similar theoretical standpoint, argues that after an initial decline in fertility, the level at which the yield stabilised would have been high enough for manuring to be unnecessary, if an equal area of land was left fallow.

Figure 4.7: A pair of ewes kept for making sheep's-milk cheese, central France. In the context of an enclosed field like this one, the traditional bell is used primarily to alert the owners to attacks by wolves.

dwellings unless required elsewhere. A flock of sheep and/or goats might also be present throughout the year[14], for various reasons (Gregg 1988, 200). To begin with, ovicaprids take in enough water from what they eat, so never need to be taken to water sources; they are less vulnerable to predators in proximity to settled areas (Figure 4.7); their milk is more palatable than cow's milk to infants and small children, who were presumably amongst the least mobile social groups; physically weaker people, who may have been less mobile for a variety of reasons, would find them easier to manage than cattle. Sheep manure is also more than three times richer in nutrients than cow manure and, when fresh, is easier to collect and move (GardeningOn 2018). Indeed, in the early stages of cereal growth, farmers might briefly graze their sheep (being lighter than cattle) on the young plants to prevent 'lodging' *i.e.* the eventual collapse of over-tall stems (Halstead 2006, 49), in the process directly manuring the crop.

Once the cereal harvest was complete, in late August or September, cattle could be loosed onto arable fields[15] to graze the ground bare of stubble and weeds, whilst also manuring the land (Barker & Webley 1978, 174; Rowley-Conwy 1981, 91-5; Fenton 1981; Halstead 2006, 46). Cereals were probably cut just below the ear, leaving long stalks to be browsed (F. Kelly 2000, 46). As winter approached, the nutrition available on arable land would diminish to almost nil and the continued presence of livestock would start to compact the soil to the detriment of future crop growth. Therefore, since Rowley-Conwy rejects the possibility that much use was made of forest browse, his scheme necessitates fields of summer pasture, plus some means of feeding the stock through the winter, all of which he insists lay within the same clearing.

Some argue that cattle in the British Isles would not need to be stalled through the winter, because the climate was mild enough and the surrounding forest would adequately shelter animals who also enjoyed the protection of shaggy coats (*e.g.* Schulting 2008, 97; Serjeantson 2011, 14; 19). However, the proposal that livestock could straightforwardly find sufficient winter browse (Trow-Smith 1957, 14; Serjeantson 2011, 14) is questionable. Cattle would quickly consume whatever evergreen leaves and thinner stems existed nearby, but, with predators at their most desperate in winter, could not be left to stray without close supervision. Solutions to this problem are discussed in Chapter 6. Even if there was no routine need for stalls, it remains plausible that small numbers of cows – perhaps those carrying calves – were stalled inside dwellings[16] (Sakellaridis 1979, 171; Troels-Smith 1960, 9-10; Kinnes 1988, 5), if only in the harshest winters. Tightly stalled, a cow takes up little more space than its own body (Popescu *et al.* 2013).

[14] That said, the only stable isotope study undertaken – of a single sheep – could not distinguish it from either a cow or the associated human community in terms of its mobility (Neil *et al*. 2016, Fig. 2).

[15] Historically, such fields were called 'half-year' or 'average' lands (*e.g.* Oswald & Pollington 2013, 46-51).

[16] In Britain, this practice persisted into the 20th century (*e.g.* Jessop *et al.* 2013). A recent study of byre-houses has played down the pragmatic motivations usually given for sharing space, arguing that seasonal co-habitation was a symptom of families' pride and affection for their cattle (Gardiner 2014, 158).

Figure 4.8a: Generalized growth curve for a wide range of grasses growing under normal conditions, showing the negligible growth rate between the end of October and mid-March, based on data from the Grassland Research Institute in Berkshire. These dates can be refined through analysis of the Nature's Calendar data (see Table 6.4). Note the bimodal trend, with a secondary peak in August *i.e*. immediately after the traditional hay harvest. Image: Wells 1974a, fig. 7.2.

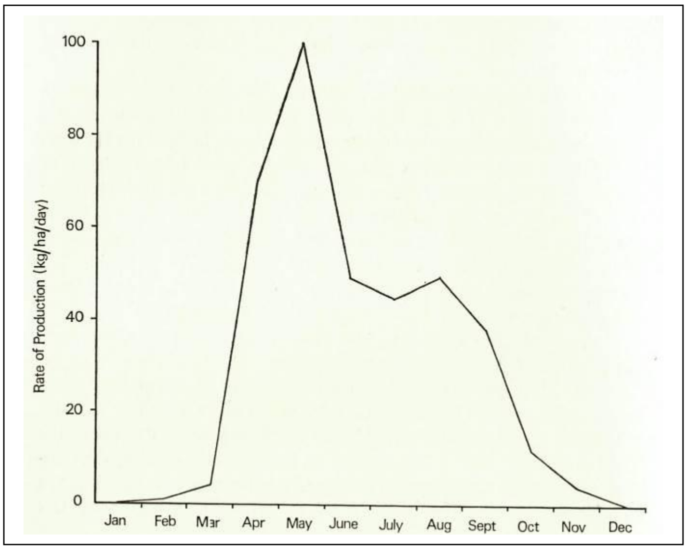

Figure 4.8b: Severe poaching (*i.e.* damage to the sward and underlying soil) around hay feeders at the end of March, produced by a herd of 20 cattle left out over the winter. On the current thin downland turf, this will take several years to recover fully. Combe Hill causewayed enclosure is visible in the background.

Cattle require 0.5-1.0ha of grazing land each (Seavey & Porter 2009); the higher figure seems reasonable for the Early Neolithic, since rough grassland is less nutritious than modern pasture, but Neolithic cattle probably had smaller nutritional requirements. Grass in northern Europe grows at a negligible rate between late October and mid-March, regardless of weather (Fig 4.8a). For Neolithic pioneers, arriving with a few livestock from continental Europe, and for groups which moved away from early foci, small clearings with herb layers or natural riverside meadows near their dwellings, coupled with leaf fodder (see Chapter 6.7), would perhaps see them through the first few winters. But as herd sizes increased over the decades leading up to long barrows and causewayed enclosures beginning to be built, it seems very unlikely that the restricted grassland available within a single clearing would be sufficient, even allowing for expansion in its extent. Over-wintering cattle in small paddocks or meadows near winter quarters is unsustainable, even in the short term with moderate numbers of stock. On damp ground, 'poaching' will impede or totally prevent the regrowth of grass the following spring (Wells 1974b, 182-3; Van Bysterveldt 2009; Figure 4.8b). Dung, which breaks down slowly in winter, will also accumulate to toxic levels, further impeding regrowth (Dick Haigh, livestock farmer, pers. comm.). Mayo's Ceide fields – exceptionally – appear to have offered sufficiently large expanses of established grassland for cattle to be moved frequently from one area to another year-round, but these were not laid out until the first half of the 3rd millennium BC (Caulfield 1978; 1983; Cooney 1997, 28).

Piggott (1954, 92) thought that sheep and cattle strayed over wide areas to find food, requiring little mobility on the part of humans, but this scenario,[17] is implausible, for reasons detailed in Chapter 6. Societies around the world have found a solution in 'transhumance': the practice of driving livestock away from 'infield' pastures for the duration of the growing season, allowing the grass around the winter quarters to be harvested in July to early-August, dried and stored as winter fodder (J.G. Evans 2003, 172-200). Recent stable isotope studies provide some support for this pattern of mobility (Neil *et al.* 2016). Some have doubted whether hay was produced on any significant scale in the Early Neolithic (*e.g.* Trow-Smith 1957, 14; Gaillard *et al.* 1994), but the view that it <u>must</u> have been, based once again on the presumption of economic optimization, has won through (Gregg 1988, 108; Lambrick & Robinson 1988, 72; Barclay & Hey 1999, 71; Halstead 2006, 50). With the hay stored, the infield meadows, like arable fields, could be grazed for as long as the weather and/or condition of the pasture permitted, as a means of saving the stored fodder as long as possible in case of a harsh winter and/or late spring.

Sceptical scrutiny may be overdue, however, because the practicalities of harvesting hay are challenging. Hay, unlike cereals, needs to be cut as low to the ground as possible, making it difficult, back-breaking and time-consuming to cut large quantities with flint

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[17] Piggott perhaps drew on contemporary understandings of medieval upland vaccaries (*e.g.* Trow-Smith 1957, 107-8), although Hoskins (1958) criticized Trow-Smith for under-playing the importance of cattle.

Figure 4.9: A field of foggage, photographed in early March. Over the previous summer, the grass was left to grow long and then die off naturally, offering a form of low-nutrition winter fodder. Knap Hill causewayed enclosure is visible in the background.

sickles. Uneven ground, the norm in forest clearings, would make the task even more awkward, perhaps implying a close interplay with arable cultivation, which would gradually level the ground. Early medieval Ireland[18] offers an alternative scenario that does not invalidate the suggestion that transhumance was practiced. Hay was not made, but families drove their cattle to summer pastures and maintained an infield of 'foggage', called 'preserved grasslands' in the Irish documents (Figure 4.9). Foggage has much lower nutritional value than growing grass or hay, so the rare winters when deep snow covered the ground invariably proved disastrous (Wells 1974b, 184-5; Kelly 2000, 45-7). If this was the main form of winter fodder used in the Early Neolithic, the need for supplementary nutrition in the form of 'leaf fodder' would be greater. As discussed in Chapter 6, gathering this probably led people to move beyond the clearings, thus exploiting wild resources (*contra* Rowley-Conwy *et al*. 2020, 416; 414).

In a mixed farming regime, an essential corollary of transhumance is the distancing of livestock from crops, including hay, through the growing season. These might otherwise prove irresistibly tempting; incursions by livestock, just as by wild animals, could prove disastrous for the harvest and thus the next season's sowing (H.S.A. Fox 1996, 2-3). In the doubtful event that fences were used (Lawson 2007, 40), there would be a considerable requirement for wooden posts and rails, which could be obtained most effectively by coppicing near the clearing (J.M. Coles 1976a, 63), arguably another use of 'wild' resources outside the clearing. Alternatively, hedges would have the added advantage of offering extra browse.

In summary, there is a strong case for accepting the long-held belief that livestock husbandry would require forms of mobility that took at least some of the community away from the familiar views afforded by the arable taskscape. The next two chapters investigate whether these journeys would afford opportunities for remote visual perception in practice.

4.6 The spatial extent of a 'home base'

Wild plants seem to have contributed relatively little to diet and wild animals even less (Rowley-Conwy *et al*. 2020), so only farmed resources are relevant when considering of the sizes of clearings utilized. Barker and Webley (1978, 170) estimate that *c.*4ha of good arable land, or *c.*6ha poorer land, would feed a community of 25, allowing 0.45kg of grain per person per day. However, they overlook the need to grow an extra 20-30% for use as seed (Gregg 1988, table 35). This brings the figure closer to the 8.75-10.0ha that Gregg's calculations would indicate for a community of the same size (*ibid*., 137-45; Figure 4.10).

[18] M. Gardiner's (2012, 109) protest that '…the patterns of rural Ireland in the 18th or 19th centuries [are] projected backwards to provide evidence for a distant and unchronicled Gaelic past' is relevant here. However, he neglects to discuss the detailed chronicles provided by the early medieval Irish law texts and other documents, which do prove that a similar pattern of transhumance was in operation at that time.

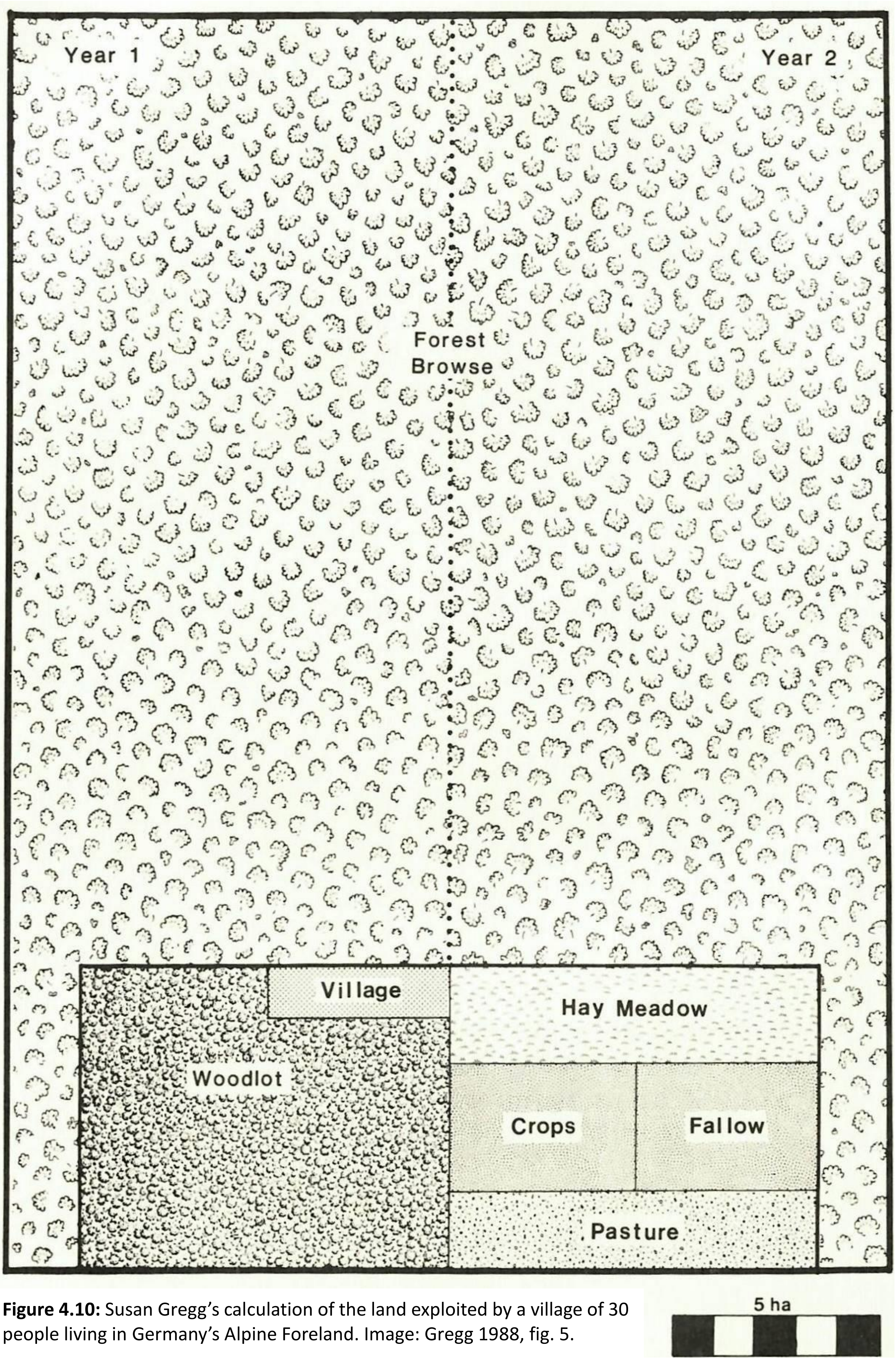

Figure 4.10: Susan Gregg's calculation of the land exploited by a village of 30 people living in Germany's Alpine Foreland. Image: Gregg 1988, fig. 5.

Assuming the cultivated area was circular (as a heuristic device), with a margin of 3m along the forest edge, Barker and Webley's lower estimate (revised to allow for seed) would require a clearing 255m in diameter and Gregg's upper estimate 360m. These estimates of area, however, are based on unfertilized soil; manuring could reduce the area of land needed by 50-75%. Using 19th-century records, Rowly-Conwy *et al*. (2020, 413) argue that the annual manure output of one cow would fertilise 1ha. This estimate is approximately half the quantity used by modern farmers and contains some problematic assumptions about how the manure was gathered. If correct, the same community of 25 would require only 1.25-5.0ha of arable land, depending on soil quality, fertilised by 2-6 cattle, and needing a clearing only 130-255m in diameter to contain the arable.

Much therefore depends on livestock numbers. Gregg (1988, 103-9) and Bogucki (1988, 85; 87-8) concur that a herd of 30-50 cattle is optimal to be self-sustaining. Bogucki's argument that smaller herds would not be viable relies on his optimizing theoretical standpoint and his premise that each community would be self-sufficient, without access to external sources of new stock. The earliest pioneer communities perhaps placed themselves in exactly this difficult position (Legge 1989, 233), yet it seems implausible that they could transport 30 cattle per family by boat. Some generations later, gatherings at causewayed enclosures probably facilitated stock exchanges (Schulting 2008, 97-8).

Gregg (1988, 165) reasonably concludes that a 'household' in the Alpine Foreland kept 5-6 cattle, of which 2-3 were milk-cows, plus a similar number of ovicaprids. In medieval Ireland and the West Country – *i.e.* environments comparable to southern England[19] – families kept 5-10 cattle (A. Lucas 1989; Herring 2012, 94), while Wordsworth (1810) recorded that 2-3 milk-cows sufficed to supply the dairy needs of a Cumbrian family. Herd size might fluctuate through the year in response to feed availability, remaining at a maximum through the summer before being reduced in autumn through selective slaughter, to the highest level that the winter fodder supply was expected to support (Piggott 1954, 28-9; Legge 1981). But calculations in this purely economic mode underestimate the degree to which herd size would reflect the status of the community.

Ovicaprids are less challenging to feed through winter. They are hardier and do less harm to pasture through poaching in winter conditions, so could feasibly remain outdoors[20]. To feed a sheep outdoors year-round requires *c.*0.2ha of pasture, so a herd of 30 sheep would need 6ha of pasture. As with cattle, this requirement could be reduced to as little as 0.04ha per animal by careful use of weedy arable land and nearby forest browse, or by transhumance, so that the herd would only need 1.2ha.

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[19]For East African pastoralists heavily reliant on milk products, 50-64 animals can sustain a family of six (Dahl & Hjort 1976, 175-6; Hjort 1980; see also Dyson-Hudson & Dyson-Hudson 1970, 111-3; Dombrowski 1993, 27), but this is clearly not an appropriate comparison (C. Evans 1988b, 94).

[20] Despite this, ovicaprids <u>were</u> stalled at numerous settlement sites in Switzerland (Sakellaridis 1979, 172).

Figure 4.11: Traditional 'beehive' haystacks in Romania.

The larger examples, *c.*6m tall, are based on a layer of branches to allow aeration and built up around a pyramidal frame.

Smaller stacks may be constructed around a single upright pole; the hay is carried to them on 'stretchers' and pitched up onto the top of the stack with long-handled forks.

The surface of the stack is raked downwards to form a 'thatch', with a 'wreath' around the central pole to stop rain entering at that vulnerable point. To preserve the 'roof' as long as possible, the hay is dug out from all sides, eventually producing a characteristic apple-core shape. Where livestock continue to graze the field, the stacks must be fenced.

Like clearance cairns, stacks are constructed at intervals suited to the volume of hay produced by the land. Note the small cultivated plot amongst the hay meadows.

Images from Kuriositas. (2016). *The Art of the Romanian Haystack*. http://www.kuriositas.com/2013/09/the-art-of-romanian-haystack.html.

In the Middle Ages, mature cows (including those carrying calves) were fed *c.*6.8kg of hay each per day through Winter (Trow-Smith 1957, 117), meaning that a single cow would require *c.*1 tonne between mid-November and mid-April. This modest figure is just over half the 20th-century quantity of 13.3kg per mature animal per day on which Gregg (1988, 108) bases her calculations, and seems convincing[21]. 19th-century statistics indicate that Trow-Smith's figure equates to the product of 0.25-0.5ha of well-managed meadow, mowed using a scythe. Given the issues with hay mowing mentioned above, the larger area may be more realistic, meaning that a herd of 30-50 cattle would need 15-25ha of meadow[22]. Gregg's (1988, 108) suggestion, based on Ellenberg's (1952) records, that 1 tonne could be harvested from 0.68ha of natural riverside meadow seems plausible and she concludes that a herd of 40 cattle would need 19.66ha of this resource (Gregg 1988, 167). Of course, this demands that riverside meadows were not being exploited for summer grazing; it also assumes that they were much closer to the 'home base' than Barker and Webley's model predicted, for moving 30 tonnes of hay uphill for any distance would be demanding, to say the least.

In summary, the requirement for paddocks for cattle and sheep, and probably meadows to provide winter fodder, greatly increases the size of the clearing needed for arable cultivation. Gregg (1988, 165-7) concludes that a village of 34 inhabitants, with 40 cattle and 40 ovicaprids, would need 55.54ha, translating into a circle 845m in diameter. Using Barkey and Webley's preferred community of 25, inhabiting smaller buildings with fewer outbuildings, keeping 30 cattle and 30 sheep, and factoring in manuring of arable, greatly reduces the figure, to 18ha (of which c.85% would be meadow). This translates into a circle only 485m across, less than half the diameter of the clearings postulated by Allen (Richards & Allen 1990, fig. 155). It seems likely that the pioneers who first travelled to Britain with embryonic herds and flocks were even smaller than the numbers used here and, therefore, could inhabit smaller clearings. As with the population estimate above, these figures can only serve as crude indications, for it goes without saying that no clearing was perfectly circular and that all clearings undoubtedly changed in extent over time, though not necessarily in direct proportion to changes in population size.

[21] In the harsher conditions of Romania, however, one cow will eat c. 4 tonnes over the winter, hay fodder being required well into May (A. Nicolson 2020).

[22] Each tonne of hay would take up 12–15m^3 of storage space, most likely in the form of one traditional 'beehive' haystack (Countrywide Farmers n.d.; One Scythe Revolution 2010; Figure 4.11)

Figure 4.12: Hay-making in progress in Romania in August. Most farmers here have 2-3 cows *I.e.* the same figure used in the estimates above. Mowing (with scythes) traditionally begins on St John's Day (24th June) and can take up to a month to complete. Once dry, the hay has to be gathered in and stacked quickly; this, no less than the arable harvest, is a physically demanding task which demands the participation of whole families. Image from Kuriositas (2016) *The Art of the Romanian Haystack*. http://www.kuriositas.com/2013/09/the-art-of-romanian-haystack.html.

4.7 Summary: mobility and remote visual perception

This chapter was required to re-establish a baseline understanding of the ways in which people experienced their world through moving on, moving around, and staying put. Key points to emerge are that travel along inland waterways was potentially more important than previously acknowledged, although this mode of travel probably afforded quite specific remote views, usually restricted to the line of the watercourse itself. The sparsity and consequent isolation of inhabitation around the landscape has been underlined. The limited degree of movement arising from arable cultivation is also evident, meaning that in some topographic settings, farmers would usually see no further than the eaves of the clearing that encompassed their arable taskscape.

The concept of the 'home base', prevalent until the early 1990s, has fallen into disuse as post-processual academics have distanced themselves from perceived environmental and economic determinism. Scholars of the older school, with its optimising theoretical standpoint, can justifiably be accused of turning prehistoric life into a mechanistic agenda, without space for error, mishaps, or behaviour driven by anything other than pragmatism. Yet the same scholars were also determined to explore the details of Early Neolithic people's everyday practical engagements with their world. By contrast, scholarship since the early 1990s sometimes appears to have lost touch with these realities, reflected in an apparent unwillingness to go beyond proclaiming diversity of practice. Pryor (1997) has castigated ignorance of the realities of subsistence farming, but there undoubtedly <u>was</u> diversity of practice: the experience of being a part-time Lincolnshire sheep-farmer is not universal. At least one stable isotope analysis (of the 14 adults and 4 sub-adults buried in Hazleton long barrow in Gloucestershire) seems to support the idea that the diet of the sampled individuals – though not necessarily the mobility pattern for the whole community – revolved around two separate parts of the landscape, recognizable because their geological signatures were distinct from each other (Neil *et al*. 2016). One of these places seems to have been the environs of the long barrow, while the other, estimated to be c.40 km away, could equate to a home base. Re-evaluation of optimizing calculations made before 1990 produces a plausible estimate of 18ha for the home base of a community of 25 *i.e.* the area occupied by their dwellings, arable land, hay meadows and pasture. This would translate into a circular clearing less than 500m in diameter. Clearly, neither the number of people nor the hypothetical area can be considered a stable or standard 'unit of settlement'. However, while a community of half that number or even less, inhabiting a much smaller clearing, would not be unexpected, a community much larger than 50 would be.

So, would a clearing of this size allow people to see beyond the perimeter of the clearing itself, either 'from their doorsteps' or in the course of their routine patterns of movement? As Figure 4.13 demonstrates, the answer depends not only on the height of the surrounding forest – which will be explored in Chapter 5 – but also on the topography.

Figure 4.13: Photograph of Combe Hill from 1.8km to the north, taken in late March. The intervening land is a plausible location for Early Neolithic settlement, located on level ground between two minor streams. The viewpoint is 100m north of the relict hedgeline. Few of the oaks in the hedgeline are more than 15m high and only the ivy retains its leaves through winter, so the profile of the hill is clearly detectable. But the uppermost branches of the small oaks make it difficult to pick out detail.

If the home base was located on approximately level ground, and the surrounding topography was also level or only slightly varying, no amount of movement within the clearing would afford views beyond its perimeter. On the other hand, if the clearing included sloping ground, or lay close to much higher ground, remote views might be available, though perhaps not from every part of the clearing. Indeed, in some settings, even a clearing only 125m in diameter, less than 1.5ha in area, might afford remote views. It is, therefore, legitimate to argue that many home bases routinely afforded the inhabitants a suite of distant views. Clearings of this size could also be picked out easily by anyone surveying the landscape from an elevated viewpoint, such as a long barrow or causewayed enclosure, as long as they themselves were not surrounded by forest.

This summary began by expressing a generally supportive view of ‘old school’ interest in pragmatism and the realities of rural life. The critique of Rowley-Conwy *et al*. (2020) may seem to run counter to this, since Rowley-Conwy is a long-standing believer that pragmatism governed farming practice. His conclusion that a community’s farming activities were confined within a single clearing (*ibid*. 414), may be valid for arable cultivation, but seems unlikely, at best, for the management of livestock, particularly dairy cattle. Ultimately, his determination to discount mobility in livestock husbandry seems to be part of his sustained attack on Julian Thomas’ position, including the theory that 'movement between seasonal pastures will have provided one of the defining rhythms of life' (Ray & Thomas 2003, 39). This may, however, be an instance of ‘throwing the baby out with the bathwater’, for the well-rehearsed arguments for transhumance remain strong. However, the issue runs still deeper, for Rowley-Conwy *et al*.’s (2020, 416) claim that communities made negligible use of wild resources seems implausible in the context of a mixed farming regime, which probably exploited natural meadows, forest browse, and coppiced wood. This is not to mention the potential for diverse non-dietary uses for wild plants and animals, an issue about which the authors remain silent.

Cutting-edge science has demolished key pillars of post-processual thinking about the Early Neolithic, but now the challenge is to control the theoretical pendulum before it swings back to wholly functional interpretations. This chapter has addressed the problems Pryor identifies by giving greater precision to the modes, scales and purposes of movement around the landscape, particularly the farming taskscape. Chapters 5 and 6 will explore the patterns, scales and tempos of movement through which people involved themselves in the wider landscape.

Chapter 5. Forest and its uses in the Early Neolithic

Could we but have flown over Neolithic Europe, it is possible that we might have failed to observe that patches of the endless forest were in fact being utilized by small, scattered communities of farmers.

- Grahame Clark (1945, 67)

5.1 Introduction

Chapter 2 demonstrated that the limited understanding of the Early Neolithic environment presents serious methodological challenges for research into remote visual perception. Forest remained an imposing and widespread presence throughout the period, even if intermittently managed and constantly undergoing seasonal change (Austin 2000, 65; 75; Cummings & Whittle 2003, 255-6; Evans & Hodder 2006, 13; Noble 2017, 1-2). While the Neolithic heralded more intensive tree clearance for settlement, arable cultivation and grazing (*e.g.* G. Clark 1945; 1947; Farrell *et al*. 2020), and perhaps other reasons (*e.g.* A.G. Brown 2000; Williams 2006, 14), scholars agree that its extent at any given place or time is simply unknowable[1]. Debate continues about the size and duration of clearings, and the means by which clearance occurred.

Palaeo-environmental data[2] from excavated features offers localized, temporally restricted insights (Allen & Gardiner 2009, 50). Axe distribution is not a proxy for clearings, since axes were not only, or normally, used for felling trees (L. Larsson 2011; Roy *et al.* 2023; *contra* Piggott 1954, 9; Noble 2017, 18; 45-68; Healy 2020). Conversely, Mike Allen (2000a, 16) suggests that areas lacking evidence for Neolithic activity were forested. Both theories underplay variations in the effectiveness of different prospection techniques, and the fact that today's woodlands are themselves under-researched.

Detecting diachronic change in the environment is a key issue, especially in the context of the increasingly precise chronologies available for the Early Neolithic. Reports on individual sites and monuments tend to extrapolate from a few samples to arrive at fairly coarse pictures of the environment, usually comprising at most three phases. Yet environmental conditions at the outset of the Neolithic may have changed significantly by the time the first burial monuments were built, followed up to eight generations later by the first causewayed enclosures. Likewise, the condition of the environment as it pertained at the start of the construction of any individual monument might be transformed by the time its use ceased.

[1] *E.g.* Tilley 1994, 73; A.G. Brown 1997, 133; Fisher *et al*. 1997, 587; Austin 2000, 65; Garrow 2006, 15.

[2] The evidence comprises *Mollusca* in dry conditions and pollen in damp and, to lesser degrees, *Coleoptera*, preserved plant remains and seed impressions. Useful summaries include: Osborne 1978; Robinson 2000a; Allen 2000a, 11-12; Allen & Gardiner 2009, 51-55; Whitehouse & Smith 2010.

Figure 5.2a: Białowieża Forest, in eastern Poland. Image: Wikimedia Commons.

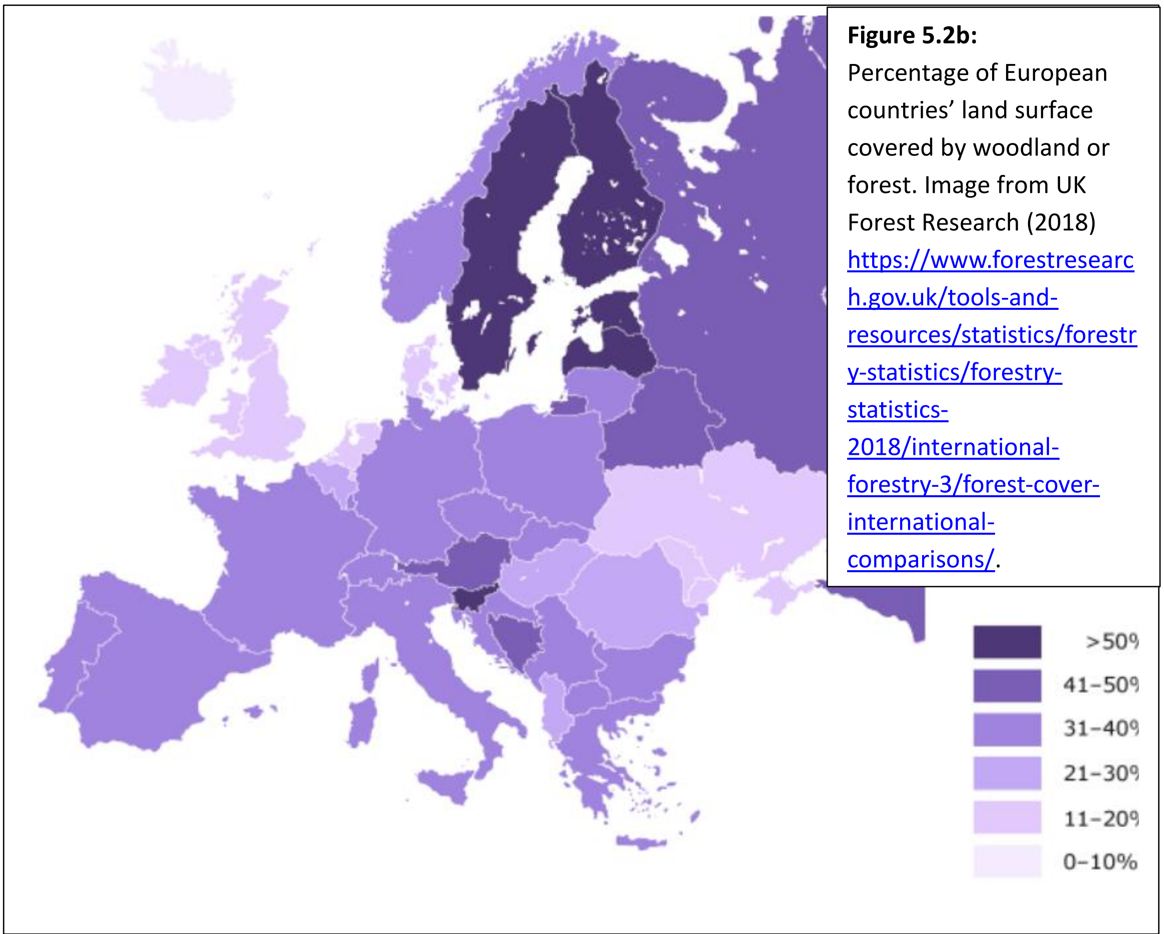

Figure 5.2b: Percentage of European countries' land surface covered by woodland or forest. Image from UK Forest Research (2018) https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2018/international-forestry-3/forest-cover-international-comparisons/.

Presence/absence has preoccupied most studies, but the challenge posed by our patchy understanding of the Neolithic environment runs deeper. Although France, Germany and Poland are all more wooded than the British Isles, few western European academics have experienced dwelling in forest[3]; it therefore constitutes an 'arena of the unfamiliar' (Bailey & Whittle 2005, 3; Noble 2017, 70; Figure 5.1a/b). Consequently, most scholars present forest as a homogenous background, to be dealt with as succinctly as possible (*e.g.* Haughey 2009, 143-5). Accordingly, Neolithic people are thought to have conceptualised it in a similarly basic way (*e.g.* Whittle & Pollard 1999, fig. 227). Noble's (2017) more in-depth study of forest is mainly concerned with its metaphysical qualities, so treats both physical diversity and the practices of forest-dwellers rather sparingly, partly because it draws largely on archaeological literature. The widespread lack of empathy for the day-to-day experience of being in forests is analogous to academia's 'disconnect' from the realities of farming, lambasted by Pryor (1997).

Discoveries of spectacular waterlogged artefacts of Mesolithic and Neolithic date (Coles *et al*. 1978; Brunning 2003; Williams 2006, 600) show that knowledge of forest resources and woodworking was crucial in everyday 'Stone Age' life (*e.g.* Kennard 1955, 9; Noble 2017). Yet better-preserved inorganic artefacts invariably overwhelm discussion (Coles *et al*. 1978, 1). This in turn perpetuates an impoverished picture of forest life (C. Evans *et al*. 1999), reinforcing a polarized perception of clearings as places that were intensively managed, used and socialized, with forest representing the opposites (Tilley 1994, 23). Forest was undeniably home to wolves, bears, boars and other dangers (Boyd-Dawkins 1921, 256; Tansley 1939, 163). But we risk back-projecting anachronistic perceptions of forests as dark and dangerous 'outlands' (*e.g.* Topping 1997b, 119; J. Richards 2013[4]) onto what must actually have been deeply significant, economically important and wholly integrated elements of lived landscapes[5].

Understanding how people experienced both clearings and forest through routine life will offer firmer foundations for understanding how they perceived the remote views that the environment occasionally afforded. This chapter, then, explores the character of forest around the outset of the Neolithic, and the processes, both natural and anthropogenic, by which clearings may have developed. Its aim is to advance as far as possible beyond generalizations in order to address three questions in relation to remote perception:

[3] By contrast, a review of *Barkskins,* Proulx's (2016) historical novel about the deforestation of North America, notes that she 'engages with what she knows on more visceral terms than a writer who has simply alighted on an interesting subject' (Alex Clark 2016).

[4] Richards states that "The Dorset cursus divides dark, dangerous woodland from light, safe, open country" (8 May 2013 *Stories from the Dark Earth: Meet the Ancestors Revisited* Series 2, programme 4, BBC Radio 4, a reversal of his earlier views (J. Richards 1999, 37).

[5] See, for example: C. Evans 1985, 82; Bloch 1998; C. Evans *et al*. 1999; Austin 2000, 64-5; Evans & Hodder 2006, 13, 16-19; Noble 2017 *passim*.

Figure 5.2a: Aerial view of 1km^2 (100ha) of Białowieża forest. Image: Google Earth.

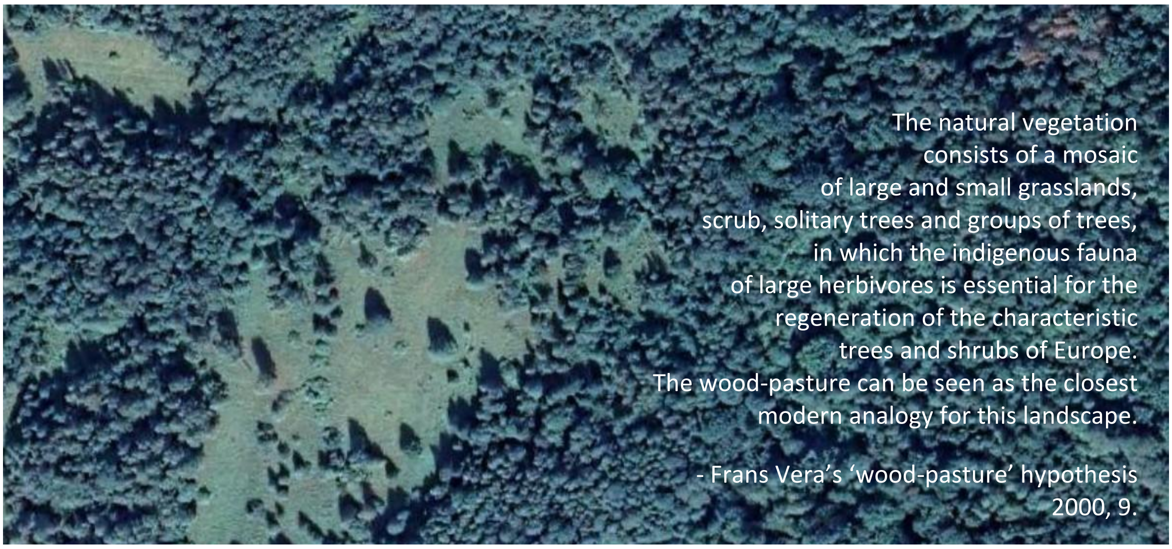

Figure 5.2b: Aerial view of another part of Białowieża forest, where natural clearings have formed. Open corridors also follow many of the minor streams, due partly to beaver activity. Image: Google Earth.

- What was the vegetative environment of the Early Neolithic like?
- What were clearings like?
- In the context of the life-ways sketched out in Chapter 4, where, when and how did affordances for remote perception arise?

5.2 The extent of forest at the outset of the Neolithic

A generation ago, the environment into which the pioneer farmers thrust themselves was routinely termed 'wildwood'[6] (Rackham 1986). The gradual acceptance that forest 'co-evolved' with other species, including humans, has eroded this concept (Macphail 1999; Austin 2000, 63; Rackham 2006, 103-5; Williams 2006, 10). The royal reserve at the heart of Białowieża Forest, in Poland (Figure 5.1a), probably comes closest to 'wildwood' and is often held up as a model for Early Neolithic forest (*e.g.* Bogucki 1988, 27; Noble 2017, 42-3). Yet even this was subjected to logging in the 18th century, albeit limited and selective (Kornaś 1966, 106; Schama 1995, 45-7; Vuure 2005, 67-9). The vegetation was also affected by the management of game for hunting from at least the 13th century (*ibid.*, 66-7). So today, even if we accept that wildwood ever existed, there is none surviving in Europe (papers in Kirby & Watkins 1998; Noble 2017, 38). What survives is 'ancient semi-natural woodland' (Willis 1993). This covers only 2.6% of England and Wales, a reduction from 4.7% *c.*1930 (Spencer & Kirby 1992) and perhaps 15% at Domesday (Rackham 2006, 113-4), the majority in Surrey, Kent, Sussex and Hampshire (in that order). Even taking coniferous plantations into account, the UK only reaches *c.*13% cover, less than half of the figure for France and Germany and less than a fifth of some Scandinavian countries (Forest Research 2018; Figure 5.2b).

Two opposing hypotheses have dominated ecological discourse about the extent, character and dynamics of forest before the Neolithic. The traditional model[7] envisaged a virtually closed canopy of mixed deciduous forest (Figure 5.2a). A.S. Watt's (1947) 'gap-phase' model argued that tiny, scattered clearings created by sporadic wind-throw, disease and lightning strikes provided opportunities for regeneration. Opposing this, Vera (2000[8]; Figure 5.2b) argued that the environment, while generally dominated by trees, was closer to medieval and later wood-pasture or parkland[9].

[6] Alternative terms include 'climax', 'original-natural' or 'virgin' forest (Clements 1916; Tansley 1935; Whittaker 1953; Peterken 1996, 326).

[7] *E.g.* Fox 1932, 49-52; Tansley 1939, 163-4; G. Clark 1945; Hoskins 1955, 86; Iversen 1949; 1973; Whittle 1977a, 10.

[8] See also A.G. Smith 1970, 89; Van der Veen 1975; Putnam 1986.

[9] This debate, the details of which are reviewed in Appendix 2, had been rehearsed 60 years before (Salisbury & Jane 1940; Godwin & Tansley 1941).

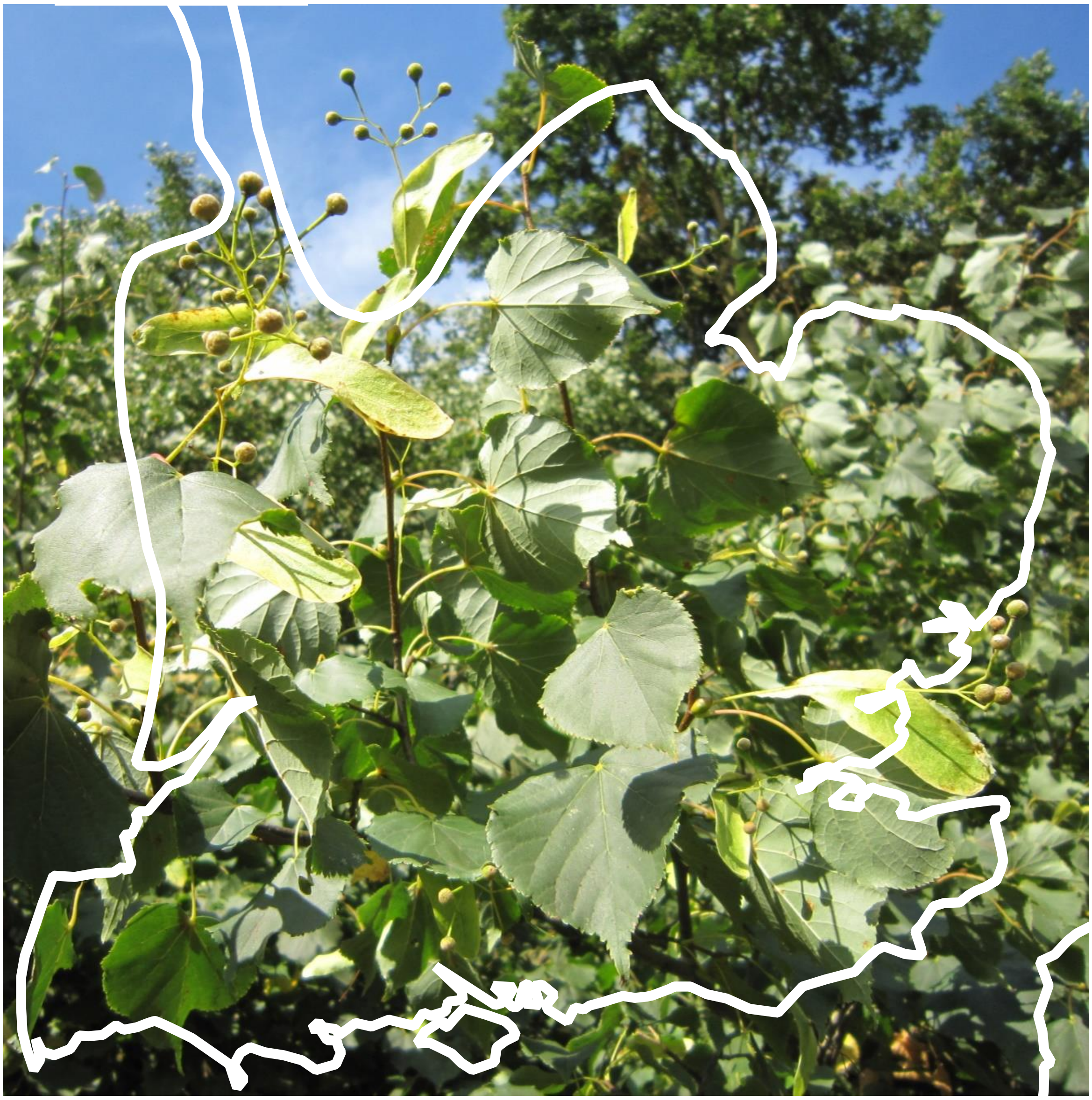

Figure 5.3: Small-leafed lime (*Tilia cordata*), which dominated forest in the 'lime province', shown in outline, which includes the whole study area for this thesis. Though still widespread in continental Europe, where its flowers are used to make an infusion to remedy a wide range of health problems, the species is far less common in Britain today than its broad-leafed and hybrid cousins (*Tilia platyphllos* and *Tilia x europea*, respectively). It can live to more than 500 years old and grow to a height of 40m. Its seeds, prominent in this photograph, are particularly nutritious for livestock. Photographed in early October.

To summarise Appendix 2, the palynological evidence that only tiny clearings existed at the outset of the Neolithic is at odds with numerous other strands of evidence. The most plausible inference is that larger clearings did exist throughout the Mesolithic and, indeed, were widespread and fairly numerous, but that they were insufficient in size, number or duration to affect pollen diagrams (K.J. Edwards 1982; S.T. Andersen 1992, 166; A.G. Brown 1997, 133; 139; M.J. Allen 2000a, 22; Whitehouse & Smith 2010, 544). A recent palynological study of the Mesolithic–Neolithic transition in the Somerset Levels concludes that *c.*5% of the surrounding dryland was clear of forest in the Late Mesolithic (Farrell *et al.* 2020, 288-9). Conversely, human activity is sometimes undetectable within a few kilometres of a pollen sample interpreted as indicating such activity (Dark 2007, 184). The scale of patches emerges as the key issue; Vera's proposal that the environment was mostly park-like seems untenable (Williamson *et al*. 2017, 12-13), but Watt's 'gaps', particularly on Salisbury Plain, were perhaps 'as large as parishes' (Allen & Gardiner 2009, 61). Browsing by wild ungulates perhaps sufficed to maintain clearings created by humans (Edwards & Buckland 1984), but Mitchell's (2005) comparison of Britain and the European mainland with Ireland supports the view that human activity, rather than wild ungulates, was primarily responsible for maintaining and enlarging clearings. Most clearings probably originated naturally in line with Watt's model, but humans perhaps created some from scratch. In a landscape of scattered clearings of varying size, then, the physical potential for occasional distant views must have existed at the outset of the Neolithic, and actually throughout the Mesolithic.

5.3 The character of Early Neolithic forest

Chapter 4 established that even if Early Neolithic people favoured clearings, they were not confined within them permanently. They must, therefore, have spent some of their lives moving within or through forest, where remote perception was a fundamentally different issue. Yet it would be wrong to stereotype forest as a polar opposite of open country in terms of remote perception. It has long been understood that forest was a 'mosaic' or 'patchwork', whose composition varied through time[10]. Natural agents – wind, wildfire, disease, beavers and browsing ungulates – operated ceaselessly (Chapter 5.4), creating different affordances for visibility. In the Early Neolithic, of course, humans and their livestock were also operating ceaselessly.

At a gross level, five forest 'provinces' have been defined, based on known preferences of different species[11] (Birks *et al*. 1975; K.D. Bennett 1989; Peterken 1996, 326; K.J. Edwards 2004, fig. 5; Rackham 2006, fig. 35; Noble 2017, 34-8). Most causewayed enclosures in Britain, and all the case studies for this thesis, fall within the 'Lime province'. Yet each province was itself a mosaic of smaller-scale variations (Packham & Harding 1982, 136-7;

[10] *E.g.* Kennard 1933, 240; Godwin & Tansley 1941; Barker & Webley 1978, 167-8; Remmert 1991; Forman 1995; A.G. Brown 1997, 139; J. Moore 1997, 35-6; Clare 1995; Robinson 2000a, 35; M.J. Allen 2000a, 11-12; 2005; Vera 2000, *passim*; Whitehouse & Smith 2010, 549.
[11] In order to help the main text flow, scientific names of tree species are only given in Table 5.1.

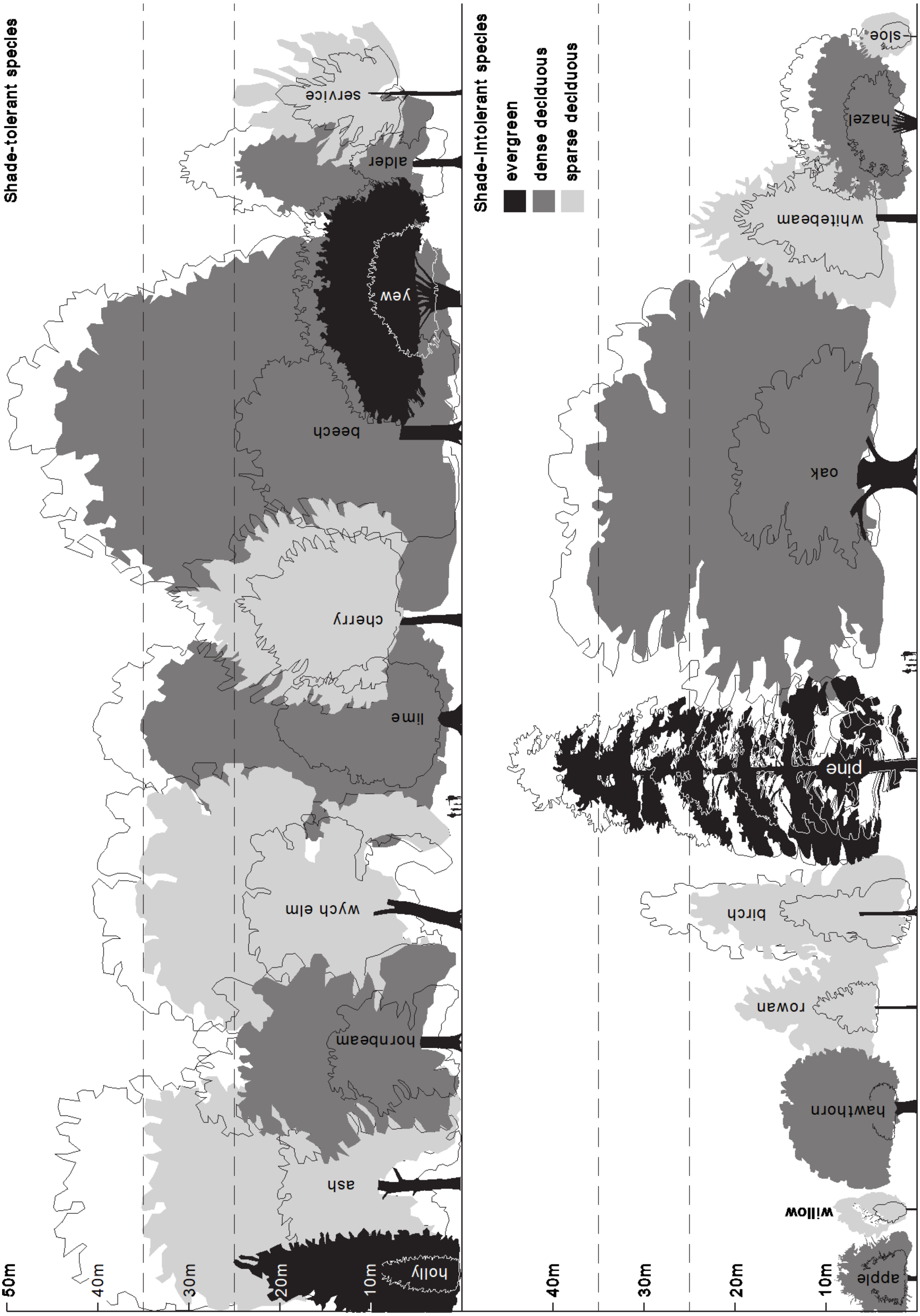

Figure 5.4: Tree species of the Early Neolithic and their relative heights. Normal height shown in tone; maximum and minimum in outline. Note that the profiles are those of trees growing in ‘open country’, to emphasize the differences.

Common name	**Scientific Name**	**Height**	**Need for light, from seedling > mature** (0=tolerates dense shade, 6=needs fully open ground)
Scots pine	*Pinus sylvestris*	30 – 40m	5 > 5
Birch	*Betula pendula*	15 - 25m	5 > 5
English (peduncular) oak	*Quercus robur*	20 - 42m	5 > 4
Sessile oak	*Quercus petraea*	20 – 40m	5 > 4
Crab apple	*Malus sylvestris*	6 – 9m	5 > 4
Hawthorn	*Cratageus monogyna*	5 – 15m	5 > 3
Hazel	*Corylus avellana*	8 – 12m	5 > 3
Whitebeam	*Sorbus aria*	20 – 25m	5 > 3
Blackthorn	*Prunus spinose*	5 – 7m	4 > 4
Rowan	*Sorbus aucuparia*	10 – 20m	4 > 4
Elder	*Sambucus nigra*	5 – 15m	4 > 4
Goat willow	*Salix caprea*	5 - 9m	3 > 4
Grey willow	*Salix cinerea* subsp. *Oleifolia*	5 - 9m	3 > 4
Black poplar	*Populus nigra*	20 – 30m	3 > 3
Wayfaring tree	*Viburnum lantana*	3 – 5m	3 > 3
Black alder	*Alnus glutinosa*	12 – 25m	3 > 3
Ash	*Fraxinus excelsior*	20 -35m	1 > 2
Wild service	*Sorbus torminalis*	15 -25m	1 > 2
Wild cherry	*Prunus avium*	25 – 30m	1 > 2
Small-leafed lime	*Tilia cordata*	20 – 40m	2 > 1
Wych elm	*Ulmus glabra*	24 – 35m	1 > 1
Yew	*Taxus baccata*	10 – 20m	1 > 1
Holly	*Ilex aquifolium*	10 – 25m	1 > 1
True service	*Sorbus domestica*	10 – 25m	1 > 1
Hornbeam	*Carpinus betulus*	15 – 25m	1 > 0
Beech	*Fagus sylvatica*	25 – 45m	0 > 0

Table 5.1: Tree species of the Early Neolithic, showing their relative heights and need for light from germination to maturity.

Figure 5.5: Tall, slim, branchless beeches growing near Peak Camp causewayed enclosure, Gloucestershire (see Chapter 8). Although it was perhaps 3°C warmer than today in 4050 BC (Cheddadi *et al.* 1997), by the 38th century BC a cooler climate, similar to today's, started to restrict beech and hornbeam to the southern part of the 'lime province'. Note the lack of any significant understorey, a typical feature of beech forest.

Remmert 1991). While small-leafed lime dominated, penduncular oak, hazel and ash were next in abundance, with more pine in eastern England and beech in what is now Epping Forest. Ash was more common on chalk and limestone, oak on acid sands and gravels, and heavy clays. Although it was perhaps 3°C warmer than today in 4050 BC (Cheddadi *et al.* 1997), by the 38th century BC a cooler climate, similar to today's, started to restrict beech and hornbeam to the southern part of the province. Water-loving alders, willows and, to some extent, black poplars[12], and penduncular oaks favoured the margins of watercourses and wetlands, while beech, elm, hornbeam and lime avoided wet ground (Packham & Harding 1982, 136-7; Rackham 2006, 8). Hornbeam and lime tend to cluster together[13] (Rackham 2006, 8).

Distributions reflected the underlying geology to some extent (Tansley 1939, 273-4). Penduncular oak is well-suited to poor soils overlying heavy clays and sands; sessile oak prefers stony conditions; ash calcareous soils; Scots pine and birch acidic soils, such as the East Anglian Brecklands. Elms prefer highly fertile soil, though it is possible that they themselves contribute to that fertility (Rackham 2006, 8). Along with other 'plant indicators', their presence may have alerted pioneer farmers to good soil (Clements 1920). Alternatively, farmers possibly targeted existing secondary forest, mainly comprising birch and ash (S.T. Andersen 1992, 159; Noble 2017, 78-9). While these generalized distributions must have some validity, the occasional discovery of pine pollen[14] on chalk downland (*e.g.* Staines 1991, 15) suggests that 'brown earth' sufficiently deep to sustain most species was widespread, eventually washing downslope following clearance and agriculture (Limbrey 1978; J.G. Evans *et al*. 1988; 1993; J.G. Evans 2003, 77). This soil degradation would have amplified the differential effects of relief on forest composition[15] and tree size (Jenīk 1979, 129-31). Around the fringes of established clearings and when new gaps developed (by whatever means), lower-growing species, including hazel, hawthorn and blackthorn, would spring up, their nuts or berries dispersed by wild animals and birds. Seedlings would be protected from grazing by thorny species, including blackberry (*Rubus*) and briar rose (*Rosa rubiginosa*). Usually, this tangle would eventually be overtaken and suppressed by faster-growing species such as birch and ash; light-hungry ashes poison their competitors, their dense root-mats further suppressing seedlings (Step 1903, 47).

[12] Although poplar will certainly tolerate damp conditions, some caution is required because its pollen normally only survives in completely anaerobic conditions (Mott 1978), so its distribution in the wider landscape may be underestimated.
[13] The reasons why these species are 'gregarious' is unknown, although it is proposed in Chapter 6 that grazing practice may be an important factor.
[14] Although pine produces pollen in huge quantities; being very light, this can be transported far by wind.
[15] By the Bronze Age, this would have created the environmental conditions envisaged by antiquaries, namely valley bottoms hosting dense forest while the summits remained largely open (see Chapter 2).

Figure 5.6a: Digging out a typical tall, slim, branchless 'bog oak' in the 1950s. Image: Wikimedia Commons.

Figure 5.6b: Exposed forest, probably of Late Mesolithic or Early Neolithic date, at Dove Point on the Wirral (*i.e.* just outside the 'lime province'). Note the slim boles and lack of buttressing. Image: Reid 1913, Plate 1.

As Table 5.1 and Figure 5.4 show, seven tree species present in the Early Neolithic reach a maximum height of 35m, while twice that number (including these) reach 25m. The taller trees include small-leafed lime, which, notwithstanding Vera's reappraisal of the need to calibrate the percentages, dominated many regions where monuments were built. In forest, assuming adequate soil depth and moisture levels, all species grow rapidly to approximately their normal maximum heights due to phototropism, developing densely foliated crowns while still retaining relatively slender boles with few lateral branches below the crown (Step 1903, 14-15; J.M. Coles *et al*. 1978, 23; Tudge 2005, 267; R. Morgan 2006, 112-3; Noble 2017, 43; Figure 5.5). This theoretical growth pattern is confirmed by anecdotal discoveries. For example, an incomplete oak bole 20.4m long with no side branches[16], was found in 1961 near Ely, Cambridgeshire (Porter 1969, 172-3; Figure 5.6a). Fallen trees in submerged forests display a similar morphology (Reid 1913, 31-2; M. Bell 2007, 37; Timpany *et al*. 2021, 6-7; Figure 5.6b). In crude terms, such heights imply that, in summer, unless a viewpoint was 30-35m higher than the nearest forest, the view beyond the limit of that forest would be – at most – restricted to glimpses of higher ground, if any existed nearby (Evans & Hodder 2006, 16-17).

Tansley (1939, 277) estimates that Early Neolithic forest contained 150-250 trees per hectare. Recent surveys[17] of expanses of submerged forest indicate similar densities (*e.g.* Clapham *et al*. 1997). Veteran trees of great girth might exist in more open parts of the landscape, but would be rare within forest, because a tree past its prime cannot long withstand competition from neighbours (Rackham 2006, 23; *contra* Noble 2017, 1). Consequently, most trees had slim boles by comparison with today's veteran oaks. In Britain's Late Mesolithic submerged forests, a bole 0.9m diameter is typical of larger trees (Reid 1913, 31-2): an oak of 1.2m was the largest of 24 recorded at Hartlepool (Cameron 1878, 352; Trechmann & Kennard 1936). An oak of 92cm was the largest of over 100 recorded in the Severn Estuary (M. Bell 2007, 38); another measured 12.33m to the first branch, yet was only 0.34m in diameter (*ibid*., 45 & CD3.1). Dendrochronology shows that similarly slim trunks in Cardigan Bay were under *c.*300 years old when they died (Martin Bates, pers. comm.). Within forest, or looking out into open country from forest, these observations can be combined to arrive at an estimate of visibility that concurs with my own field trials: a maximum range of 100–150m, assuming good object/background contrast (Figure 5.7).

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[16] A 13.2m-long fragment, found in 2012 at Wissington Fen, Norfolk, was estimated to be one quarter of a 55m-tall tree *c.*200 years old (Fenland Black Oak Project 2023). Though the tree was clearly of impressive size, the basis for this implausible height, when the tree had apparently not even reached 300 years old, just seems to be the minimal decrease in girth of the surviving fragment from bottom to top, which is not a reliable indicator. Suggesting that modern oaks typically reach only 20m tall is an underestimate.

[17] No early studies of submerged forests include plans, but a photograph taken in 1923 showing the numerous stumps at Ynyslas in Cardiganshire, probably mostly of Early Neolithic date, gives an impression of a density at the lower end of this range (Godwin & Newton 1938, Plate 3). Detailed recording of small areas (*e.g.* M. Bell 2007, fig. 6.2), however, indicates that distributions recorded by more extensive surveys could be incomplete and asynchronous (see also Timpany *et al*. 2021).

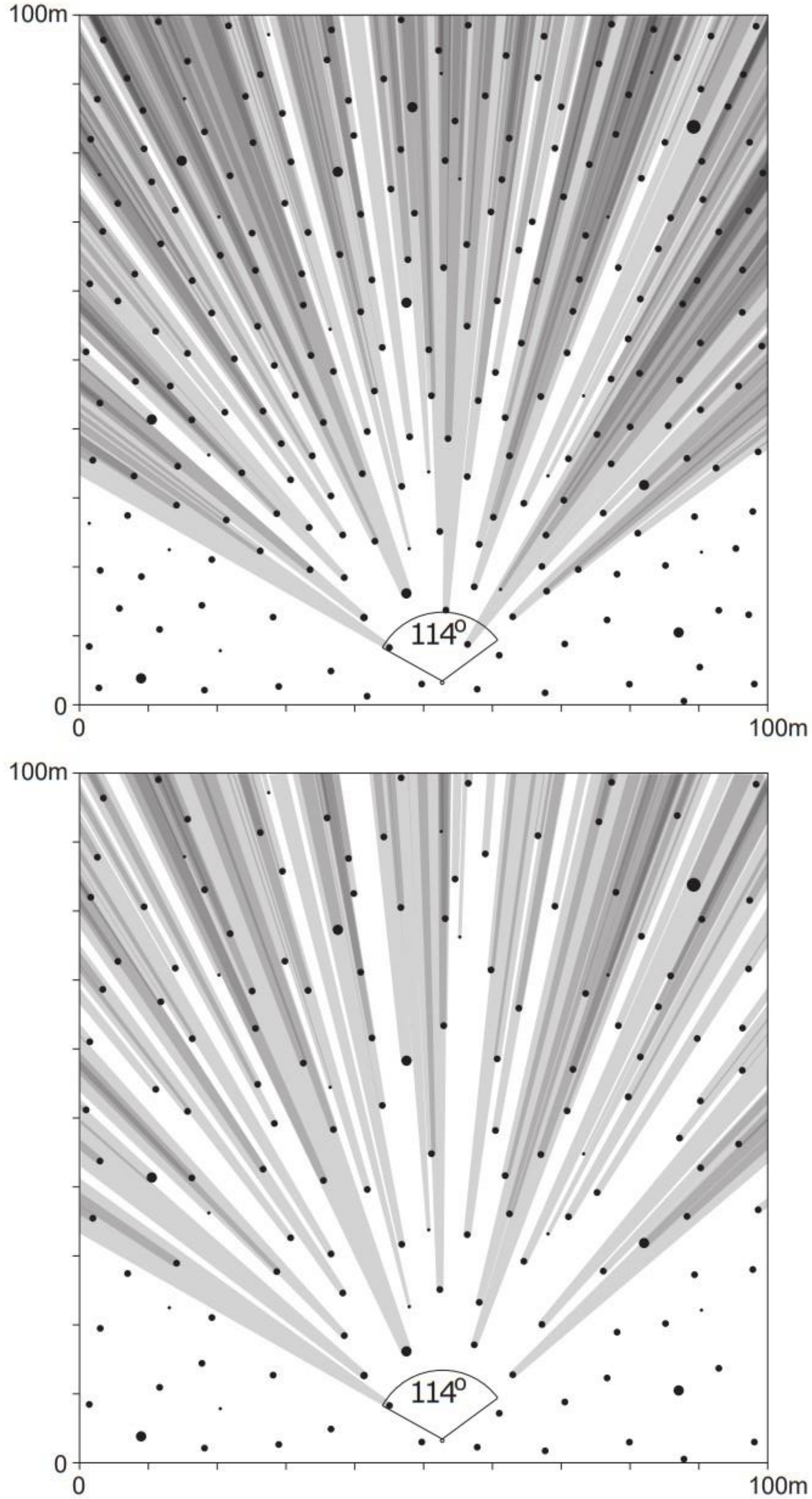

Figure 5.7: Visibility from a fixed point in forest, illustrating how tree boles with typical Neolithic diameters rarely afford lines of sight longer than 100m, even without an understorey (white sectors visible, toned sectors obscured). Above, a density of 250 trees per hectare; below 150 trees per hectare, based on Tansley's (1939) upper and lower estimates respectively.

Forest certainly restricts views, but it is important to emphasize its heterogeneity and the consequent variability of effects on vision. Different species have different qualities: birch, wild cherry, ash and willow have relatively sparse foliage, through which some of the background can usually be seen distinctly. Holly and yew, on the other hand, having evolved to deter browsing, develop dense foliage from ground to tip, not only presenting an impermeable barrier to visibility year-round, but also casting pools of shadow that reduce object/background contrast. Ivy-covered trees have a similar effect, though both ivy and holly are prone to browsing, especially in winter. Beech, hornbeam and oak (both pendunculate and sessile) often retain many dead leaves into the winter, sometimes until budburst in spring (Longman & Coutts 1974)**.** Alder loses its leaves in winter, but retains so many large catkins that visual permeability increases little, while hazel and crab apple have such dense concentrations of stems and twigs respectively that they present almost impermeable screens year-round.

Although seasonal change undoubtedly has an effect, the proposal that winter/early spring offers <u>greatly</u> improved long-distance visibility (Austin 2000, 69-70; Cummings & Whittle 2003, 260-1) requires qualification, and not just because the species listed above remain difficult to see through in winter. Looking out across forest from an elevated clearing, the sparser twigs at the tops of trees effectively become translucent in winter/spring to a height *c*.5m lower than when in full leaf. Below this, the mass of twigs forming the crowns of the trees still obscures visibility as much as the leaves themselves. Clarity of vision would also improve in winter, for while the trees retained their leaves, high levels of transpiration[18], and evaporation after rainfall, would leave the atmosphere permanently humid (Jenīk 1979, fig. 206; Tudge 2005, 381-2), making remote views above the canopy hazy.

On the other hand, the view from a clearing into forest only increases to *c*.150m when the leaves fall, because the interior is still relatively dark (unless snow covers the ground), reducing object/background contrast. A mass of 'mantle growth' will grow up around the perimeter of a stable clearing - effectively a natural hedge (Groenman-van-Waateringe 1978, 138-9) - screening the area behind, even when bare of leaves.

[18] 100ha of woodland transpires about 5,000m^3 of water per day (Tudge 2005, 381).

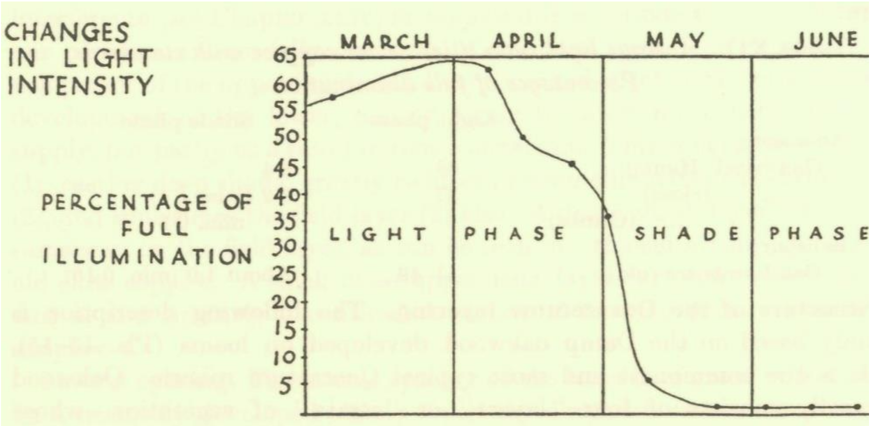

Figure 5.8a: Percentages of daylight penetrating to ground level within a closed-canopy deciduous forest, March - June. A sparse herb layer forms at *c.* 10%, a continuous layer at *c.*50% (Ehrenreich & Crosby 1960; Anderson *et al*. 1969, fig. 1). Image: Tansley 1939, fig. 52.

Figure 5.8b: Browse-line on a beech tree, 1.75m above ground level, created by a pair of European bison (*Bison bonasus*) in Howletts Wild Animal Park, Kent. Bison were not present in the British Isles in the Neolithic, but my measurements of the browse-line created by a pair of genetically engineered aurochs at Thot wildlife park, near Lascaux in central France, indicates exactly the same figure. Red deer (*Cervus elaphus*) sometimes browse even higher. Of course, the effect of browsing is more pronounced in this enclosed space where there are relatively few trees.

Nor is seasonal change straightforward if the viewer is within forest. Once the leaves have fallen, even if a moderately dense shrub layer exists, visibility within forest usually increases to *c.*150m (Figure 5.8a). But differential light levels decrease the distance from which a brightly-lit clearing is detectable, looking from within a darker wooded area[19], from *c.*400m in summer to *c.*150m in winter. Yet most small trees and shrubs, including blackthorn, crab apple and hawthorn, are intolerant of shade and would not survive indefinitely once dominant trees had overtaken them. Browsing ungulates, both wild and domesticated, remove some of the understorey and create a 'browse line' at least 1.6m[20] above ground level (Deer Initiative 2011, 4; Figure 5.8b), again increasing the field of vision beneath the canopy for humans. In such conditions, visibility might be *c.*100-150m even in summer, at least on fairly level ground. Yet topography is also a factor, because the eye-level of the viewer has to be lower than the lowest branches in order to see ahead.

In summary, the conventional binary opposition of clearing versus forest fails to convey the variable character of the latter. Some areas would feel light and open because trees were sparsely distributed, others because species like cherry were dominant. Patches where beech was dominant had dense canopies, but remained open at ground level; conversely, patches of coppiced hazel might allow people to see the sky, whilst limiting views ahead to a few metres. Such variations would inevitably affect the frequency and quality of remote visual affordances, sometimes subtly, sometimes less so.

5.4 Exploiting forest resources through the seasons

A wide range of wooden artefacts was used in the Early Neolithic (J.M. Coles *et al.* 1978). 'Old World' archaeology, however, is generally less receptive to the potential diversity and significance of wild plants used in prehistory, compared to the 'New World', with its plentiful ethnographic[21] records (M.K. Jones & Colledge 2001, 399). Consequently, the practicalities and temporalities involved in obtaining these resources remain underexplored (Whittle 2000, 2), at least by archaeologists. The assumption that people exploited forest resources in autumn is partly justified, but closer analysis indicates that there were reasons for people to enter the forest throughout the year, affording very different opportunities for remote visual perception. The procurement of timber for building is discussed below and the involvement of forest in livestock husbandry in Chapter 6.

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[19] Cummings and Whittle's illustration in support of this suggestion shows the view towards an unwooded horizon in the middle distance through a narrow belt of young oaks only a few trees deep.

[20] In conditions where food is limited (*e.g.* hunting parks), deer may stand on their back legs, allowing red deer to reach above 2m and roe deer 1.5m. The browse-line for European bison, measured by myself at Howlett's Wild Animal Park, Kent, is 1.85m above ground level.

[21] An Old World example is the tree-list contained in the law-text on farming in early medieval Ireland, which demonstrates sophisticated botanical knowledge (Kelly 2000, 380-5 and Table 5.2).

Figure 5.9: Bright sunlight illuminating a clearing 50m away. Photographed in early September near Crippets Barrow, Gloucestershire (see Chapter 8).

Class/species	Qualities
'Nobles of the wood'	
Oak	The tallest in the woods; provides acorns and bark for tanning; good for woodworking.
Hazel	The food-provider of the woods; provides rods (for fencing and construction).
Holly	Provides winter fodder; good for making chariot shafts; good for making spits for outdoor roasting.
Yew	Good for making 'noble artefacts' (high quality domestic vessels?)
Ash	Good for making furniture and shafts for weapons (spears?). Good for making oars and yokes.
Scots pine	Provides resin for making pitch.
Wild apple	Provides fruit and bark (for dying cloth yellow?).
'Commoners of the wood'	
Alder	Good for making shields, masts and tentpoles.
Willow	Good for construction and making thongs.
Hawthorn	
Rowan	
Birch	
Elm	Good cattle fodder.
Wild cherry	
'Lower divisions of the wood'	
Blackthorn	
Elder	
Spindle-tree	
Whitebeam	
Arbutus	
Aspen	
Juniper	

Table 5.2: Tree species and their qualities, as listed in the early medieval Irish law codes (after Kelly 2000, 380-5). Note the absence of lime and hornbeam; most of Ireland being in the 'Hazel-Elm province'.

Figure 5.10a: One season's growth on a coppiced hazel stool, photographed in late October mist.

Figure 5.10b: Hazelnuts, harvested over a few minutes in late August on the fringe of a clearing. Compared to procuring other forest resources, this relatively safe task, for which shorter stature, sharp eyesight and nimble fingers are advantageous, was perhaps given to children.

Some of the best known wooden artefacts – *e.g.* the tools from Ehenside Tarn, Cumbria or the hurdles from the Somerset Levels (Darbishire 1874; Coles 1976b) – could be products of coppiced trees, or hedges, rather than high-canopy forest (Mabey 1979b, 39). Due to its shock-absorbing flexibility, straight stems, workability and smooth surface, ash has long been preferred for tool handles[22], amongst other things (Evelyn 1670, 40; Brimble 1946, 328; Edlin 1969, 64; Green 1978, 140). It can be easily coppiced or 'laid' (*i.e.* the process used in traditional hedge-making), which often produces 'elbows' ideal for making angled handles. Wood for tools (as well as timber for structures) is ideally harvested during the tree's dormant period (December to March), when low sap levels make wood less brittle and less prone to cracking as it dries (Edlin 1969; Mabey 1979, 40), but timing varies in practice (Edlin 1953, 196-7). Similarly, hazel rods were traditionally harvested on Christmas Day, although January to mid-March and mid-September to the end of November were more normal (Evelyn 1670, 78-9). These are also the periods when coppicing and hedge-laying are undertaken to ensure the trees survive.

Although individual trees in clearings can be coppiced effectively, forest conditions require more intervention. Managing larger patches of trees is the best way of getting new shoots to grow healthily and straight, to ensure that they have equal access to light, and to counter browsing through 'safety in numbers' (Joys *et al*. 2004). A 7-year coppicing cycle has been detected in the Somerset Levels (Coles & Coles 1986, 56), a traditional interval suited to most[23] post-medieval needs (Evelyn 1670, 79). Shorter intervals may have been common in the Early Neolithic, when products as thin as arrow-shafts and wattles were probably common. The suggestion that coppicing increases potential for remote perception (Cummings & Whittle 2003, 259) is questionable. An area coppiced in the late autumn/early winter remains clear until the following spring, but within three years, dense clusters of new shoots grow to over 2m, thus restoring restricted visibility, or probably reducing it, until the next harvest (Figure 5.10a). After 7 years of regrowth, hazel, the most prolific species, will have produced up to 2,000 new stems per hectare (http://smallwoods.org.uk/our-work/woodland-products/a-brief-history-of-coppicing/).
Coppicing hazel would also lead to increased medium-term nut yields (Figure 5.10b). Hazels can be easily transplanted, or grown from nuts or twigs with existing root growth (Evelyn 1670, 78-9), supporting the theory, mentioned above, they they might have been 'farmed'[24] in the Neolithic – or indeed the Mesolithic. While hazels often spring up within hedgerows (Figure 5.11a), they respond poorly to laying, so cannot be made into a stock-proof barrier.

[22] Tellingly, the tree's common name derives from *æsc,* the Anglo-Saxon for 'spear', and the wood was also selectively used for Bronze Age spear-shafts (Green 1978, 141). Ash was numbered amongst the seven 'noble' trees of early medieval Ireland for the same reason (Kelly 2000, 383; see Table 5.2).
[23] An average of 14 years was favoured for making 'white coal' (M. Palmer & Neaverson 1994, 47).
[24] Ideally, trees should be *c.*2.5m apart, allowing enough light for the tree to fruit well (Harmer 1995, 2).

Figure 5.11a: A hazel, formerly coppiced to form part of a hedge, illustrating how the dense stems of a mature tree (plus catkins) make the tree a serious obstacle to vision, even in winter. Photographed on a rainy day in early March near Kit's Coty, Kent.

Figure 5.11b: An ancient yew, illustrating how completely mature specimens impede vision. Photographed in parkland near my home in Kent, in early February.

Three yew bows, two flat and one long, have been found in the Somerset Levels (Coles *et al.* 1978, 10). Yew, the ideal wood for manufacturing both types, is toxic to both cattle and humans, so might not be tolerated near settlements, but might be one of the few forest trees to grow to great age (Figure 5.11b). Making bows requires straight stems at least 18cm thick[25], with as few branches as possible: suitable young trees would grow beneath the canopy. Ancient yews are difficult to fell and to work, but people perhaps felled relatively mature trees to obtain numerous suitable 'staves' from around the outer trunk. In early medieval Ireland, yew was accounted a 'noble' tree due to the fine domestic vessels that it could yield (Kelly 2000, 383). Though yews are not rare, finding the best specimen may have required prolonged searching in the forest; alternatively, perhaps particular trees were managed and returned to repeatedly.

Though inevitably under-represented in the archaeological record, wild foods were probably of greater importance in the Early Neolithic than in any subsequent period (M.A. Robinson 2000b, 89). Some forest foods, *e.g.* wood sorrel (*Oxalis acetosella*) and the morel fungus (*Morchella sp*.), become available as early as April, while the fruit of medlars (*Mespilus sp*.) and wild service trees (*Sorbus torminalis)* must be left to over-ripen before harvesting in December (Mabey 1979a, 54; 79; 179; 180). Table 5.3, however, confirms the common presumption that there was greatest abundance through the late summer and autumn: the season for most fruits (crab apples, wild pears, sloes, elderberry, damsons, grapes, and haws are all attested at Early Neolithic sites), as well as hazelnuts and most edible fungi.

Fruit trees often grow on forest fringes and within clearings because their fruit require direct sun to ripen. Over time, these species may have become associated with human settlements because the seeds from gathered fruits were dispersed there (Mabey 1979a, 12). Crab apples, with high levels of pectin, would be virtually indispensable to jam-making, a more reliable way of preserving fruit than drying. Apart from wild cherry, these species are relatively low and difficult to climb to their tops, so fruit-pickers would probably not gain distant views.

However, wild honeybees (*Apis mellifera*) often make nests high in mature forest trees, usually in dead parts containing suitable cavities. In eastern Spain, rock paintings show ropes and ladders being used to reach nests in tall trees (J.G.D. Clark 1942; Dams 1978; Figure 5.12). These are generally considered Late Mesolithic because they depict the gathering of a wild resource and definite domesticated animals are lacking, but stylistically similar paintings in the Libyan Akakus are considered Neolithic, because cattle and ovicaprids are shown (Tertia Barnett, pers. comm). Honey itself is not archaeologically

[25] The power of a yew bow derives from the different strengths of the heartwood and outer core (Alan Clark 2016 unpublished and pers. comm.; Noble 2017, 130)

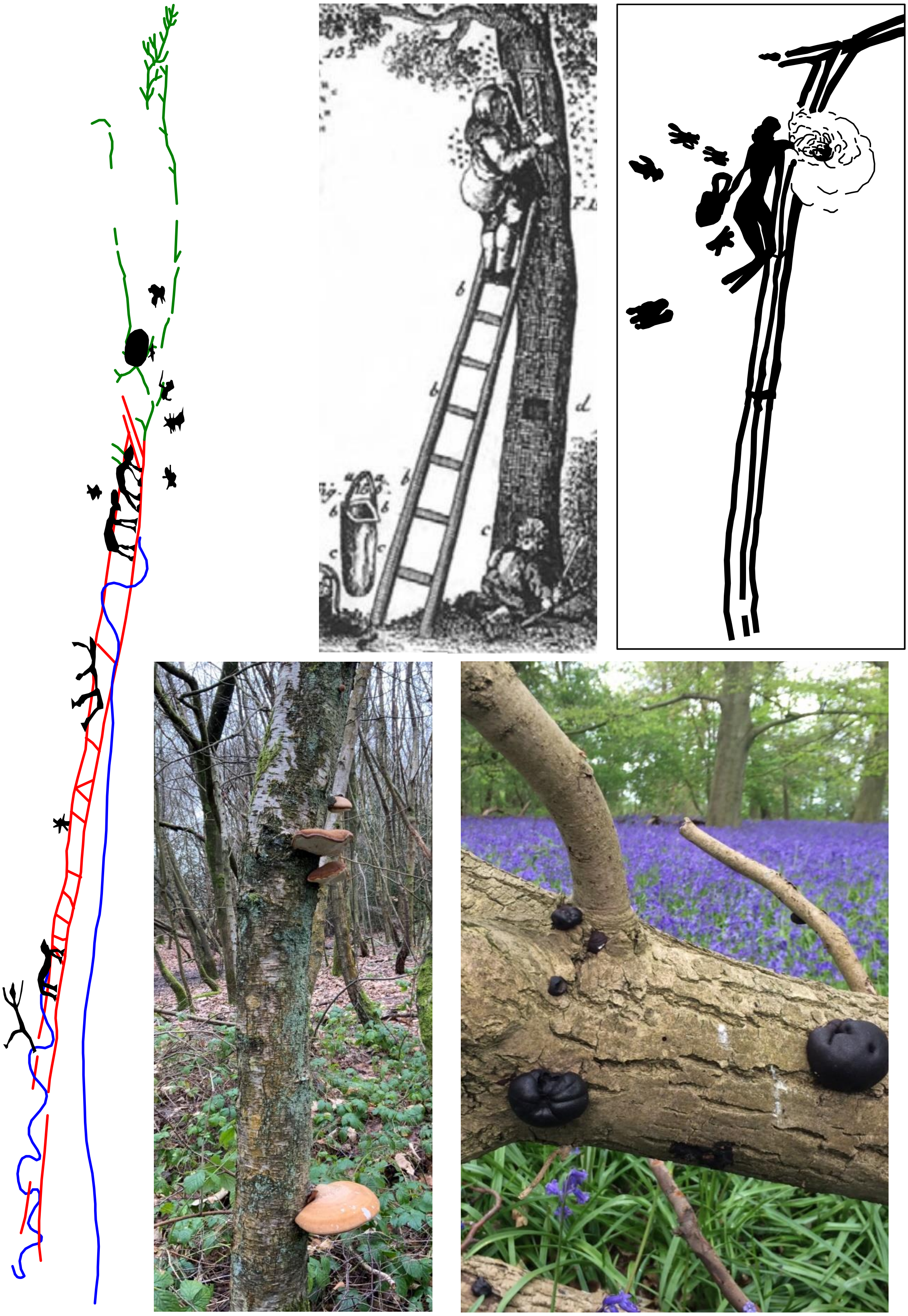

Figure 5.12: Critical forest resources: honey and tinder. Far left: honey gathering at Barranc Fondo, Valencia (redrawn in colour). Above: honey gathering in Germany in 1774 (from E. Crane 1983, fig. 16.2) and at Las Cuevas de la Araña, Valencia. Below: young Tinder Fungus (*Fomes fomentarius*), growing on its preferred species of birch, and King Alfred's Cakes (*Daldinia concentrica)*, which only grows on fallen ash.

attested, but must have been valued as a sweetener, a salve and, perhaps, an ingredient of mead (J.G.D. Clark 1942; Limbrey 1982, 282-4; Kelly 2000, 113). It is collected in early June to mid-September, when the forest canopy is in full leaf. Beeswax, on the other hand, which was widely used for sealing *Linearbandkeramik* pots (Heron *et al*. 1994; Salque *et al*. 2013, 524-5) is best collected in the spring (Tom Robinson, Master beekeeper, pers. comm.), when views from elevated positions were potentially extensive. Tall trees with dead branches are risky to climb, however, so people possibly made hives: for example, cavities cut into healthy trees, or hollow logs tied to accessible parts of the trunk[26]. Limes are forest honeybees' favourite nectar source (Limbrey 1982, 281; Tudge 2005, 214); since limes numerically dominated most lowland Neolithic forests, honey was presumably widely available[27]. Limes naturally congregate (Rackham 2006, 8) and in post-medieval eastern Europe were selected for locating hives (E. Crane 1983, 83). The chosen trees had to be at least 120m apart, but a single tree might be used for three hives, placed at intervals between 5m and 25m above ground. Brown bears (*Ursus arctos*) often climbed the trees for honey, so they were hunted and low branches were lopped to impede them.

Making and conserving fire would be crucial. The fungus called King Alfred's Cakes (*Daldinia concentrica)*, which grows only on fallen ash trees, like certain bracket fungi including Tinder Fungus (*Fomes fomentarius*), which prefers birch, make excellent slow-burning tinder when collected in summer (Mabey 1979, 150; Figure 5.12). Fast-burning tinders, *e.g.* seedheads of rosebay willowherb (*Chamerion angustifolium*; Figure 5.15b) and bog cotton *(Eriophorum angustifolium)*, grow in more open country, the former thriving in ground cleared by fire. It may have been especially important to gather the forest fungi, however, because they smoulder very slowly: a large fungus allows fire to be transported for more than a day[28]. Cow dung - readily available to Neolithic herders - is a viable alternative, but less effective because it burns faster and more erratically. In addition, smoke from cow-dung is acrid and unpleasant, while smoke from the fungi is sweetly-scented (though both will deter biting insects). Tinder Fungus, like the Birch polypore and several other fungi found in prehistoric contexts, also has medicinal properties (Grienke *et al*. 2014).

Almost without exception, red deer antlers used in the Neolithic were shed naturally, rather than sawn off. They must have been picked up as soon as they were lost, in mid-March to April, or they would be gnawed away by the deer (Elliot 2009, 18-21). It is difficult even to estimate the numbers procured annually by a community. As with stone

[26] This was certainly done by the late Iron Age in eastern Europe (E. Crane 1983, 80 and fig. 84) and by the Middle Ages forest honey was produced there on an industrial scale (*ibid*., 79-87). In 1772, there were reported to be over 20,000 hives in the Prussian forests (E. Crane 1983, 86-7).

[27] As flowering trees such as hawthorn, blackthorn and apple colonised the margins of clearings, hives may also have been kept close to settlements, as was normal in early medieval Ireland (Kelly 2000, 111).

[28] 'Otzi' carried four pieces of *Fomes fomentarius* and pieces of *Piptoporus betulinus* (Peintner *et al*. 1998).

Figure 5.13: A path within an ancient coppice-with-standards, created by badgers but evidently used by other wild animals. Photographed in late March north of the causewayed enclosure on Combe Hill.

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<tr><th>Nov</th><th colspan="2">Dec</th><th colspan="2">Jan</th><th colspan="2">Feb</th><th colspan="2">Mar</th><th colspan="2">Apr</th><th colspan="2">May</th><th colspan="2">Jun</th><th colspan="2">Jul</th><th colspan="2">Aug</th><th colspan="2">Sep</th><th colspan="2">Oct</th><th>Nov</th></tr>
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<tr><td colspan="2">Key:</td><td colspan="8">tools and materials</td><td></td><td colspan="6">animal husbandry</td><td></td><td colspan="6">food</td></tr>
<tr><td colspan="24">Table 5.3: A selection of seasonally available forest resources.</td></tr>
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Figure 5.14: A track wide enough for forestry vehicles, leading to a bright clearing, but entirely overhung by the tree canopy. Photographed in early October near the causewayed enclosure adjacent to the River Deûle at Carvin, Pas-de-Calais.

axes,spreading the huge number of finds across the whole Early Neolithic reduces annual consumption to low numbers. Nevertheless, since chance discoveries of intact shed antler s are very rare, even low numbers must indicate the use of tracking skills akin to those required by hunters. Alternatively, since red deer, as herd-forming animals, are relatively easy to tame through regular feeding in fixed places, they could have been 'farmed'[29] in effect (Chaplin 1975, 42; Sakellaridis 1979, 173; Sharples 2000, 113; Field 2004, 157). Wild boar were also tamed and domesticated at this time, presumably using similar techniques (Larson *et al*. 2007, 15277). This management is unlikely to have occurred near cereal crops or hay meadows, both of which deer and pigs can damage severely, especially in the period up till mid-May (Putman & Moore 1998, 147-8). It is also easiest to tame hungry wild animals through deliberate feeding in winter and early spring. Perhaps, therefore, some remote clearings were reserved for deer 'farming', for both antler and meat. As described above, this practice perhaps originated in the Mesolithic.

Pollard's (2006, 139-40) proposal that fox, wolf and brown bear are found so rarely that that they must have been taboo, perhaps because they scavenged human corpses, is questionable. Animals that are more desirable for their pelts than for their meat are usually skinned where they are killed, leaving the carcass to scavengers (Zeiler 2006, 29; Serjeantson 2011, 47). Toe bones usually remain attached to full pelts, but are often missed in excavations, so Serjeantson's scepticism that furs were widely used is also questionable. In any case, such predators were probably also hunted to make them wary of herders and of places where livestock gathered regularly (see Chapter 6.6). Wild boar and aurochs, both occasionally present in faunal assemblages, may have been killed during unexpected encounters or targeted deliberately because they threatened crops and would mate with domesticated animals, with unwanted[30] consequences (Boyle 2006, 19; Legge 2010, 32-3). Boar, though probably more active diurnally than usually thought, avoid humans (Podgórski *et al.* 2013, fig. 2). None of these species could be assaulted by people who lacked the knowledge and skills of hunting, which can only be acquired through regular experience (Cotton *et al.* 2006, 159-63).

In summary, people must have left clearings and moved through and within forest for many reasons, at all times of year. While farmed products dominated their diet, they still sometimes hunted, probably to defend their livestock and crops, possibly to acquire skins, and perhaps for sport (*contra* Murray 1970, 72; K.M. Clark 2006, 38). Cluttered, uneven forest floors would encourage them to use the narrow paths created by wild animals wherever possible (Figure 5.13). Late medieval travellers through the *Grosse Wildnis* separating East Prussia from Poland and Lithuania averaged 17-24 km per day and

[29] In early medieval Irish law, deer and cattle were referred to by the same terms and were apparently equivalent, although contemporary faunal assemblages are dominated by cattle bones (Kelly 2000, 272-3).
[30] Ancient DNA studies reveal that a few female aurochs bred with domesticated males (Schibler *et al*. 2014), but at what point in their long history of coexistence remains unclear.

Figure 5.15a: Typical 'forest mantle' vegetation near the causewayed enclosure at Carvin, northern France. Rosehips and sloe pips have both been found on Early Neolithic sites. Rosehips, in addition to being sweet, have the highest concentration of Vitamin C of any fruit.

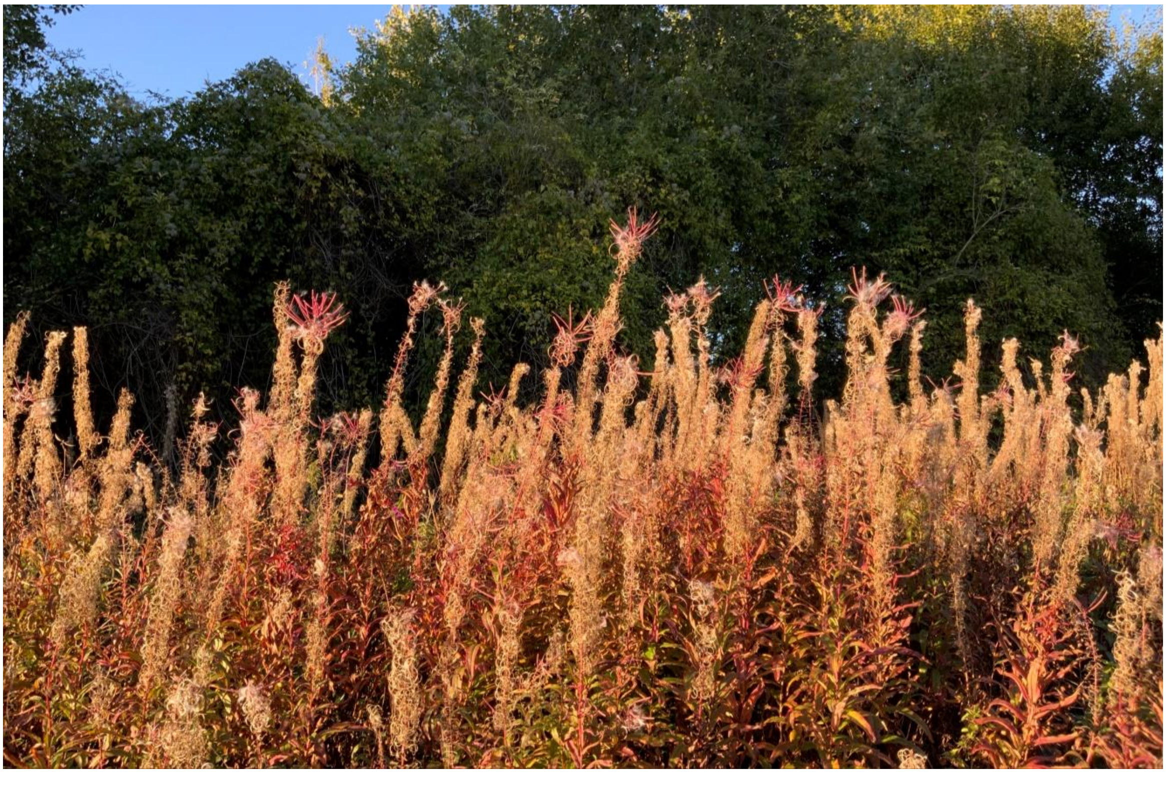


Figure 5.15b: A stand of rosebay willowherb (*Chamerion angustifolium*), also known as 'fireweed', photographed in early October near the causewayed enclosure at Carvin, northern France. The fluffy seed-heads of the plants, here growing on the site of a large bonfire, make an excellent fast-burning tinder.

sometimes only 8km when walking through that forest (Vuure 2005, 208-11). Paths established by deer and beaver would also be followed by predators[31], browsing aurochs and indigenous hunter-gatherers. Many encounters with dangerous animals and potentially equally hostile humans probably occurred by chance on such paths, far from home-bases. So the first farmers did not enter a wilderness, but a landscape with established communication networks. The introduction of livestock would gradually broaden the paths familiar to the Mesolithic hunters (see Chapter 6). Yet in terms of remote visual perception, even these broader trackways would seldom afford distant views (contra M. Bell 2020, 117), because the forest canopy will eventually span gaps up to *c.*20m wide *i.e.* wider than a main road[32] (Figure 5.14).

5.5 The size and distribution of forest clearings: natural dynamics

The theory that immigrant farmers may have opportunistically sited their settlements, farmland and monuments in pre-existing natural clearings (A.G. Brown 1997, 138; 2000, 49; Austin 2000, 74) has been accepted without much critical analysis, reflecting a sense that clearings too are 'entirely unknowable'. Environmental modelling tends to be crude (Baker 1999, 283): for example, Allen's depiction of clearings as circular (fig. 155 in J. Richards 1990) is obviously schematic. But accrued understanding of ecological dynamics provides deeper insights.

In gross terms, the Early Neolithic climate is also fairly well understood. Westerly storms were more frequent and intense in Britain from *c.*4,450-3,050 cal BC, causing rivers to flood more frequently after *c*.3,780 cal BC (Tipping 2010, 69-70). A more continental climate with higher summer temperatures, beginning *c.*4,100 cal BC[33], perhaps encouraged the spread of agriculture through Europe (Bonsall *et al.* 2002). Grasslands in southern Britain may have emerged in part due to reduced precipitation after *c.*4,250 cal BC, as certain tree species reacted to climate warming, while elsewhere hazel and birch apparently became more dominant (*ibid*).

5.5.1 Wildfires

Wildfire is often casually cited as a probable creator of clearings. Models of the causes and effects of wildfires are well-developed, particularly in North America (*e.g.* R. Bell 1889; Wright & Heinselman 1973; Baker 1999; Bradstock *et al*. 2005; Parisien *et al*. 2011; Paton 2015) and the Mediterranean (Keeley *et al.* 2011). This benefits archaeologists, because different types of fire are difficult to distinguish in microscopic charcoal records, while the pollen record can be virtually unaffected (J. Moore 1997, 37). Most scorn the idea that

[31] In fact, my observations at Howletts Wildlife Park indicate that European wolves will follow habitual routes which themselves produce narrow paths.
[32] Indeed, this figure has been arrived at by measuring the distance spanned by trees, of several different species, on either side of eight roads, selected because the span seemed particularly broad.
[33] There was perhaps a cold snap in Alpine regions in the 37th-36th centuries BC (Schibler *et al*. 1997).

Figure 5.16: An oak, seriously scarred by lightning but still alive, standing on the edge of the Greensand escarpment in Kent, photographed in mid-February. Fieldwalking and excavation indicate that the top of the adjacent promontory was intensively used in the late Mesolithic and Early Neolithic, although no monument was constructed before the Iron Age hillfort of Oldbury (Oswald & Haselgrove 2016).

wildfires could create extensive clearings in the damp deciduous forests that covered most of Early Neolithic Britain (*e.g.* Edlin 1956, 85; Mellars 1976, 33; Rackham 1986, 79; 2006, 56; Simmons 1988, 113; Peterken 1996, 335). Noble's (2017, 46) claim that dead wood littering the forest floor would burn easily only holds good where the underlying geology is free-draining *e.g.* sandy heathlands (Tansley 1968, 98-107). Otherwise, dead wood that remains in contact with the ground absorbs moisture and requires weeks of drying before it will burn easily. Where wildfires do occur, lightning usually causes ignition (J. Moore 1997, 36; Parisien *et al.* 2011, 800). 'Catastrophic' strikes – *i.e.* those which visibly burn the tree and are may start a wildfire - affect oaks most frequently, followed by pines (Rose 2012). This is partly because oaks are often the tallest trees locally. In isolation, they can also survive on higher ground[34], because their deep, spreading root structure makes them more resistant to wind-throw than shallow-rooted species such as birch, pine and beech (see Section 5.4.2). Yet the effects of lightning strikes seldom spread beyond individual trees, which often continue to grow, albeit damaged (Figure 5.16).

Where pyrophytic tree species (birch, pine and the less common poplar) exist as small patches within broad-leafed forest, lightning-ignited fires are unlikely to start or spread (Peterken 1996, 335). Only on acidic soils, where heathland groundcover is also pyrophitic, are lightning-induced fires relatively common and serious, usually occurring in late summer or early autumn every 80-100 years (Peterken 1996, 335; A.G. Brown 1997, 135-6; Rackham 2006, 58). It is also easier for humans to burn such areas during the same time-frame (*contra* J. Moore 1997, 38, who suggests spring), both accidentally and in controlled ways. This is relevant because forests dominated by pine and birch were mostly restricted to the East Anglian Brecklands, the Greensand ridges and sand/gravel terraces of the South-East, and uplands further west (see Section 5.2). Not a single Early Neolithic monument falls within the Brecklands[35], however, suggesting that good soils attracted early farmers more than open environments. Equally significantly, many river valleys may have supported patches of heathland vegetation, prior to alluviation (A.G. Brown 2000, 56). Low rises on the floors and margins of river valleys, particularly in eastern England, were favoured for siting both long barrows and causewayed enclosures. Despite its acidic character, soil in these damper conditions may have been made more suitable for cultivation by alders, which 'fix' nitrogen (Tudge 2005, 2003). Wildfires in forests dominated by pine and birch produce patches within the larger mosaic, of variable sizes and shapes (Wright & Heinselman 1973; Bradstock *et al*. 2005; Parisien *et al*. 2011). The initial effects, however, are distinctive and produce specific conditions of visibility. Wildfires tend to move rapidly and burn fiercely, consuming dead and dry plant material on the ground, burning to death (but not always

[34] So A.G. Brown's (2000, 50) comment that clearings created by lightning are 'unpredictable in time and space' (my emphasis) is not wholly correct: strikes generally affect elevated ground (in the local context).
[35] Although an early component of the later flint mines at Grimes Graves has perhaps gone unrecognized.

Figure 5.17a: Aftermath of a small wildfire on Yateley Common, Hampshire, photographed in April 2006, 8 months later. Here, river terrace sands and gravels overlying Camberley Sand Formations support a typical heathland ecology. Like the East Anglian Brecklands, Early Neolithic monuments are absent (RCHME 1979, fig. 1). Image: Colin Haywood-Gray/Wikimedia Commons.

Figure 5.17b: The aftermath of the Great Storm of 15th-16th October 1987 at Toys Hill, Kent, which revealed distant views for the first time. Image captured by Bob Ogley; reproduced with his permission.

scorching taller trees (Wright & Heinselman 1973, 9; Paton 2015, 41-2). This can kill species other than pine, birch and poplar, which have co-evolved with fire[36] to increase their dominance in heathland habitats (Keeley *et al*. 2011; Figure 5.17a). The young, thin stems of regenerating birch are in turn favoured by beaver and deer (Wright & Heinselman 1973, 9). Consequently, forests susceptible to wildfire usually have little or no undergrowth, resulting in good visibility beneath the canopy, except for 5-10 years after the fire, while the dense stems of regenerating birch and poplar are maturing alongside taller pyrophitic plants such as rosebay willow herb. Meanwhile, the patchy evergreen canopy of the pines, 30-40m high, is barely affected.

In summary, wildfires were probably only a significant agent of forest clearance in specific regions, where geological conditions supported pyrophytic plant communities. Even there, serious fires were infrequent, occurring perhaps once every 3-4 generations. These areas may therefore have hosted more open environments before the Neolithic. They apparently attracted Mesolithic hunters, but there is little evidence that farming pioneers were drawn to the open conditions *per se*. The exception to this rule is perhaps the floors of river valleys, where occasional wildfires probably interacted with other dynamic agents. Natural clearings in these areas, which were attractive for other reasons, may have been claimed by Early Neolithic communities.

5.5.2 Wind damage

In Europe's ancient semi-natural woodlands today, wind-throw, resulting from root-break or root-hold failure, is by far the most common mechanism through which trees are lost, affecting 0.5-2.0% of the total British population annually (Peterken 1996, 328; A.G. Brown 1997, 140-1). In England, the 1987 'Great Storm' increased this figure to 10–12%: an estimated 15 million trees covering 1,830km^2 (Grayson 1989; Figure 5.17b). Historically, winds this strong occurred once every 200-300 years[37] somewhere in the British Isles, while lesser storms that caused serious damage to woodlands occurred on average every 40-50 years (Grayson 1989, 8). This implies that about twelve major storms occurred during the currency of long barrows and causewayed enclosures.

The prevailing winds in the British Isles are now, and have always been, from the west to south-west sector (Lamb 1950; 1972; Meteorological Office 1952; Shellard 1976). They comprise both straight maritime airflows and circulating cyclonic/anticyclonic airstreams, these last types usually generating the strongest winds. Westerly blows were perhaps particularly frequent and intense during the Early Neolithic (Tipping 2010, 69-70), evidenced by the shared eastward falling of East Anglian 'bog-oaks', spanning 5,000-

[36] Pine bark and needles withstand all but the most severe scorching, while the cones actually require heat to release their seeds. Birch and poplar are capable of regenerating rapidly by producing multiple stems from the root or stump and also produce large quantities of light-weight seed that can be wind-dispersed over long distances onto the ideal mineralized seed-bed of the fire site.

[37] 1703 saw the previous comparable storm in Britain, primarily affecting the Midlands (Grayson 1989, 8).

Figure 5.17: The aftermath of the Great Storm October 1987, illustrating beech trees blown down in accordance with the slope. The survivors are mostly oaks. Image captured by Bob Ogley; reproduced with his permission.

1,500 cal BC (C. Lucas 1930). But due to seasonal continental influence, strong easterly and southerly winds also affect the regions where Early Neolithic monuments are most densely distributed. Dendrochronological analysis of bog-oaks across northern Europe also indicates several climate-related dying-off/germination phases in the Late Mesolithic and Early Neolithic (Leuschner *et al.* 2002). One of the most serious occurred in 4,000-3,900 cal BC (*ibid*., 703) *i.e.* the time of the earliest immigrations. During these phases, less healthy trees will have been particularly susceptible to wind-throw. Strong winds are most frequent between January and March, but these often cause less damage than weaker blows when the trees are in full leaf, which makes them more resistant and top-heavy, while the sap-filled wood is more brittle[38].

Importantly, local topography modifies wind direction and strength at ground level (Meteorological Office 1952; Shellard 1976; Foster & Boose 1992). Research after the 1987 storm showed that although trees were blown over in all settings, woodlands on the crests of steep slopes (whether or not on the windward side) and adjacent high ground were most vulnerable to wind-throw, while woodlands on gentle slopes in the lee of high ground were least vulnerable (Peterken 1996, 330). Valleys funnelled airstreams, resulting in increased tree-throw on prominent parts of valley sides. It is impossible not to observe that many monuments on high ground occupy such positions, suggesting that wind blows may have created the clearings which hosted them. The incidence of wind-throw was also above average on weak subsoils, including gravels and riverine silts (A.G. Brown 1992; Peterken 1996, 330). This recalls the sites of many low-lying monuments.

Trees growing in open country and those on windward edges of forests, where these edges have stabilized, develop 'buttresses' reaching *c*.1.5m above ground, giving them a stronger root-hold. Low branches growing on the sides(s) exposed to light confer a lower centre of gravity, which makes them less susceptible to wind-throw (Tudge 2005, 273). Oaks, which develop broad root-spreads and some buttressing because they initially require moderately open areas in which to grow, are generally more wind-resistant. During the 1987 storm, oaks less than 400 years old tended to suffer broken limbs and crowns rather than being thrown down (Peterken 1996, 330). By contrast, limes, common in much of southern Britain in the Mesolithic and Neolithic, were more likely to be toppled completely (Grayson 1989, 15 & table 7), though their capacity to regenerate is strong (see Section 5.8). Trees that have always lived within forest usually have a relatively weak, shallow root-hold and a high centre of balance. Consequently, if a tree of sufficient size and weight within a forest is wind-thrown, perhaps because it has already been weakened by root or stem decay (Peterken 1996, 330), it can set off a chain reaction, resulting in extensive 'blow-downs'. Most trees involved fall within 30 degrees of due-downwind, except on steep slopes (Figure 5.18), where they fall with the direction of the slope

[38]This gives rise to the common emphasis on autumn gales, which are actually less severe and frequent.

Figure 5.19a: Deliberate woodland clearance on the crest of the Greensand Ridge, Kent, has left conspicuous notches on the horizon, here seen from a distance of 1.6km to the south on a misty day at the start of November. The Rooks Hill clearing originated as a medieval assart, potentially comparable to an Early Neolithic clearing.

Figure 5.19b: One of many 'tip-up mounds' on the Greensand Ridge in Kent, left by trees that fell in the Great Storm of October 1987, photographed almost exactly 30 years later.

(Peterken 1996, 328). Considering the settings of monuments on high ground, if trees standing on the crests of steep scarps fell downslope, they may have opened 'windows' that afforded views out over lower-lying areas. Conversely, a clearing in such a location would inevitably create a 'notch' on the horizon when seen from lower ground, assuming the existence there of a clearing large enough to see beyond its perimeter (Figure 5.19a). In heavily forested landscapes, such notches would be even more conspicuous from afar than they are today.

Most clearings in deciduous woodland caused by the 1987 storm were under 0.5ha, with an average diameter of 80m, although some reached 2.0ha[39]. They were often approximately circular or somewhat linear in the direction of the blow (A.G. Brown 2000, 50; Peterken 1996, 331). Again, it is hard to ignore the similarities with the size and shape of most causewayed enclosures, many of which are approximately circular, enclose less than 2.1ha (commonly *c.*0.6ha) and are 50-200m in diameter (Oswald *et al*. 2001, figs. 4.6 and 4.23). Trees along a newly-created forest edge take several decades to adapt their growth patterns to secure themselves, as described above. Until this is achieved, a peripheral belt *c.*100m wide remains more vulnerable to wind (Foster & Boose 1992, 94). This often leads to episodic increases in the size of clearings, particularly on the most exposed side, though local topography remains a factor in directing the wind. This observation recalls examples of causewayed enclosures enlarged by the addition of outer circuits (Oswald *et al.* 2001, 75-7).

Although strong winds create 'clearings', these were not blank canvases onto which monuments, fields or settlements could immediately be imposed, as sometimes implied. Wind-thrown trees tear up a root-plate averaging 3m wide (twice that for large trees), creating a 'tip-up mound' and pit, collectively covering *c.*3% of the surface of the clearing (Peterken 1996, 331). Stumps can take 50 years to degrade significantly, invariably leaving an earthwork (Figure 5.19b). How did people digging ditches and constructing banks cope with such obstacles? Their prominence and longevity may explain why some were used for caching objects (C. Evans *et al*. 1999). Despite the undoubted ubiquity of trees throughout the Neolithic, excavations identify relatively few tree-throw holes[40] compared to the enormous number of trees that must have existed over nearly two millennia (Macphail & Goldberg 1990; A. Gibson 2003, 139). Their relative scarcity is perhaps partly

[39] This statistic relates to semi-natural deciduous woodland; 'blow-downs' in coniferous plantations were often far larger. The deciduous figures broadly tally with the damage done by a 1938 hurricane in New England, where 73% of the damaged patches in one valley were under 2.0ha and only 11% were over 5ha (Foster & Boose 1992, fig. 6). However, the largest clearing created, sustaining more than 75% damage, covered *c.*37ha.

[40] More effort has been devoted to their recording as their significance has become better understood (*e.g.* C. Evans *et al.* 1999; T. Allen *et al.* 2004; Lamdin-Whymark 2007). For example, excavation of *c.*0.35ha near the Drayton cursus revealed some 78 tree-throw holes, which were later shown to span a range of dates (Barclay *et al*. 2003b, 60-62). So this relatively dense concentration does not represent a 'snap-shot' in time, nor anywhere near the total number of trees that must have occupied the area over two millennia.

Figure 5.20a: The impassable chaos in the Weald of Kent left by fallen trees in the wake of the Great Storm of 1987. Image captured by Bob Ogley; reproduced with his permission.

Figure 5.20b:
The hulk of an elm tree (planted *c.*1920, died of Dutch Elm Disease *c.*1985), photographed in early February, *c.*30 years after its death. The stump, on Walmgate Stray, York, was eventually removed for safety reasons 5 years later.

because forest trees are usually more shallow-rooted than open-country specimens, which need to be more strongly anchored to combat wind-throw, and therefore leave slighter holes. Hornbeam, beech and ash are more prone to 'trunk-break' than wind-throw (Peterken 1996, 328-9), leaving 'snags' up to 10m high, with the remaining trunk, at most, barely attached. Consequently, newly-created 'clearings' are a tangled mat of fallen trunks, branches and crushed underwood up to 2m deep, arduous even to move through (*ibid*., 333; 341; Figure 5.20a). Hazel and birch debris begins to rot within a year, but other species take several years before disintegration begins. Within this period, regeneration will commence (see Section 5.8).

5.5.3 The 'Elm decline'

After decades of debate, the consensus is that the elm decline that occurred throughout Europe over a few decades *c*.3,770 cal BC was caused by a strain of the *Ceratocystis* fungus, although climate change and human interventions[41] may have played supporting roles (Bogucki 1988, 33-4; Peglar 1993; Peglar & Birks 1993; A.G. Parker *et al*. 2002; Rackham 2006, 107-8; C. Batchelor *et al.* 2014). Elm favours the most fertile soils and makes up a significant proportion of the trees in those conditions, thriving particularly on calcareous soils (Tudge 2005, 350-1; M. Parker 2015, 3). Areas with these soils, including eastern Kent and the North Downs, probably saw the earliest Neolithic settlement, while the chalklands of Wessex and Sussex were occupied soon after; monuments are common in all these regions. In forest conditions, elms develop canopies 24-36m high, suppressing the understorey and perhaps explaining the sudden increase in the proportion of hazels observed after the Decline (Rackham 2006, 88).

The near-simultaneous deaths of clusters of elms may have prompted deliberate clearance of their environs for agriculture[42] (Rackham 2006, 101), supporting Piggott's (1954, 5) belief that the events were linked. Yet elm wood is very hard - resistant to both splitting[43] and fire - making it difficult to fell and to dispose of, because even the dead wood burns poorly (M. Parker 2015, 10). Consequently, elm skeletons may have outlasted the clearance of their surroundings for decades (Figure 5.20b). Elm responds to attack and often reproduces by sending out suckers; the new shoots are particularly attractive as browse.

[41] Many had previously argued that the decline was caused by excessive harvesting of leafy branches as cattle fodder (e.g. Troels-Smith 1960, 22-24; Heybroek 1963; Garbett 1981; Packham & Harding 1982, 138; P.J. Fowler 1983, 5-6; Parker *et al*. 2002; Williams 2006, 22). As Troels-Smith points out, building on observations made in the 1920s, harvesting elm branches would inevitably have a serious impact on elm's ability to reproduce, because the tree will not produce pollen for 6-7 years after cutting back.

[42] This represents a rather different connection between the health of tree and human populations from that suggested by Baillie (1998), who argues that climatically-induced difficult spells in the growth of oaks tend to coincide with episodes of human hardship.

[43] For this reason, it was traditionally used for chair seats, amongst other things.

Figure 5.21a: A 0.9m-high beaver dam in the Diois region of south-eastern France, constructed in 2016 and photographed 6 years later, soon after the family had moved further upstream. Note the trees in the background, killed by the resulting inundation.

Figure 5.21b: A recently felled young oak, 14cm in diameter, in a different beaver territory in the Diois region. The profile of the 'kerf' is similar to that made by a stone axe.

5.5.4 Beavers

Although surviving material evidence is scarce, beaver (*Castor fiber*) were undoubtedly widespread in the Early Neolithic (B. Coles 2006). Skeletal remains and gnawed wood have been found at some Mesolithic[44] and Neolithic riverside sites, from Runnymede in Surrey to Stainton West in Cumbria (Serjeantson 2006, 121; 2011, 47; F. Brown 2009, 20). Beaver-gnawed wood was suspected[45] at Etton causewayed enclosure (Maisie Taylor, pers. comm.), while a molar at Offham causewayed enclosure presumably derived from a colony on the Ouse, less than 1km away but 60m lower (T.P. O'Connor 1977, 231-2). Their general absence from faunal assemblages suggests that they were most valued for their warm, waterproof pelts, as noted above (Serjeantson 2006, 121).

The scarcity of material evidence seems to have blinded most British archaeologists to the environmental impacts of beaver (*e.g.* Sidell & Wilkinson 2004, 41-3; Haughey 2009; 2016; Noble 2017). By contrast, in countries where beaver still live[46], they are renowned for transforming riparian landscapes. All the watercourses[47] in southern England near which monuments were built would offer suitable habitats. Families occupy territories *c*.3.6km long (maximum 7km), with neighbouring territories often contiguous (Coles & Orme 1983, fig. 2), so long stretches of most watercourses in Britain were probably colonised.

Beaver affect the environment in five ways[48] relevant to this thesis.

1) To build and subsequently maintain up to 6 lodges and 30 dams per family, beavers fell 200-400 trees[49] per year (2-3ha of forest), obtaining them up to 50m from the water's edge and working most intensively in autumn. Felling leaves a stump up to 45cm high, which will often produce new shoots the following spring: ideal food for both beavers and other browsers, including aurochs, red deer and roe deer (Coles & Orme 1983, 98; B. Coles 2001, 68; Vuure 2005, 186). Remarkably, 70% of felled trees are accurately directed towards the watercourse, so that they seldom 'snag' on standing trees, even when wind causes the final toppling (Badyaev 2015). Since smaller trees, especially water-loving species like alder and willow, predominate along watercourses, this activity creates open corridors, usually along both riverbanks and sometimes along its entire length. Flooding caused by dams may eventually exceed the extent of the tree-felling, hindering movement along the banks by other species, until the beavers extend their feeding zone (Coles 2001, 64 & fig. 1).

[44] Bones from at least twelve individual beavers were found at Star Carr, where hunter-gatherers also made use of trees felled by beavers (Knight *et al.* 2018, 251).

[45] This could not be confirmed before the conservation process rendered the marks unrecognizable.

[46] The last few beavers in Britain were hunted to extinction in the Middle Ages.

[47] As noted in Chapter 4.1, they favour rivers and streams with stable, slow currents (*i.e.* the gradient is not too steep), but will manage the rate of flow by dam-building if necessary (B. Coles 2001, 68-74). If they survive a serious flood, beavers will sometimes relocate their lodges and dams.

[48] The following summaries are mainly derived from Kay 1994 and Rosell *et al.* 2005.

[49] Each tree may be up to 35m tall and 90cm in diameter, although the average is 10–30cm.

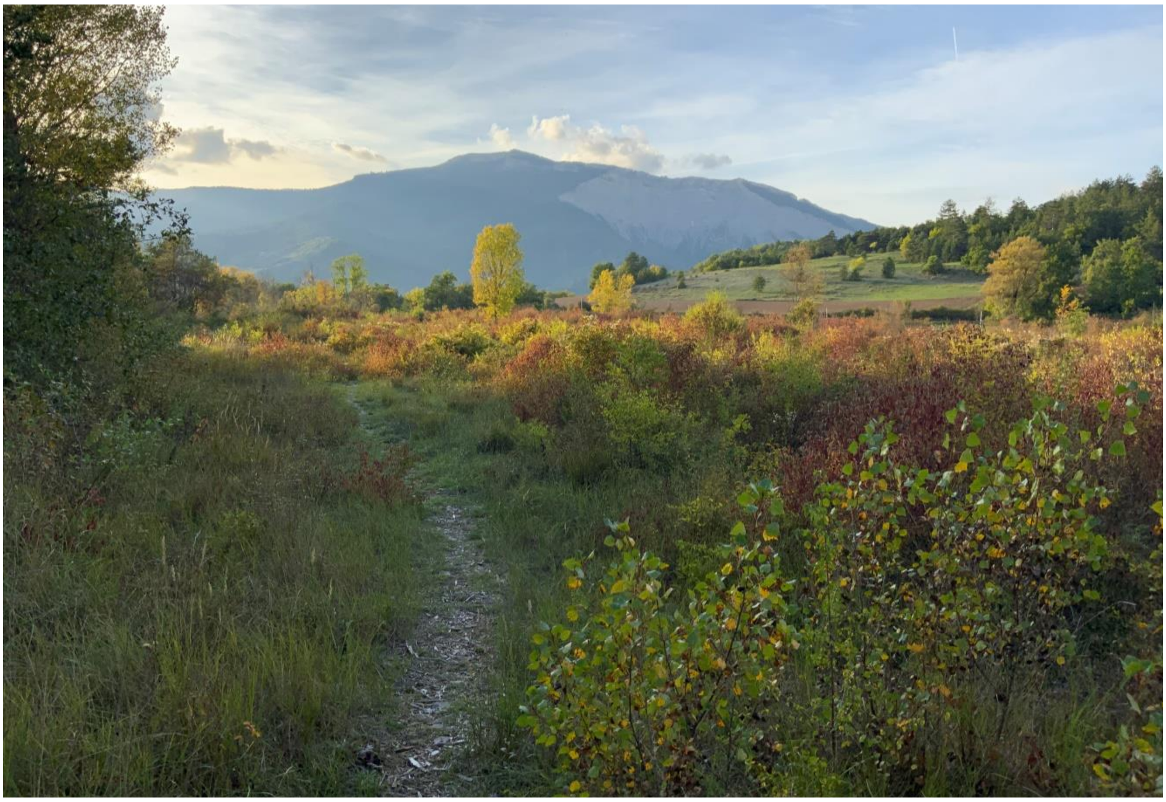


Figure 5.22a: Former woodland being managed by the family of beavers responsible for felling the oak shown in Figure 5.21b; little of the regrowth is higher than 1.5m. Note that the trail in the foreground is produced by beavers.

Figure 5.22b: Marshland and saturated ground extending for 1.8km along the valley floor, created by the beaver dam shown in Figure 5.21a, which raised the water level at that point by 0.8m.

2) Flooding and ground saturation often kill pine and beech, which need dry roots (Coles & Orme 1983, 99). Over the course of *c.*8 years, many other species will die, leaving alder, willow and poplar, whose bark is beavers' preferred food. So, although pine and beech are not preferred foods, even more open corridors develop, initially through defoliation and eventually through collapse.

3) Beavers consume *c.*1.5-2.0kg of bark and shoots per day in summer, reducing to 0.9kg in winter. They fell large trees to promote the growth of new shoots and to lessen competition for their preferred species[50]. Since they need to gnaw continually in order to wear down their fast-growing teeth, they often target trees with harder wood and/or rough bark (*e.g.* oak and pine), even though these are not needed as food or construction material. Consequently, even if a dam is not constructed, because the watercourse is naturally deep enough, trees are still felled in large numbers. This continuous 'coppicing', which, like the constructional felling extends *c.*50m from the water's edge, results in abundant low regrowth, especially from species like willow and alder, which respond well to severe pruning. Regrowing stems are never allowed to reach more than *c.*1.5m high, but form dense clumps (Figure 5.22a).

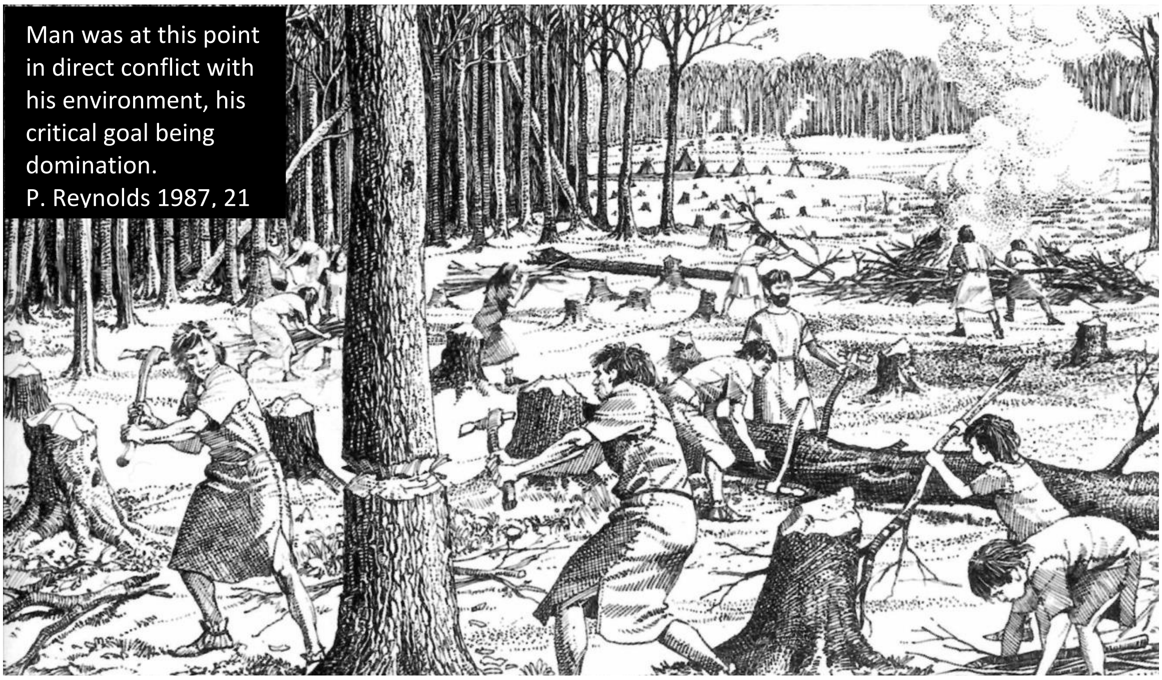
4) Creating ponds saturates the ground beyond the inundated area, indirectly making a broader corridor more vulnerable to tree loss by wind-blow (A.G. Brown 1997, 141; Figure 5.22b). Increased riverbank erosion, combined with dams and 'canals', may cause new channels to develop, where the macro-topography allows (Coles 2001, 65-8).

5) Although watercourses carried relatively little silt before arable agriculture, beaver burrows and canals generate considerable volumes, much of which gets redeposited behind the dams (Coles 2001, 76-8). The ponds, also full of uneaten shoots *etc.*, may eventually become so silted that the stream changes course, leaving the relict pond to become a 'beaver meadow'[51].

Long before the Neolithic, then, beavers had probably turned major and minor watercourses into open corridors with relatively good remote visibility, especially along the axis of the watercourse. Near the causewayed enclosure at Eton rowing lake, for example, the foreshore of the contemporary Thames was open and intensively used, with Early Neolithic material concentrated around a disused lodge (T. Allen *et al*. 1997, 124). The open corridors perhaps merged with more extensive clearings where monuments lay. These too may result from beaver activity, for many riverside causewayed enclosures have irregular footprints (*e.g.* Alrewas and Mavesyn Ridware, alongside the Trent in Staffordshire), as though designed to encompass pre-existing clearings.

[50] They may give up a territory if food resources are depleted, but recolonize when the plants recover. If they survive a serious flood, beavers will sometimes relocate their lodges and dams.
[51] Beverley, East Yorkshire, is a town named after its beaver meadows. Swinemoor and Figham Moor, two of the town's three ancient commons, are expanses of lush pasture alongside minor watercourses, which very probably originated through beaver activity.

Figure 5.23a: Land on the fringe of the beaver-induced marshland shown in Figure 5.22b, following controlled grazing of the riparian vegetation by sheep.



One still encounters the nonsense that prehistoric people ‘cleared the forest by fire’ to create fields: nonsense because even in the most favourable circumstances fires may kill trees but do not destroy them, and there remains the immense task of getting rid of dead trees and roots. – Oliver Rackham 2006, 58

Figure 5.23b: Reconstruction of forest clearance using axes and fire, exemplifying the belief that people’s determination to grow crops was the key factor in human – environment relations. The process appears unrealistically tidy, and the tree-fellers are swinging long-handled axes using their whole bodies, both the tool and the technique being anachronistic. Image reproduced courtesy of the Museum of London.

Hunting by humans - the beaver's only effective predator - disrupts their impacts on the landscape, and not just by reducing numbers. In North America, the only way[52] to hunt these largely nocturnal animals was to break their dams to drain the pond protecting the lodge, before digging them out (McManus 1972, 44). This labour-intensive process was usually undertaken in autumn or winter, when the animals were at their fattest and most numerous, and the humans' need for food greatest. Wider environmental impacts were usually temporary, because other beaver families soon take over deserted territories and make repairs, but repeated hunting would obviously have longer-term effects.

In conclusion, beavers were undoubtedly important environmental agents throughout the Mesolithic and Neolithic, in ways that created specific affordances for remote visual perception in relation to many low-lying monuments.

5.6 Forest clearance by humans

Into an already complex ecosystem, we must introduce human activities. Some degree of forest clearance, whether natural or deliberate, was a prerequisite for building monuments and settlements, and for arable agriculture (G. Clark 1945; 1947; M.J. Allen 2000a, 16). As demonstrated above, immigrant communities would have encountered numerous pre-existing clearings. Yet they undoubtedly began to make further impacts immediately on arrival. Post-processualism has largely jettisoned practical observations arising from experimental forest clearance (*e.g.* Iversen 1956; Steensberg 1957; Jorgensen 1985; summary in Noble 2017, 50-9). Consequently, the mechanisms and effects of clearance tend to be discussed vaguely, sometimes with a conspicuous lack of practical understanding.

Clearing forests using stones axes and fire was undeniably 'no mean feat' (A.G. Brown 1997, 135; A. Gibson 2003, 139; Noble 2017, 178-9; Figure 5.23b), if that was really how it was achieved. Yet descriptions of clearance and its effects are confused: on one hand, the expertise in forest management of people who dwelled in a landscape dominated by forest are probably underestimated. On the other, it is sometimes assumed that Early Neolithic farmers cleared forest with a speed, thoroughness and permanence to rival medieval assarting, the destruction of North American forests, or even the Amazon (*e.g.* G. Clark 1945, 66-7; Reynolds 1987, 21). J.M. Coles (1976, 61) suggests that a single man could clear one hectare in a month. By this, he must mean 'felled', for disposal of the debris alone would take far longer. All the mid-20th century experiments, however, were driven by a maximizing theoretical agenda and a belief that forest was essentially inhospitable, biases overlooked by the latest study (Noble 2017).

[52] Beaver will quickly gnaw through wooden traps, so it was only when colonists with steel traps arrived in North America that beaver populations started to decline.

Figure 5.24: Examples of hafted Neolithic axes from northern Europe, illustrating their consistently short length and the wide range of woods used. Hafts this length would strike a tree 75-100cm above ground level.

	Location of find	Published source	Wood		Location of find	Published source	Wood
A	East Dean, East Sussex	Dawson 1894	unknown	**I**	Magleby Long, Stevns, Denmark	Becker 1947, fig. 4	ash
B	Sigerslev, Denmark	National Museum of Denmark	ash	**J**	County Monaghan, Ireland	J. Evans 1897, fig. 93	pine
C	Etton, Cambridgeshire	Taylor 1998, fig. 162	?rowan	**K**	Arnakkegård, Sjælland, Denmark	Becker 1947, fig. 2	birch
D	Solway Moss, Cumbria	J. Evans 1897, fig. 91	?hawthorn	**L**	Arnakkegård, Sjælland, Denmark	Becker 1947, fig. 3	birch
E	Penhouet, Loire, France	J. Evans 1897, fig. 99a	ash	**M**	Ehenside Tarn, Cumbria	Darbishire 1874	beech
F	Robenhausen, Switzerland	Keller 1878, plate X	ash	**N**	Port Talbot, Wales	Savoury 1971	birch
G	Robenhausen, Switzerland	Keller 1878, plate XI	unknown	**O**	Rodbyhavn, Lolland, Denmark	BBC 2014	ash
H	Borum Stormose, Denmark	Becker 1947, fig. 1	ash				

Table 5.4: Key to axes in Figure 5.24

Species of tree	Diameter	Time to fell	Reference
Oak	20cms	Not recorded	J. Evans 1897, 162
Oak	<35cm	<30 minutes	Iversen 1956
Pine	17cm 20cm	5 minutes 7 minutes	H. Nietsch, quoted in J.G.D. Clark 1945, 68
Pine	25cm	20 minutes	Semenov 1964, 130
Pine, alder, birch, ash, willow	15cm	7 minutes	Stelcl and Malina 1970
	32cm	24 minutes	Cranstone 1971
Oak	30cm 60cm	*c.*20 minutes *c.*90 minutes	Startin 1978, 154 (estimates)
			Jorgensen 1985 (no copy of this available)
Poplar Field maple	27cm 29cm 17cm	35 minutes 52 minutes 62 minutes	Mathieu & Meyer 1997, fig. 4
	40cm	118 minutes	Darrah 2006, 123
Oak	90cm	"a full day"	Pryor 1998, 38

Table 5.5: Recorded times for experimental tree-felling using stone axes, illustrating that larger trees have not been tackled. Early experimenters apparently achieved results considerably more quickly.

Perhaps Early Neolithic farmers found it inconceivable that the forest could ever be completely eradicated, just as European settlers in North America initially eschewed well-established practices of forest management because they saw the forests as limitless and inexhaustible (Austin 2000, 77; Proulx 2016). But adopting historical analogies arguably falls into the trap of compressing the long timescales over which such tasks may have been undertaken in prehistory into single, intensive events (Whittle, Healy & Bayliss 2011b, 1). This often reflects a conviction that arable agriculture was the key objective for Early Neolithic communities and that nothing but total clearance would suffice to meet this end (*e.g.* Mercer 1990, 8). Actually, clearance was probably patchy, piecemeal and intermittent, reflecting numerous different needs (O'Connor 2010, 4). While Allen (2000a, 23-4) identifies ten stages in clearance, Gibson's (2003, 139) imaginative, nuanced exploration recognizes the likelihood that clearance represents numerous processes intertwined, taking place over the course of years. His model implies that the character of

Figure 5.25: A recently clear-felled hornbeam coppice, with oak 'standards' left for timber. Though reminiscent of the imagined scene in Figure 5.23b, it is partly the use of steel tools that enables such tidiness, plus the fact that the larger trunks are not a waste product, but the actual crop. Photographed in early February in the Weald of Kent, one of the most heavily wooded parts of Britain.

clearings, and thus their susceptibility to remote perception, was not static. Nevertheless, entrenched black-and-white ideas remain difficult to shift.

Some of Gibson's suggestions, however, are questionable and at odds with the prolonged process he envisages. Given the high ratio of complete axes to fragments, it is questionable whether axes were routinely used to fell trees that were not required for construction (Pryor 1998b, 39; *contra* Noble 2017). Neolithic axes were short-handled: generally 40-60cm long (Figure 5.24). This is significantly shorter than bronze-bladed examples, but compares closely with Native American stone tomahawks, hinting that Neolithic axes were used as (or symbolized) weapons (Davis & Edmonds 2011). Although 40% of the corpus above had ash hafts (Table 5.4), the wood is conspicuous by its absence amongst the British examples (M. Taylor 1998, table 21), suggesting that utility was often less important than aesthetics[53]. When used for felling, they could not be used like medieval and later long-handled axes, instead striking trunks 0.7-1.1m above ground (Steensberg 1957, 68; Coles *et al.* 1978, 26; Noble 2017, 53). If the intention was to remove the roots eventually, retaining a long stump would allow more effective use of leverage. Experiments with stone axes have only ever tackled one tree over 40cm in diameter (A.G. Brown 1997, 136; Table 5.5). However, slim trees, which do account for the majority used in Neolithic structures, were perhaps targeted precisely because they were easier to fell (Clare 1995; *contra* Noble 2017, 48). As noted above, in forest conditions, trees of considerable age and height would retain relatively slim boles by comparison with open-country examples. This invalidates Darrah's (2006, 120) objections that buttressing would impede felling. Experiments suggest that a competent person would need *c.*30 minutes to fell a tree of that size, though someone less experienced would take far longer[54]. Yet it is clear that, when the need arose, people were capable of working (though not necessarily felling) trees of a size to rival the sarsens of Stonehenge (Noble 2017, 138-73). The suggestion that felling was undertaken in early summer (J.M. Coles 1976, 61) rests on the assumption that clearance was intended to make way for agriculture. If building timbers were required, trees were more probably felled soon after losing their leaves in autumn, although, contrary to traditional belief, wood is not much lighter or less brittle in winter (Edlin 1953, 196-7).

It would be far easier, however, to pull forest trees over with ropes, due to their relatively weak root-hold and high centre of gravity, perhaps after severing key lateral roots close

[53] For example, pine <u>was</u> used, even though it is poorly-suited to axe handles because its grain structure leads it to split (Wood 2010). Several of the woods used (*e.g.* hawthorn, yew and alder) are deeply coloured, while others have attractive grains (*e.g.* beech, although this also makes good artefacts).
[54] Darrah (2006, 123), for example, took about four times as long as Steensberg (1957, 68) to cut through a slightly larger trunk.

Figure 5.26a: Experimental 'notching' (*i.e.* a step further than 'girdling') of small trees using a replica Mesolithic axe. Shown here are an alder (in the foreground) and a wild cherry. My objectives included: 1) to test whether notching trees low down in mid-September killed them or coppiced them; 2) to test whether a small hole in the canopy made any appreciable difference to the herb layer; 3) to see whether I could work comfortably using the short-handled axe by kneeling or sitting.

Figure 5.26b: The same trees exactly 5 years later. Both are dead and could easily be burnt at this stage; the alder has fallen (though still propped up by nearby trees); its stump has started to rot in the ground. Note the considerably increase in the herb layer resulting from the small hole in the canopy.

to the surface (Barclay *et al*. 2003b, 66; M. Taylor, quoted in Evans & Hodder 2006, 318). Oxen might also be employed (Mercer 1990, 8; Serjeantson 2011, 20). This technique requires a pre-existing clearing in which trees can land without 'snagging' on their neighbours, but would avoid the need for the difficult and time-consuming task of digging, cutting and/or burning out stumps (Pryor 1998, 40). In my own experience, to burn out a stump effectively, a fire needs to be lit in a well-ventilated cavity dug directly beneath the roots and then fed for several days. In contrast, a prone tree with roots intact could have been reduced in size more effectively and comfortably, using vertical (*i.e.* gravity-assisted) blows. It is easy to prevent regrowth and to encourage fungal decay by burning the root-plate, perhaps accounting for the many tree-throws that contain charcoal (Barclay *et al*. 2003b, 62; Harding & Healy 2007, 51-3).

Gibson (following others) convincingly suggests that larger trees were perhaps killed by 'girdling'[55] and then left standing to die and decay at their own pace. Girdling is most effective in spring and early summer, when the tree has already invested much of its energy in growth, but can still take several years to kill the root (Iversen 1956; Kilroy & Windell 1999, 3-4; Pepper 2008, 3). Noble's (2017, 47-8) scepticism that the technique was used in the Neolithic because of this delay echoes earlier optimizing theories. In any case, his suggested maximum of 15 years[56] would be exceptional, most mature trees taking 2-5 years to die (http://www.forestryforum.com/board/index.php?topic=56794.0). If necessary, 'notching' (*i.e.* cutting into the sapwood; Figure 5.26) will hasten the death of the crown, producing significantly increased light levels by the same autumn, potentially enough for arable crops, and certainly for increased herb growth, by the following spring (Anderson *et al*. 1969). Notching can also encourage the growth of new shoots by effectively coppicing the tree, but any regrowth may have been a desirable by-product for browsing cattle. Using a fire set around the base of the tree, the technique most common in the ethnographic record (Kennard 1955, 9; Jenīk 1979, figs. 143-5), usually ensures that no regrowth occurs and further hastens decay by facilitating fungal and insect attack. Shaw's (1969) experiment took 6 hours' work to set a fire that burned for 60 hours around the base of a 44m-high tree, so it could be pulled over. This option is therefore viable, if necessary, but far more labour-intensive than just killing the tree. Where fire was used in clearing scrub (*e.g.* Barnett *et al*. 2010), its purpose was probably often to clear away dead underbrush and rejuvenate the herb and shrub layers, rather than to kill or burn trees (Rackham 2006, 59; Dark 2007, 183). Exactly this process was documented in the later 14th century in the small clearings that punctuated Poland's *Grosse Wildnis* (Vuure 2005, 206).

[55] This term is preferred here to 'ring-barking', because the process also involves cutting through the cambium layer beneath the bark to be effective.
[56] This figure is apparently derived from J.M. Coles (1976, 61), who implies that his source is an ethnographic study of forest clearance in Russia, for which he provides no authority.

Figure 5.27a: Land pockmarked by old alder and birch stumps in the New Forest, Hampshire. Photographed in late March.

Figure 5.27b: Stacks of seasoning firewood for a single household. Photographed in early October near the 35ha causewayed enclosure discovered in 2016 at Bure-Saudron, on the limestone plateau between the Rivers Meuse and Marne.

Gibson's proposal that dead trees could be chopped down a few years after their deaths is unrealistic (see also A.G. Brown 1997, 136). With the exception of birch, whose wood rots quickly beneath its bark, most woods get harder and more resistant to lateral blows as they dry (Edlin 1969, 19). Once the roots have rotted thoroughly, however, a dead tree can be pulled over more easily. If left standing, it will gradually shed its branches, pock-marked by insects and birds, until, perhaps decades later, the trunk finally falls, often pushed by wind (J.M. Coles 1976a, 61). Nutrients are thus released back into the soil, without any need for labour-intensive felling (*contra* Noble 2017, 48). Neither a standing dead tree nor its stump, nor even a prone, branchless trunk, is a serious impediment to growing cereals, as attested around the world[57]. The agricultural experiments in Denmark's Draved Forest proved equally effective (Steensberg 1957; Noble 2017, fig. 3.6). Records of European settlement of Ontario indicate that stumps of deciduous trees could be pulled out by oxen 8-10 years after felling, but that coniferous stumps were often still insufficiently rotted after 50 years. Even by 1880, 90 years after they were first cleared, 46% of the highly productive fields in York County still contained stumps[58] (C. Schott quoted in G. Clark 1945, 69; Figure 5.27a).

The wood of trees that have died suddenly and then been suspended and dried above ground makes good fuel, but would be more difficult than green wood to cut up into convenient lengths using axes. Yet well-seasoned wood, if not charcoal, would have been essential for cooking, when constant, low temperatures are needed. It seems likely, therefore, that slim trees were felled in considerable numbers for firewood and that large stacks of drying wood were a feature of every settlement (Figure 5.27b). Seasoned wood burns with negligible smoke and steam and is therefore translucent and bluish, making it almost invisible from long distances, especially against the dark background of a forest canopy (*contra* Gillings & Wheatley 2001, 13).

Causewayed enclosures with near-circular plans could only be designed and executed in spaces that were already largely clear of trees and scrub (Pryor 1988, 70). For example, the nearly perfectly circular middle circuit of the enclosure on Windmill Hill was evidently constructed last and, therefore, in a long-established clearing considerably larger than the circuit (J.G. Evans 1966; 1972, 242-8; Macphail 1999). In contrast, the more approximate circles of the other two circuits seem to have been constructed in recently-cleared ground and perhaps, therefore, echoed the plans of the contemporary

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[57] For example, native North Americans (Cronon 1983; Williams 2006, 54); the Achuar of Amazonia (Descola 1996, 157); farmers in Peru and West Africa (Jenīk 1979, 74; 91 & fig. 143); in post-medieval Schleswig, Poland and Finland (sources quoted in G. Clark 1945, 69). Ethnographic studies from regions that are very different from northern Europe in geology or climate are admittedly less relevant, but Canada and Russia, which are broadly comparable, provide supporting evidence (Coles 1976, 59- 61).

[58] Cultivation was certainly carried out in many Bronze Age 'cairnfields', even though the cairns are often only a few metres apart. The initial foci for the development of some of these cairns were probably rotting stumps (Oswald *et al*. 2006, 39; Gates 2009, 62-3).

Figure 5.28a: A debris-littered clearing in beech woodland, 20 months after clear-felling. Photographed in mid-October near the causewayed enclosure at Carvin, northern France.

Figure 5.28b: Debris produced by the clearance of West Tump long barrow, Gloucestershire, 38 months after being piled here, and now easy to burn. Photographed in mid-September.

clearings (see Chapter 7). There is also possible evidence, in anomalous deviations in the circuits of other causewayed enclosures, that trees or stumps were still standing[59] when these earthworks were constructed (Oswald *et al.* 2001, 60). The same phenomenon has been noted in the perimeters of some cursus monuments and timber mortuary structures (Gibson & Loveday 1989; Loveday 1989; Buckley *et al.* 2001, 153; Noble 2017, 107). It seems plausible, therefore, that living trees, or the skeletons of dead ones, remained standing within 'clearings' and perhaps in the interiors of enclosures[60].

Returning to the idea that humans appropriated clearings created by natural events[61], particularly wind-blows, how would the clearance process differ from clear-felling by humans? To begin with, burning the deep tangle of 'green' debris would be time-consuming and labour-intensive, requiring large, fierce fires of seasoned wood to consume the wetter material. Even pushed by strong winds, fire will not spread far through green wood without careful tending, contrasting with wildfire's rapid progress through dry brushwood. Yew, pine and holly, and to a lesser extent hawthorn, birch and ash, can be burned green as long as the fire has a good base. Other broad-leafed species, however, need a prolonged period to dry sufficiently, the duration depending on both the species and the thickness of the wood. Most species need 2 years, while oak, lime and cherry need at least 3, before they will burn well (A. Miles 1999, 79). The Draved Wood experiments suggest that people left clearings created by wind-blow until at least the following summer before they intervened (Steensberg 1957, 69). By this time, fallen debris would be drier and regenerating herbs and shrubs would contribute. Even so, the burning in Draved Wood took 4 days and nights of almost continuous work (*ibid*.), a labour-intensive approach predicated on an assumption that people were rushing to clear land for agriculture. Yet intense burning risks removing all organic matter from the soil, leaving it infertile.

It is more likely that the process lasted years, or even decades (Figure 5.28a/b). In the Late Mesolithic, large timbers of slow-drying species were incrementally reduced by burning until portable, also making them susceptible to fungal and insect attack (Bell 2007, 322). Young shoots, whether of saplings unaffected by the wind-blow or of regenerating fallen trees, would be killed by this burning. Repeat burnings in subsequent summers would

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[59] At Sarup causewayed enclosure, in Denmark, a standing tree was aparently deliberately encompassed by one of the small fenced enclosures that accompanied the inner circuit (Andersen 1997, 67 & fig. 83).

[60] This shows that an imaginative approach to features and practices that would leave no sub-surface trace is necessary. For example, where excarnation took place, the dead would need to be placed beyond the reach of wolves (*i.e.* over 3.6m) for <u>any</u> bones to survive. Humans and trees were linked in some burial monuments (Noble 2017, 153-9), so perhaps large, dead trees – striking symbols of death – were used for this purpose. If so, the living may have climbed so that their eye-level was 6m or more above ground. Alternatively, such views might be reserved for the dead.

[61] J.M. Coles' insistence (1976a, 62) that Early Neolithic forest cover was unbroken except by rivers and swamps and his silence on the issue of the effects of browsing by wild and domesticated ungulates appear to be facets of his belief in the absolute importance of cereal cultivation, typical for the 1970s.

Figure 5.29a: A virtually smokeless cooking fire, made with well seasoned wood left suspended above ground by river floodwaters. Photographed at the start of April, not far from the probable causewayed enclosure at Green How, Cumbria.

Figure 5.29b: Resinous smoke and steam billowing from a wildfire in Cropton Forest, North York Moors, in June 2010. Cropton is largely modern coniferous plantation, but the underlying soils and pre-existing vegetation are similar in character to other regions susceptible to wildfire, and there is widespread evidence for the use of fire to clear land on the Moors in the Mesolithic. Image: Andy Beecroft/Wikimedia Commons.

eventually remove all but the largest stumps and trunks[62]. By this stage, if not before, wild ungulates and livestock could gain access to browse. The protraction of the process is a key divergence from Piggott's (1954, 30) scenario.

Unlike the minimal, translucent smoke produced by cooking-fires, initial burnings of unseasoned wood would generate dense clouds of grey smoke and steam up to 300m high, visible 50–90km away on clear days (Figure 5.29a/b). Flames rising 3-10 times the diameter of the fire (P.H. Thomas 1963, fig. 3) could overtop the forest canopy. Even if lower, fires would create a glow within the clearing that would be detectable at night. Thus, the creation of clearings might be more detectable than any subsequent phase of their use, allowing specific places to be located from afar.

Allen (2000a, 21) suggests that steep slopes were probably left untouched by human efforts. This is pertinent to many upland monuments, which often lie close to steep scarps. In the more intensively exploited landscapes of historic periods, woodland has often survived on such slopes, generally as coppice, because this terrain was unsuitable[63] for either settlement or arable farming (*e.g.* Figures 1.2a; 5.19a; 5.27b). Although Brown (1997, 194) asserts that there is unlikely to be much correspondence between present and Neolithic forest distributions, Allen's observation seems reasonable. The practical uses of steep slopes were equally restricted, trees were equally difficult to clear, and cattle equally reluctant to graze there in the Neolithic[64].

5.7 Timber for building structures

Some assert that construction of structures "would require the felling of X hectares of forest" (*e.g.* Gregg 1988, 165), but timbers for structural projects were probably acquired more selectively than by extensive clear-felling (Pryor 1998, 39), unless clearing space to host the structure. Historically, oak has remained the most commonly used structural timber: it is easy both to cleave longitudinally and to cut through laterally when green; it gets harder as it dries and its heartwood remains resistant to rot (Edlin 1949, 13; Darrah 2006, 122). Roundwood – trunks or branches left unsplit – is even stronger, and obviously requires less working. Oak's properties were evidently recognized in the Neolithic, for it was routinely used for structures, including as half- rounds and planks. Given the high

[62] This accords with the process used in recent times by herders in Brazil, though the initial clearance there was carried out with steel axes (J.M. Coles 1973, 22).

[63] The fact that the preservation and management of forest on slopes was widespread in the medieval and post-medieval periods largely reflects the greater pressures on land.

[64] Usually, felling requires a 'kerf' to be cut on the side of the tree towards the direction in which it is intended to fall and the main cut on the opposite side. On slopes, the height difference makes it difficult to wield an axe effectively on both sides. Therefore, 'windrow' felling is sometimes used, involving the cutting of a kerf on the downslope side only, so that when the uppermost trees on the slope are eventually felled, their fall downslope will knock over their neighbours. However, this seldom works as neatly as intended; often falling trees get snagged on others, requiring more labour in a working environment impeded by the half-fallen trees as well as hampered by the slope (Coles 1973, 21-2).

Figure 5.30a: Clearance resulting from renewed management of an ancient patch of coppice-with-standards, showing timber oaks separated by typical distances. Photographed at the end of March, from the northern rampart of Bigbury hillfort, east Kent.

Figure 5.30b: A clearing in the early stages of regeneration, near the possible causewayed enclosure on Barscarrow Hill, Dumfries and Galloway (Oswald & Edmonds 2021, fig 4.12). Photographed in late August.

proportion of oaks in most western European forests,and the tendency of trees in high-canopy forest to grow tall and straight with few low branches (see above), building timber would be available near most construction sites. In historic parcels of coppice-with-standards and wood pasture, separations of 10–18m are normal and oak standards make up only 20-33%[65] of the potential total (Nisbet 1905, 342; Edlin 1948, 81; http://smallwoods.org.uk/our-work/woodland-products/a-brief-history-of-coppicing/; Fleming 2012, 16; Figure 5.30a). If individual oaks were selected for felling, patches of forest would be 'thinned' without increasing remote views. Oxen could be used to drag timbers (Mercer 1990, 8; Williams 2006, 43). Noble's (2017, 172; 177) argument that the involvement of the whole community in such tasks constituted an important social dimension of projects supposes that oxen were not regarded as part of the community.

In dense forest, it was probably difficult to bring individual trees to ground without 'snagging' them on their neighbours (Darrah 2006, 123). Alternatively, coppicing would dramatically increase the density per hectare of suitable trunks (Evans & Hodder 2006, 317-18). As described above, surrounding trees would also have to be felled to give the 'stools' sufficient light. This scenario implies three thorough clearances of relatively small areas, widely separated in time: the first when the acorns originally germinated; the second when the oaks were cut down for the first time, in effect coppicing them (whether with foresight or not), the third for the construction project itself, perhaps a century later. Areas cleared of forest were sometimes reoccupied (J.G. Evans 1966; 1972, 242-8; Coles & Orme 1984, 12; Macphail 1999).

5.8 Forest regeneration

Clearings created by wind-blows, if humans do not interfere, are often so densely covered in debris that they are initially impenetrable even to deer, and consequently regenerate with few set-backs (Grayson 1989, 37; Peterken 1996, 331-4). Lime, in particular, will regenerate from a trunk which retains very limited root-hold (Rackham 2006, 10), often creating linear patterns of regrowth (Figure 5.31a/b). Some claim that areas newly cleared of forest, whether naturally or artificially, would regrow rapidly if ignored by humans, leading to total reinstatement within *c.*60 years (M.J. Allen 2000b, 44; A.G. Brown 2000, 50; Figure 5.30b). Stumps resulting from the clearance of space for the Raunds long barrow apparently quickly regenerated (Campbell & Robinson 2007, 23; 28), while excavations at Carsie Mains, Perthshire, demonstrated that a probable mortuary enclosure both cut and was cut by the root- or throw-holes of mature trees (G.J. Barclay & Brophy 2004).

[65] Evans & Hodder (2006, 318) estimate *c.*100 50-year-old oaks (*i.e.* trunks suitable for use without intensive working) per hectare on the site of the Haddenham causewayed enclosure. This figure is too high (double Edlin's (1948, 81) figure), implying trees 10m apart, making up 40-66% of the forest.

Figure 5.31a: The tip-up mound of a broad-leafed lime, brought down by the Great Storm of October 1987, regrowing 30 years later. Photographed in mid-February at Oldbury hillfort, Kent.

Figure 5.31b: A pair of broad-leafed limes, brought down in opposite directions by the Great Storm of October 1987, now regrowing along the entire length of both trees, over 35 years later. Photographed in late January in Knole Park, Kent.

However, ecological studies show that the rapid regeneration often assumed by archaeologists does not always occur. If wild animals were given a head-start by human intervention, even a comparatively low density of 2.75 deer/ha could ensure the long-term survival of a clearing. Browsing prevents the growth of seedlings and deforms the regrowth of any mature trees that remain alive, including coppiced stumps (Buckland & Edwards 1984, 246; Harmer 1995, 3; Putman & Moore 1998; Joys *et al*. 2004). The relatively scarce clearings of the Early Neolithic would probably attract proportionally higher levels of browsing and consequent suppression of regrowth (Buckland & Edwards 1984, 246). In other words, clearings deliberately created or enhanced by humans may have endured longer than natural clearings left untouched, even without prolonged human management. Over time, regrowth and browsing would turn the raw edges of new clearings into hedge-like barriers, replete with the food resources detailed in Table 5.3, providing further attractions for both humans and wildlife (Groenman-van-Waateringe 1978, 138-9). Such clearings can also have distinctive auditory qualities[66] (Noble 2017, 79).

Even fully regenerated forest retains distinctive qualities[67]. The presence of oak, hazel, hawthorn, sloe, and elderberry, plus multi-stem regrowth, stumps, healed wounds on trees, fragments of charcoal and perhaps artefacts, would betray the former existence of clearings (*contra* Noble 2017, 115). People in the Early Neolithic were undoubtedly adept at recognizing such signs.

5.9 Summary: forest and remote visual perception

The underlying aim of this long chapter was to move beyond generalizations, to develop a more dynamic, multi-faceted picture of Early Neolithic ecosystems, by drawing upon ecological knowledge to an unusual degree. Most accounts of prehistory deal with the environment as a uniform and largely inert back-drop to human activity. In contrast, this chapter has concentrated on the variability inherent in forest and the different qualities of tree species. Neolithic language(s) probably had rich vocabularies to capture this diversity (R. Macfarlane 2016). Even seasonal changes cannot be reduced to generalizations: for example, transpiration would make distant views hazy throughout the summer, while lying snow would leave the forest floor relatively bright. The environmental impacts of beaver have been greatly underestimated in accounts produced by British archaeologists, though the discussion above would be superfluous in countries where the animals still thrive. Taking an 'ethnographic' approach to historic uses of resources has also highlighted the potential importance of practices only tangentially recorded in the archaeological record, such as transporting fire, or harvesting beeswax

[66] When in full leaf, the impenetrable edge of Nut Wood, at Wharram Percy in North Yorkshire, produces a loud echo at a distance of up to 40m.

[67] Although, surprisingly, the Amazonian Achuar were reportedly not always able to distinguish mature secondary growth from primary forest (Descola 1996).

Figure 5.32: A centuries-old ash coppice stool, last harvested *c.*150 years earlier, showing that without browsing or repeated harvesting, overgrown coppice would prevent remote views, within the life-span of many Early Neolithic monuments. Photographed in early March near the causewayed enclosure on Combe Hill, East Sussex.

and shed antler. These practices, amongst others, must mean that communities were not confined to single clearings year-round, but made frequent forays of varying durations into and through forest (*contra* Rowley-Conwy *et al*. 2020, 414; 416). All these spatial and temporal variations must be considered in conjunction with the patterns of settlement and movement discussed in Chapter 4. In addition to affording different timings and qualities of visual encounter, these journeys must also have influenced people's sense of the significance of particular views.

This said, there are undoubtedly important 'headlines', which, while undeniably coarse-grained, establish a different and more secure foundation than the starting-point:

- Throughout the Mesolithic, the vegetative environment included clearings, created by natural agents and maintained or enlarged by hunters, some of which were large enough to afford opportunities for remote visual perception.
- The erratic tempo(s) and causes of change that occurred naturally in forest do not mesh easily with the gross, *longue durée* changes attested in the archaeological record.
- Wildfire was a significant agent only in particular regions of southern Britain, but may also have affected parts of valley floors.
- High winds – the most important agent of change - would create clearings differentially on escarpment edges, exposed valley-side eminences, and river floodplains.
- The 'elm decline' probably created open patches that coincided with fertile soils.
- Beavers produced long corridors of clearance, tens or even hundreds of metres wide, along major and minor watercourses.
- The most thorough regional pollen study yet undertaken (Farrell *et al.* 2020) suggests that the outset of the Neolithic, *c.*5% of the land was open.
- Trails, like clearings, were created by natural agents and would be followed (if not actively maintained) by Mesolithic hunters, so the landscape inherited by even the earliest Neolithic immigrants was not a 'trackless wilderness'.
- In the Early Neolithic, just as in the Mesolithic, people must have employed hunting skills and gathered diverse resources from the forest and its fringes. They did not confine their activities to clearings.
- Newly created 'blow downs' would take years or even decades to convert into useable clearings. The skeletons of dead trees, standing or prone, and the prominent earthworks left by tree-throws probably lingered for generations.
- The 'first farmers' probably carried out minimal clear-felling, instead felling selectively for building and firewood, and 'girdling' other trees to kill them, thus letting in sufficient light to encourage herb growth and, eventually, to allow arable cultivation.

Figure 5.33: Meadow in an isolated clearing in the Vézère region of south-west France, photographed in mid-August from a point on the hill that emulates the siting of many Early Neolithic monuments in upland settings. The viewpoint is 100m from the edge of the clearing, and 26m higher, towards the top of a gentle slope, allowing a restricted view of the largely wooded landscape above the canopy surrounding the clearing. Note the distant hillside clearings, but the intervening stream valley is invisible.

These bald statements undoubtedly give an impression that the actions of the 'first farmers' were environmentally determined to a significant degree, a possibility which academics have traditionally found more acceptable for the Mesolithic than for the Neolithic (Bradley 1984, 11). There is a strongly suggestive correlation between the topographic situations most vulnerable to wind damage and those favoured for Early Neolithic monuments, in both upland and riparian settings. These locations would also offer rare affordances for remote visual perception: those on higher ground over lowlands; those in riparian settings along the relatively open corridors that accompanied watercourses.

One key point, however, is that there was no immediate or major change at the start of the Neolithic in many of the factors that afforded opportunities for remote visual perception. Some clearings supporting compact turf from which monuments could be built already existed. Other clearings continued to come into being naturally throughout the Neolithic, exacerbated by climate change in the 40th century BC and elm disease in the 38th. Archaeology is not well equipped to cope with the erratic and sometimes very rapid or short-term changes brought about by both natural agents and human activity. Yet the processes involved in converting chaotic debris into grassy glades suitable for grazing livestock (or taming red deer) were drawn out, so there were few abrupt or sweeping changes in affordances for remote visual perception. For a prolonged period, perhaps even decades or generations, clearings were not blank canvases simply awaiting the construction of monuments, but 'works in progress', punctuated by tree hulks and pockmarked by holes and mounds.

6. Transhumance and its consequences

One indirect destructive result of man's activity was connected with the grazing and browsing of his animals. Not only was the soil kicked away from the roots, but many browsing animals ate away the young shoots of trees… Pastoral tribes… moving their flocks of sheep and goats from place to place as pasturage becomes scarce, quickly devastate a country.

- Herbert Fleure & Wallace Whitehouse (1916, 130)

6.1 Introduction

Chapter 4 reaffirmed the long-held belief that transhumance was practiced in the Early Neolithic, meaning that livestock – particularly cattle – were moved through forest to remote clearings. Chapter 5 explored contemporary ecosystems, but how were livestock caught up in the environment beyond the 'home base'? The environmental effects of browsing and grazing by domesticates are well understood by ecologists, so potential consequences for remote visual perception can be analysed in considerable detail. Without intending to reach one generalized model (Arnold 1964), it is, again, possible to advance beyond the few basic phrases typically employed by archaeologists to describe the complex, prolonged and interwoven processes involved.

Appendix 1 traces how, from the 1920s, cattle transhumance was recognized as a model for understanding movements of people around the landscape and the functions of monuments. Due to its spatial and temporal impermanence, transhumance leaves few material traces (Barker *et al.* 1991, 84; Chang 1992, 87), making inevitable a degree of imaginative reconstruction, informed by historical and ethnographic sources (Whittle 1997, 21; Edmonds 2006a; b). Chapter 6 will concentrate on cattle, but touch upon husbandry of other domesticates, each associated with its own spatial and temporal specificities. These patterns will be explored to arrive at a 'thick description' of the relationships between livestock, environment and people, and the consequences of those relationships for remote perception.

6.2 Models for transhumance in the Neolithic

Barker and Webley's (1978) model concluded that both upland and riparian causewayed enclosures were jumping-off points into different seasonally available grazing resources. This offered a potential touchstone for considering routes and timings of transhumant journeys, which inevitably shaped people's experience of places and monuments (Ingold 1980; 1986). Academics pursued this line of thinking to a degree[1], but the issues have yet to be addressed in detail. The exhaustive study of the faunal remains from Hambledon

[1] *E.g.* Pryor 1988b, 67-9; Kinnes 1988, 5; Bogucki 1988; Thomas 1991, 28; Barrett 1994a, 93; 141-6; Pollard 1999, 81-2; Edmonds & Seaborne 2001, Ray & Thomas 2003, 39; Schulting 2008, 97; Bailey *et al*. 2011, 800.

Figure 6.1a: A transhumant flock in the French Alps in the 1920s, on the shore of Lac d'Allos, Europe's highest lake at 3,053m above sea level. Image: Wikimedia Commons.

Figure 6.1b: *Shepherds penning their sheep, Campagna*, by Charles Coleman (1850). This undulating terrain appears to be close to the coast and Coleman also recorded similar pastoral scenes around the low-lying Pontine Marshes. Image: Wikimedia Commons.

Hill, for example, concludes that the young cows slaughtered there must represent a selection from a herd normally housed elsewhere, without discussing where or how far away 'elsewhere' might be (Legge 2008, 554). The diverse materials present on the hill hint at 2-3 days' walk (Healy 2004, 31), and stable isotope signatures at potentially less than a single day (Neil *et al*. 2018, 196), conveying only a vague sense of scale.

So-called 'vertical' transhumance in mountainous regions, notably the Alps, has dominated the literature (*e.g.* Gardelle 1999; Leveau & Segard 2004; Segard 2009a; b; see also Sakellaridis 1979), but summer grazing grounds varied according to local topographic circumstances (Figure 6.1a/b). In medieval times, lowland dwellers moved livestock to nearby hills, or marshlands (coastal or freshwater), or woodlands (*e.g.* Hoskins & Stamp 1963, 9-13; H.S.A. Fox 1996; Bowden *et al.* 2009, 23;): *i.e.* areas unsuitable for arable agriculture. The primary use of woodland in early medieval France was as forest browse (Bloch 1931, quoted in H.S.A. Fox 1996, 8; see also Parain 1941, 162). In early medieval Ireland, rushy margins of streams and lakes - called 'damp pasture' - were equally valued (Kelly 2000, 45). In some places, the organisation of herd movements has differed from mountainous regions (J.G. Evans 2003, 176-9). In early medieval Ireland, transhumance was widely used for cattle, but rarely for sheep, which were usually kept near the farm year-round (Kelly 2000, 68-9). In post-medieval Cumberland, ewes with twins were kept on infield pastures, providing them with more nourishing feed (Rebanks 2015, 11).

It is a reasonable hypothesis that Early Neolithic movements of livestock would be comparable to 'lesser transhumance', as defined by early French geographers (H.S A. Fox 1996, 2); *i.e.* not much further than was necessary to find sufficient feed and to separate livestock from growing crops (including hay). Cattle can be driven up to 40km per day, but are more comfortable with *c.*25km, giving them opportunities to rest, feed and drink on the hoof, so that they retain weight (J.W. Malone 1971, 46-7). Consequently, transhumant journeys of 40km are rare[2]. In the late Middle Ages around Dartmoor, Bodmin Moor, Gloucestershire and parts of post-medieval Ireland, journeys of under 20km were normal (Chris Dyer 1995, fig. 1; H.S.A. Fox 1996, 6; 2012, fig 2.2; M. Gardiner 2012, 118), while in the early medieval Lincolnshire Fens, upland Wales and the Somerset marshlands, most were under 10km (Hoskins & Stamp 1963, fig. 1 and Figure 6.2; W. Davies 1982, 193). In post-medieval Perthshire, some journeys were only 3km (Bil 1990, 51-7). Normal walking could cover such distances in a few hours, while even ambling cattle would complete the journey within the daylight of a spring or autumn day (9-15 hours respectively). Rather than extending journeys over 2-3 days (Healy 2004, 31), avoiding isolated overnight camps would reduce the risk of predation (see Section 6.6). Such relatively local journeys recall the siting of causewayed enclosures 'at arm's length', supposedly to facilitate dangerous social interactions (J. Thomas 1991, 32-8; Edmonds 1993, 114; Sharples 1991, 255; Mercer

[2] For example, those inferred between early medieval settlements along the River Avon in Warwickshire and the Forest of Arden (H.S.A. Fox 1996, 6).

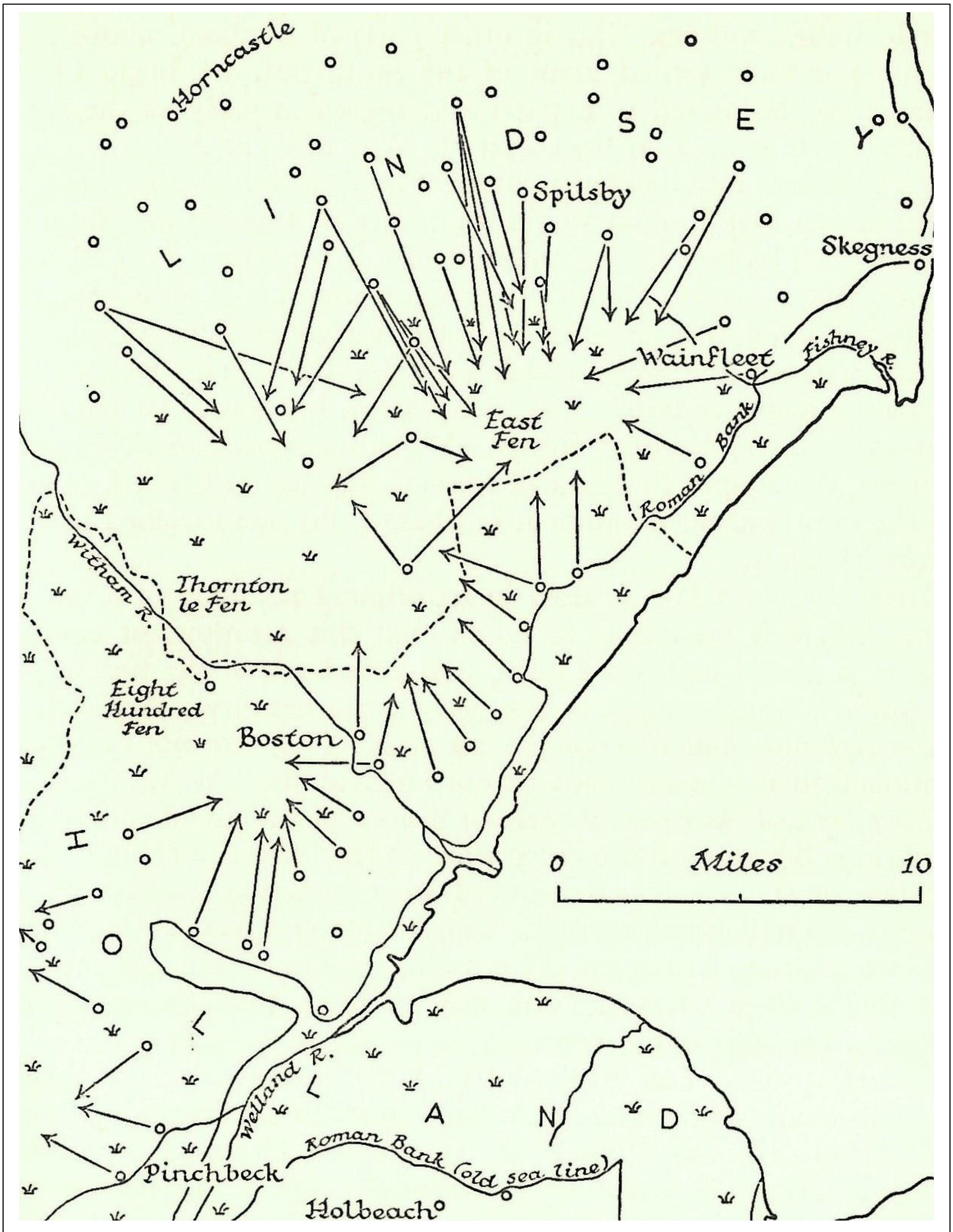

Figure 6.2: The documented pattern of local transhumance between medieval vills and parts of the Lincolnshire Fens is believed to reflect long-standing customary practice, of at least early medieval date. This pattern runs contrary to Evans and Garrow's (2006, 228) view that 'In eastern England... there seems insufficient environmental variability to warrant seasonal movement'. Image: Hoskins & Stamp 1963, fig 1.

& Healy 2008, 755). Regular transhumant gatherings may eventually have prompted the construction of causewayed enclosures (Ingold 1986, 177-9; Darvill 1987, 62), so that transhumant journeys approximate their catchments (Bailey *et al*. 2011, 800). Consequently, it appears likely that many causewayed enclosures were arenas for more local gatherings than once believed (Darvill 2011b, 196). This limits the potential of stable isotope analysis for understanding transhumance[3], which is more effective at detecting changes that occur when livestock are pastured on markedly different geologies. However, studies of sites in carefully selected geological contexts point to journeys of *c.*40km or less (Neil *et al*. 2016, 9; 2018, 196).

If an established individual community owned 30-50 cattle (see Chapter 4), and if herders from numerous communities came together at causewayed enclosures, the total number of livestock present perhaps numbered several hundred, equivalent to a modern dairy herd of moderate size. Could such numbers have been corralled within causewayed enclosures, as Piggott and others believed? For modern cattle in a stockyard, an area of 9-11m^2 per animal is considered sufficient (Seavey & Porter 2009), although earlier conditions were undoubtedly more cramped. Based on the more generous modern figure, a causewayed enclosure of the modal size of 0.6ha (Oswald *et al*. 2001, fig. 4.23) could have contained *c.*600 cattle *i.e.* a similar order to the figure proposed above. Many causewayed enclosures, of course, are much larger.

Since both cattle and sheep give voice more loudly as they reach new environments, especially pastures and watering places, initial gatherings would be noisy occasions that contributed, briefly, to the auditory signature of monuments (Mills 2005). In ideal conditions[4], lowing cattle are audible 5km away (Wildman 2021), while the whistled languages of herders[5] can be understood at similar distances. If the distances involved in transhumance were as small as some of those described above, it may therefore have been possible to hear the places occupied by monuments from the 'home base'.

Historically, cheese production was a key by-product of transhumance in many regions[6]. Once lambs and calves have been weaned[7] at 4-8 weeks, milking their mothers begins in earnest; in the Middle Ages, this was usually in late April (Trow-Smith 1957, 119). Since

[3] It may still, however, be important in understanding the networks of exchange by which new livestock were obtained to enlarge the herd and/or ensure its continuing health.
[4] Since starting this thesis, I have recorded both cattle and sheep reaching fresh pastures at distances of up to 2.5km in partially wooded landscapes *i.e.* about half the maximum distance.
[5] The whistled language of The Canary Islands, used by pre-Hispanic herders in mountainous, largely deforested topography, can be understood up to 5km away (Hernandez & Baute 2008; see also Busnel & Classe 1976). In Turkey's northern highlands, herders use whistled language in partially forested landscapes over distances of *c.*2km (Reeve 2017), again suggesting a reduction of *c.*50% in forest.
[6] In coastal regions, transhumant herders often carried out salt panning; Everitt (2000, 231-5) describes a wide range of other specialist industries.
[7] Feeding the cows ivy makes the milk unpalatable to the calves without spoiling it for human consumption (P. Evans 1975, 47); for this reason, ivy has to be used sparingly as fodder in late winter.

Figure 6.3a: Milking a Zebu cow in sub-Saharan Africa. Note the calf, trying to feed at the same time. Compare the posture of the milker with that in Figure 6.3b. Image: Wikimedia Commons/Dolima1.

Figure 6.3b. 'Milking scene' at Wadi Tiksatin in southern Libya, dating to the Early Neolithic. Note the presence of several calves and quantities of stacked equipment in the background. The physiology of the cattle engraved in similar images indicates that they are of *Bos indicus* type. The pairs of round-based pots or bags suspended from forked poles are probably related to cheese-making (Le Quellec 2011, 79).

Table 6.1: The natural and controlled reproductive cycles of different domesticates. After Wijngaarden–Bakker 1998, Table 23.6.				
	Mating	Usual 'controlled' mating	Birth	Lactation
Cattle	Aug - Sept	July - Aug	May - June	May - Oct
Sheep	Oct - Dec	Sept - Dec	mid-Feb - Apr	Mar - Aug
Goat	Nov - Dec		Apr	Apr - Sept
Pig	Jan - Feb		Apr - May	-

the presence of the calves stimulates continued milk production, they are generally kept near their mothers, but strictly separated (N. Russell 1998, 51; Kelly 2000, 39-40; figure 6.3a). Cows' natural lactation coincides closely with the transhumant period, although herders can delay the birth of young, and thus extend the lactation period, by keeping some cows from the bull until autumn (Kelly 2000, 41; Table 6.1). In medieval times, a cow feeding on poor pasture and browse, comparable to what was probably available in the Early Neolithic, was still able to produce *c.*540 litres of milk over the summer, from which *c.*54kg of fairly hard cheese could be made (Trow-Smith 1957, 122-3). A ewe under the same conditions could produce 32 litres, giving *c.*3.2kg of cheese. Sheep's cheese dominated medieval monastic production in Britain, but this was largely because it was a by-product of wool-growing on an industrial scale (*e.g.* Goodall & Oswald 2010, 7; 10). In early medieval Ireland, by contrast, the yield and quality of sheep's milk was regarded as being greatly inferior to a goat's, an animal itself not considered especially valuable, so cheese manufacturing was dominated by cows' milk (Kelly 2000, 73; 78).

Cheese production[8] in the Early Neolithic of north-west Europe has long been suspected (*e.g.* Piggott 1954, 93; Sakellaridis 1979, 126; Ingold 1980, 242; Sherratt 1981). Analysis of lipid residues in ceramic vessels eventually confirmed the practice[9], but the technique cannot distinguish between cow and sheep milk. Though the perforated ceramic 'cheese-strainers' of the *Linearbandkeramik* are not found in north-west Europe (Bogucki 1984), bags made of perforated leather, coarse cloth or woven rushes could be used instead (Salque *et al.* 2013, 522; Figure 6.3b). The weight of a cheese made using rennet could be

[8] Nerissa Russell (1998, 43) seems to assume that milk was the only product that Neolithic people would have wanted to obtain. The likelihood of widespread lactose intolerance makes cheese and/or yoghurt making even more likely, but residue analysis cannot yet distinguish fresh from processed dairy.

[9] For example: Legge 1989; 1992; 2006; Copley *et al*. 2003; 2005; 2008; Craig *et al*. 2005; Šoberl & Evershed 2009; Salque *et al*. 2013. In Britain, the initial evidence supporting the theory was the ratios detected in faunal assemblages of cows to bulls, which are as high as 10:1 (Legge 1981; Grigson 1982a).

Figure 6.4a: A transhumant family in the French Alps, July 1935. Note the faggots of elm twigs, collected for heating the milk cauldron. Image: Gardelle 1999, p.148.

Figure 6.4b. Elisa and Camille Burnet, their cow, their grand-daughter, and the village cheese-maker, photographed *c.*1960 returning to their village from high pastures. Note the head-dress of the cow, worn because she had been crowned 'Queen of Milk'; though one of the smallest breeds in Europe, Hérens cows typically produce *c.*3,000 litres of milk per year. Image: Gardelle 1999, p.117.

further reduced by drying, salting, smoking or pressing[10], so many different types were probably produced (Fox & McSweeney 2004, 1-4). Consequently, even if an Early Neolithic household had only a small dairy herd, and transhumant herders were immediately consuming a third of the cheese they made, each cow could have produced *c.*36kg of cheese each summer, similar to a full 'wheel' of parmesan. This would almost inevitably require use of the cattle themselves for transport.

The confirmation of dairying and cheese-making also has important implications for reconstructing likely patterns of stock movement and consequent impacts of browsing on the vegetation. While beef herds could have ranged over relatively wide areas as Piggott (1954, 92) suggested, dairy herds would need to be kept fairly near the milking place. There, they and their calves could be calmly tethered at the beginning (and maybe also the end) of every day, in a familiar setting, with containers and other necessary equipment to hand. Some of this was perhaps cached on site from one season to the next (Evans & Garrow 2006, 229).

There must have been important social dimensions to both transhumance and cheese-making (Kelly 2000, 28-9; J.G. Evans 2003, 173-4; Herring 2012, 89; 97-101; Figures 6.4-6.5). Intensively caring for livestock, especially milk cows, inevitably binds herders and their stock into the same social network (Ray & Thomas 2003, 38; Serjeantson 2011, 14). Ethnographically, there is considerable variety in the social make-up of herders. Whole households are only involved when stock husbandry is not part of a mixed agricultural economy; otherwise, responsibility falls to particular sectors of the community. Isotope analysis has hinted that young boys were the herders of the *Linearbandkeramik* (Knipper 2009, 151), but the tiny sample analysed is not necessarily representative. Considering human remains found at causewayed enclosures in south-east England, amongst articulated bodies (*i.e.* those most likely to have died there or nearby), there are about twice as many female burials as males; burials of neonates, infants and children are only found at causewayed enclosures; and 'elderly' adults (over 45) are not found at all (West Canfield 2019, 165-73; 2022, 62-6). This contrasts with long barrows, where adult males are over-represented. Perhaps, then, younger women and children played a major role in transhumance and dairying. In north-west Europe in historic times, teenage girls or younger boys, sometimes accompanied by a grandmother, often took on the task of

[10]Cottage cheese typically contains 80% water; parmesan only 30%. Softer cheeses may have been the main food of the herders over the summer. Drier cheeses would last longer and be lighter, making them easier to transport back to the home base for the coming winter. Producing dry, hard cheeses would require the occasional slaughtering of calves to obtain rennet from their stomach linings, causing the mother to stop letting down her milk, so timing the start of hard cheese production needs to be carefully judged. Simply drying the resultant cheese in a cool, dark place is enough to allow it to last for months or even years, but smoking, salting or pressing also help. In the context of the widespread existence of carefully-dug, bowl-shaped Early Neolithic pits, it is worth noting that several cheese types in Turkey and the Middle East, such as Syrian *gubta mtumarta* ('buried cheese') are placed in the ground, sometimes in pots, and left to mature for a year or more (synthesis of information from contributors to https://cheeseforum.org/forum/index.php/topic,19820.0.html), accessed March 2023; see Legge 1989).

Figure 6.5a: The men of a village in the French Alps delivering the communally-owned bull to the cows, photographed in late July, 1934. Note the pigs ‘always kept near the dairy’. Image: Gardelle 1999, p.181.

Figure 6.5b: Cattle making their way towards the drinking trough on Walmgate Stray, York, in early June. Although the first documented use of the common dates to the mid-13th century, field survey suggests that it was used for grazing from at least the pre-Conquest centuries (Oswald & Pollington 2012). Extensive drainage works have converted the Stray from marshland to lush pasture that only floods in winter.

tending the livestock through the summer, while adults did the more physically demanding work of harvest (Herring 2012, 97; *contra* N. Russell 1998, 44). This arrangement allows gendered knowledge to be passed between generations and perhaps builds relationships which could not otherwise exist. A visitor to Redesdale in 1604 commented that 'they sheylde together by surnames', suggesting 'clan gatherings' of related herders[11] who did not usually live in close proximity (Ramm *et al*. 1970, 4). Throughout the British Isles, tiny shelters suggest that post-medieval herders worked collaboratively, but slept as individuals or in pairs (*e.g.* Oswald *et al*. 2006, 117 & fig. 7.8; Herring 2012, 93; M. Gardiner 2012, 113).

6.3 The temporalities of transhumance

Piggott's theory that causewayed enclosures were used in late summer and/or autumn has prejudiced subsequent interpretations of relevant data. As Appendix 3 demonstrates, it is difficult to accept unreservedly most of the evidence previously accepted for seasonality (Pryor 1995, 97; Milner 2005). Archaeologists have repeatedly tried to fit the material evidence they unearth into a vague rubric of transhumance, without interrogating the ethnographic evidence that ultimately underpins that rubric.

Pollard's (1999) discussion of the temporalities of Early Neolithic life epitomises the post-processual consensus that there was considerable flexibility in most practices. Recorded temporalities of transhumance in north-western Europe, however, being fundamentally governed by the seasons, have remained fairly constrained and stable. They therefore represent reasonable indicators of the likely temporalities of Early Neolithic transhumance. Hence, it becomes possible to consider the likely state of the environment when people were making transhumant journeys, and potential affordances for remote visual perception. Yet transhumant movements were not necessarily simple 'return trips', nor unchanging from year to year. Bulls had to be with the cows for mating at about the same time that cereal needed harvesting (Figure 6.5a), while pigs would need to be fattened on acorns and beech mast before the transhumant season ended, so communities would have to decide how such additional journeys through and into the forest could be best achieved and who would take responsibility.

From the mid-13th century until the present day, lowland commons in England[12] were set aside for grazing between early May and mid-October (*e.g.* Oswald & Pollington 2013, 46-51; Figure 6.5b). The dates enshrined in legal documents, however, were established

[11] This is a rather different reading of the phrase from that reached by Herman Ramm.

[12] In upland regions, the transhumant season was shorter, extending from late May or early June to mid-September or early October, but none of the regions discussed in this thesis would qualify as 'uplands'. William Camden, who encountered male transhumant herders in Northumberland in 1599, stated that they returned to the lowlands in August, which seems improbably early.

Figure 6.6: Sheep eating hay on Alston Moor, Cumbria, photographed in mid-March.

through customary practice dating back to 'time immemorial'[13]. Sporadic documentary evidence indicates that transhumance was widely practised in early medieval times (Hoskins & Stamp 1963, 5-13; Bowden *et al*. 2009, 16-18). In 13th-century England, sheep were kept outdoors between Easter (varying between 22 March and 25 April) and Martinmas (11 November) (Chris Dyer 1995, 136). In northern France and Germany, St George's Day (23rd April) marked the start of the transhumant season (Mag Fhloinn 2005). In the 'Celtic' world, the corresponding temporal limits were marked by the festivals of *Beltane* and *Samhain*, falling up to a fortnight either side of 6th May and 5th November[14] respectively (Frazer 2008, 644). In early Irish law, the value of cattle was explicitly tied to these festivals (Kelly 2000, 59-62).

It is difficult to calculate time of year accurately based on the position of the sun's declination, especially in varying topographic circumstances and weather conditions. Other natural markers include the arrival of the first cuckoo, traditionally said to occur in England on 14th April. The available systematically-gathered observations pre-dating climate change do suggest a spike on this day and, while the average falls on 17th April, the standard deviation around this date is fairly small (Table 6.2). This, like the seasonal changes in trees (Tudge 2005, 274), might have informed the timings of transhumance in general terms[15]. However, if gatherings of scattered communities marked the start, or more probably the end, of the transhumant season (Serjeantson 2006, 113), a combination of solar and lunar observations[16] might allow people to fix a precise time, as apparently occurred in Mesolithic Britain (Gaffney *et al*. 2013). Alternatively, perhaps they simply waited for everyone to arrive.

Table 6.2: First cuckoo heard at Stoke Prior, Worcestershire 1916–1958 (based on data in A. Fraser 2001)

Mean (standard deviation in brackets)	Earliest	Latest	Modal period
17 April (6.8)	25 March	4 May	10 – 26 April

[13] That is, before 1189 (the start of Richard I's reign), which was approximately as far back as any living individual could remember by the time the laws were actually written down. Interestingly, in New South Wales, where transhumance has been practiced since the end of the 18th century, the dates are almost precisely reversed: 30th November to 31st May (King 1959, 132).

[14] Following adoption of the Gregorian calendar, Samhain and Beltane were celebrated on the nights of 30th April/1st May and 31st October/1st November. Prior to this, the festivals were held on the night of the full moons nearest the 'interstices' *i.e.* the midpoints between the solar equinoxes and solstices. These fall on the nights of 6th/7th May and 5th/6th November, the full moons up to fourteen days either side.

[15] There may have been additional considerations: in early modern Ireland, for example, Monday was considered an inauspicious day for moving cattle (Herring 2012, 98).

[16] *E.g.* Easter falls on the Sunday following the first full moon after the Spring equinox on 21st March.

Figure 6.7: An ash tree growing in the North Pennines at 305m above sea level, photographed on 19th May, soon after its buds have burst. Note the severe damage done to the trunk by past bark-stripping.

Historically, Lammas (1st August) marked the start of the cereal harvest[17], but Martinmas (11th November) was more important, marking the return from the summer pastures, completion of preparations for winter, and thus the end of the whole farming year (Walsh 2000; Mag Fhloinn 2005). Throughout north-west Europe, celebrations of Martinmas centred around common themes also present in *Samhain*: contact with the spirit world; young people engaging in 'guising'; lighting of bonfires[18] and lanterns; feasting on roast goose (about to migrate southwards). 'Martinmas beef' was imbued with religious connotations, but slaughtering the livestock when the weather turned cool obviously allowed the meat to be kept a little longer, since it could not be preserved effectively in large quantities (Serjeantson 2006, 114[19]). It is impossible to overlook how closely such themes recall the evidence for feasting and interactions with the dead at some causewayed enclosures. In other words, feasts analogous to Martinmas may have marked the end of the summer absence of the herds, attended by their guardians and perhaps also by a selection of those who had 'stayed at home'.

The specific temporal limits to transhumance established through customary practice represent 'phenological matching' *i.e.* dates chosen to coincide with the times when food resources were waxing and waning. The customary start- and end-dates of transhumance correspond closely to the mean budburst and final leaf-fall of ash trees (29th April and 7th November respectively), the tree species preferred by all cattle breeds (Louisa Gidney, Dexter Cattle Society, pers. comm.; Figure 6.7). The traditional start-date therefore falls well after grass begins to grow in mid-March (Sparks *et al*. 2019). This is partly because livestock were generally kept in the infield at first, allowing them to feed new-borns with the most nutritious grazing, without needing to expend extra effort in moving, and with shelter nearby should the weather turn bad. Departing the infield in late April/early May allowed time for the grass to recover to the point where it could be harvested as hay in late summer. Consequently, the start of the transhumant season perhaps shifted by some days or weeks each year to reflect local conditions.

Long-term environmental monitoring[20], however, shows that by the end of April, immediately prior to the traditional start of the transhumant season, all the tree species that dominated Neolithic forest, as well as herbs, are usually coming into leaf (A.M.I.

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[17] Pryor's (1998, 67) suggestion that people may have feasted at causewayed enclosures around Lammas is undermined by his own recognition that livestock husbandry was more important than cereal farming. At Lammas (from Anglo-Saxon *hlaf-mas*, meaning 'loaf-mass') it was customary to bring a loaf made from the first cereal harvested for a church blessing. Consequently, in the Anglo-Saxon Chronicle, where Lammas is referred to regularly, it is called 'the Feast of First Fruits'.

[18] Many of these customs were absorbed into All Hallows' Eve (October 31st/November 1st and Bonfire Night (5th November). The near-contemporaneity of Bonfire night is not coincidence: the Gunpowder Plot was timed to coincide with the opening of Parliament, which was fixed according to the farming calendar.

[19]Drying strips of meat in cold November air (Edmonds 1999, 11) is a viable alternative to salting and smoking, but biltong needs soaking in vinegar prior to drying, to reduce the high risk of botulism.

[20] Using only the data gathered prior to the onset of significant global warming, which had lengthened the growing season by about eleven days by the end of the 20th century (Menzel & Fabian 1999).

Figure 6.8: Traces left by wild boar rooting for acorns in woodland in the Diois region of south-eastern France, photographed in mid-October. As omnivores, pigs eat seedlings and saplings and weaken young trees and shrubs by gnawing on roots, (Seymour & Seymour 1973, 79), but they make little impact on large trees in mature woodland (*contra* Pryor 1988, 71). However, wounded roots are stimulated to produce suckers, whose growth weakens the main tree, while the wounds potentially facilitate fungal infection and disease. Since pigs were perhaps only taken into the woods in autumn (see Section 6.7), sucker shoots may have provided additional browse for wild ungulates and domesticates brought there in spring.

Table 6.3: Mean day of budburst for different tree species.		
Species	Number of years observed	Mean day of budburst 1736-1958 (plus standard deviation)
Hawthorn – *Crataegus monogyna*	143	9 March (19.1)
Elm – *Ulmus*	118	5 April (14.9)
Birch – *Betula pendula*	140	6 April (12.9)
Rowan – *Sorbus acuparia*	138	6 April (11.4)
Hornbeam – *Carpinus betulus*	137	7 April (15.2)
Lime – *Tilia sp.*	140	13 April (11.6)
Field maple – *Acer campestre*	96	19 April (11.3)
Beech – *Fagus sylvatica*	143	20 April (7.8)
Oak – *Quercus sp.*	141	23 April (10.7)
Ash – *Fraxinus excelsior*	129	29 April (11.1)

Roberts *et al.* 2015; Table 6.3), with a consequent reduction in affordances for remote perception. The mean dates of budburst, however, conceal some variation, as does the start of grass growth: latitude, elevation, soil type and, above all, air temperature all influence timings. In 2016, for example, budburst moved northward through Britain at an average of 1.5km per hour, but silver birch was 250% faster than either penduncular or sessile oak (Abernethy 2017). There is also variation within each species due to differing genetics; *e.g.* budburst of individual penduncular oaks, which came into leaf in early April to May prior to climate change, varies by over 3 weeks within a population (Cole & Sheldon 2017). Nevertheless, it is clear that all the tree species most palatable to livestock (both cattle and sheep) would usually be in leaf by the start of transhumance, while the buds of some the least palatable species (oak and beech) would only just be bursting.

Modern data show that the traditional end of the transhumant season follows the autumn cessation of grass growth in England by 12 days, a predictable time-lag (see Table 6.4). Although data is not available for the full range of relevant species, some trees are completely bare by early November, while others, including less palatable oak and beech, retain their leaves for up to 3 weeks more. Both the outgoing and return journeys involved in transhumance therefore took place at times when trees were somewhat closer to their winter bareness than the full-leaf of summer.

The same data shows that by mid-September to early-October, pigs could be driven into forest to forage for acorns, beech mast and roots (Grigson 1982b, 299; Figure 6.8). Early medieval Irish literature describes pigs 'foraging in woods and on valley slopes[21] and in remote places' (Kelly 2000, 82-4; see also Figure 6.9a). Like the pattern of 'denn' place-

[21] Woodland probably survived on steep, remote slopes (see Section 5.6 and Allen 2000a, 21).

Figure 6.9a: Feral pigs eating rotting seaweed on a beach in Corsica. Nine causewayed enclosures lie within easy reach of the coast; the associated communities perhaps also took sheep and cattle to the foreshore so that salty feed would increase their thirst, and thus their milk yields.

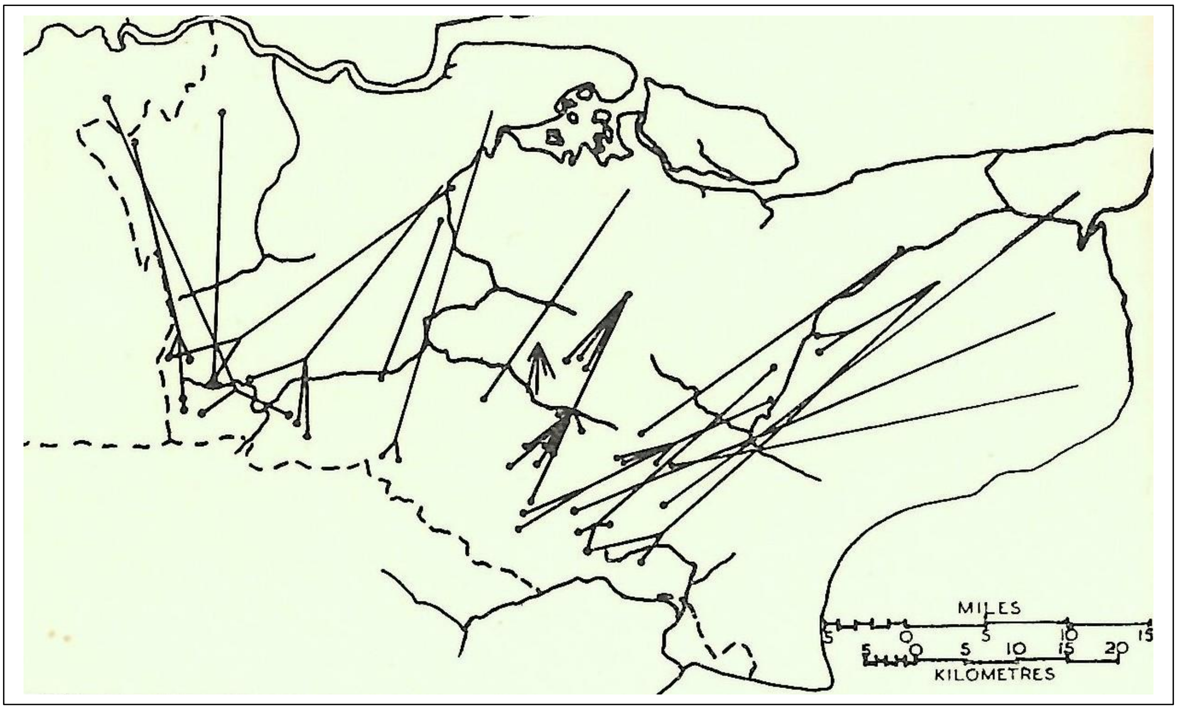

Figure 6.9b: The pattern of early medieval 'denn' place-names (indicating a swine pasture) in the Weald of Kent, and their associated settlements. In some cases, pigs were driven for up to 50km to feed in woodlands. It seems doubtful whether such long journeys were made just for the 6-week pannage season (Du Boulay 1961, 80-1), so this may constitute a parallel form of transhumance. Image: Reany 1961, fig. 5.

names in the Weald of Kent (Figure 6.9b), this contradicts the belief that pigs would be kept close to settlements (*e.g.* A. Gibson 2003, 140; J. Thomas 2013, 54). This rhythm of movement through and within forests was different and perhaps separate from cattle transhumance. With the grain processed in August, harvesters might become swineherds. Pigs might also be used to root in open ground prior to ploughing, or to improve the eventual quality of pasture. With instances of ploughing beneath long barrows on land that probably began as rough pasture, there were perhaps complex interactions between spatial and temporal patterns associated with different species.

Table 6.4: Key autumn events for 2007, the 'autumn marker year' for 1961-1990 (prior to the most serious global warming), based on *Nature's Calendar* data (Collinson 2008)

	UK average	England average	Wales average	Scotland average	N.I. average
Blackberry fruit ripe	4 Aug	3 Aug	3 Aug	24 Aug	12 Aug
Elderberry fruit ripe	19 Aug	18 Aug	22 Aug	10 Sep	31 Aug
Blackthorn fruit ripe	29 Aug	29 Aug	26 Aug	5 Sep	25 Aug
Hazel nuts ripe	4 Sep	3 Sep	4 Sep	26 Sep	10 Sep
Acorns ripe	12 Sep	12 Sep	19 Sep	2 Oct	14 Sep
Silver birch – first tint	17 Sep	18 Sep	15 Sep	7 Sep	10 Sep
Pendunculate oak – first tint	25 Sep	26 Sep	19 Sep	26 Sep	20 Sep
Ash – first tint	1 Oct	2 Oct	29 Sep	27 Sep	1 Oct
Silver birch – first leaf fall	15 Oct	17 Oct	6 Oct	4 Oct	10 Oct
Ash – first leaf fall	18 Oct	18 Oct	10 Oct	17 Oct	16 Oct
Ash – full tint	18 Oct	19 Oct	16 Oct	13 Oct	19 Oct
Silver birch – full tint	19 Oct	20 Oct	16 Oct	5 Oct	14 Oct
Pendunculate oak – first leaf fall	29 Oct	30 Oct	24 Oct	26 Oct	21 Oct
Grass stops growing	**30 Oct**	**30 Oct**	**1 Nov**	**19 Oct**	**21 Oct**
Pendunculate oak – full tint	30 Oct	30 Oct	29 Oct	28 Oct	26 Oct
Ash - bare	7 Nov	7 Nov	3 Nov	6 Nov	5 Nov
Silver birch - bare	16 Nov	18 Nov	8 Nov	4 Nov	13 Nov
Field maple - bare	17 Nov	19 Nov	16 Nov	10 Nov	Poor data
Beech - bare	18 Nov	20 Nov	15 Nov	13 Nov	Poor data
Pendunculate oak – bare	28 Nov	29 Nov	28 Nov	27 Nov	22 Nov

Figure 6.10a: Pools of brackish water in salt marshes at the mouth of the River Somme in northern France, being grazed by sheep. Photographed at the start of September.

Figure 6.10b: A natural watering-hole in the high pastures of the Diois region of south-eastern France, rare in the limestone uplands. Photographed at the end of October, just after the return of the cattle and sheep to the lowlands.

6.4 Water requirements and 'outgangs'

In northern Europe, sheep usually meet their water requirements through grazing. In contrast, cattle need to drink considerable volumes every day, making access to water critically important, both at pastures and along transhumant routes (Ward & McKague 2007; Markwick *et al*. 2014). The need is acute for lactating dairy cows: modern *Bos taurus* require on average 115 litres (roughly equivalent to a full bath) per day, because milk contains *c.*87% water. The average daily intake for *Bos indicus* in a climate similar to Britain is *c.*30 litres, but this rises to *c.*50 litres when lactating (Davis & Watts 2016, 3-6). By comparison, Dexter cattle, which are smaller than Neolithic stock, require *c.*25 litres per day when dry and *c.*50 litres while lactating (Louisa Gidney, Dexter Cattle Society, pers. comm.). Historically, cattle were grazed on salt marshes and even fed seaweed to increase their thirst, and thus their milk yield, by up to 50%, a version of a practice advocated by Aristotle and Virgil (Trow-Smith 1957, 14, 119; Kelly 2000, 43; Figure 6.10a). Eating more fibrous food than grass, such as herbaceous plants and tree shoots, also increases the need for water, while summer dehydration can be countered by providing shade, such as forest fringes (Markwick *et al*. 2014, 2) Potentially, therefore, forest browsing would increase milk yields, assuming adequate water.

Where allowed to stray, modern cattle generally feed within a 5km radius of a watering place, about twice as far as sheep, even though sheep require little or no water (Markwick *et al*. 2014, 4). Consequently, while Corcoran (1969, 29) suggests that the scarcity of surface water on chalklands and limestone uplands is problematic for cattle herders, the problem only really arises if water is lacking within 1-2 hours' walk (Barker & Webley 1978, 174; Figure 6.10b). Chalk downland, however, has relatively few watercourses and lacks fine dendritic patterns of tributaries in the headwaters (J.G. Evans 2003, 75), creating a more linear pattern of availability. If causewayed enclosures were intimately connected with livestock husbandry, we would expect to see the strong link, confirmed in Chapter 4, between their locations and watercourses. Around 80% of causewayed enclosures on higher ground in the British Isles lie within 800m of a watercourse (major or minor), while many riparian enclosures incorporate watercourses[22] into their perimeters.

Only eight causewayed enclosures in Britain (*c.*10% of the total) lie more than 1km (the maximum being 4km, or an hour's walk) from a watercourse and more than 100m higher than it. Similar proximity has been noted in later *Linearbandkeramik* settlements (Bogucki 1988, 74-7; J. Thomas 2013, 51) and pit cluster sites in Britain (Garrow 2006, 26-7; Jackson & Ray 2012, 144-5). However, some enclosures that are less than 800m from a watercourse as the crow flies would necessitate longer journeys in reality because cattle (like other large domesticates) are difficult to drive up or down steep slopes (Drewett

[22] The anomalously large enclosure at Crofton, Wiltshire, actually <u>encloses</u> a 500m-long stretch of the River Dunn (Oswald *et al*. 2001, figs. 4.21 & 5.22).

Figure 6.11a: *Bos indicus* reposition themselves to walk five abreast, increasing their speed and volume, as they approach the shore of Lake Naivasha, Kenya. The herd of 22 is large for East African pastoralist families (Dombrowski 1993, 27). Note the scars and the clipped ears, both denoting ownership.

Figure 6.11b: Cattle tracks approaching the natural watering-hole shown in Figure 6.10b.

1975, 139[23]). Indeed, humans also tend to prefer the gentlest gradients – as reflected in the 'least cost path' GIS function (H. Chapman 2003 and refs.). In early medieval Ireland, shepherds often assumed the role of alpha ram and led flocks, rather than driving them, with dogs helping to protect the animals, but not to control them (Kelly 2000, 69). Consequently, even sheep, which <u>can</u> be driven or led up and down steep slopes, may have followed easier gradients.

Overcoming the difficulties posed by steep slopes, whilst also allowing livestock to drink, is straightforwardly achievable by following watercourses[24]. Valleys are often described as 'natural corridors of movement' (*e.g.* C. Jones 2009, 121; Peterson 2015; Haughey 2016, 110; M. Bell 2020, 14), but without explicit acknowledgement of the importance to livestock herding of the watercourses they often contain. Forest-dwellers also tend to follow watercourses, partly because topography is often unrecognizable (Nelson 1986, 36; Descola 1996; Cummings 2010, 120). This practice, which calls into question the whole concept of prehistoric 'ridgeways', may have been monumentalized in the shared alignments of some cursus monuments and rivers (Pryor 1988, 70; Barclay & Hey 1999, 73 & *passim*; Loveday 2016). Movement along valleys can perhaps be inferred with most confidence in upland environments with more restrictive topography (Oswald & Edmonds 2021).

Transhumant routes are traditionally known as 'outgangs' or 'loanings'. Cattle tend to walk in long strings a few animals wide, bunching across a broader front only when they sense a threat or when hurrying towards some attractive place (*e.g.* fresh pasture, water, or a familiar, safe place; Figure 6.11a). However, the main string will often split into several sub-strings of varying numbers, which deviate several metres either side of the modal line. They also follow similar paths year after year, over time leaving a series of narrow, slightly meandering, braided paths (Figure 6.11b).

These trails would leave no archaeologically detectable trace[25], but the environmental impacts of livestock browsing on the hoof can be considered nonetheless, particularly if

[23] Bogucki (1988, 139) makes this point obliquely about Michelsberg enclosures, arguing that their hilltop locations imply that they were not used as livestock corrals. However, he neglects to mention that these sites, like causewayed enclosures in Britain, can usually be approached from some directions without any need to tackle steep gradients. At Dölauer Heide in central Germany, for example, all the major entrances relate to dry valleys, which would help to funnel the movement of livestock.

[24] Journeying along watercourses, and staying near them through the summer, has advantages for herders too. Drinking water is heavy to carry and tending livestock is often hot, dirty work, so the proximity of a place to wash and cool off would be welcome. Navigable rivers might also afford opportunities for chance encounters with others, perhaps travelling by boat, or, engaged in hunting expeditions.

[25] Defined trackways of later date are detectable in environments where they survive as earthworks or cropmarks *e.g.* hollow ways relating to Late Iron Age and Romano-British transhumance shadow minor watercourses emanating from the high ground occupied by the probable causewayed enclosure at Howe Robin, Cumbria (Edmonds & Oswald 2021, 66 & fig. 4.8). The earliest hollow ways accessing the Northumberland Cheviots from the Milfield Plain are likely to be Bronze Age (Ainsworth *et al.* 2016).

Figure 6.12a: A well-developed herb layer photographed in mid-May in Duncliffe Wood, a coppice of medieval or earlier origin, 10km north of Hambledon Hill, Dorset.

Figure 6.12b: Soays grazing rough pasture near Addington long barrow, Kent.

transhumant routes generally followed watercourses. Even before the Neolithic, watercourses probably ran within relatively open corridors, where the tree canopy had been largely removed by beavers, and regenerating trees and shrubs were regularly pruned back, both by beavers and opportunistic wild ungulates. Cattle moving along braided paths close to the water's edge would amplify this defoliation. 'Beaver meadows' perhaps offered occasional patches of herbs along watercourses, where herds could be allowed to linger. Thus, livestock would, over time[26], increase natural affordances for visibility along routes that led, indirectly, to clearings occupied by causewayed enclosures and long barrows.

6.5 The impacts on vegetation of browsing by domesticates

In forest clearings, grazing of herb communities by large ungulates, whether wild or domesticated, creates a dense turf sward over a few years[27], in part because trampling changes soil hydrology (Adams 1975, 146; McNaughton 1984; Veldhuis *et al*. 2014). Returning nutrients to the soil in the form of urine and dung also enhances herb growth differentially compared to shrubs and trees (Wells 1974b, 180-2). Browsing around the fringes of clearings and within forests (Figure 6.12a) was recognized long ago as a factor in tree clearance, but usually without detailed consideration[28]. Although Fleure and Whitehouse's (1916, 130) belief that sheep were dominant in the Neolithic lacked supporting evidence[29], sheep were much more numerous than previously believed, at least in the prime study area for this thesis (Serjeantson 2011, 30). Serjeantson (*ibid.*) repeats the common assertion that sheep and goats prefer grazing to browsing, but observations at Butser Ancient Farm suggest that Soays prefer leaf-fodder to hay (Reynolds 1987, 45) and Serjeantson herself likens Neolithic breeds to Soays (Serjeantson 2011, 29; see also Williamson *et al*. 2017, 14; Figure 6.12b). Sheep and goats, having smaller, weaker jaws, nibble thinner shoots when they browse, restricting the growth of established trees and bushes up to *c.*0.8m high, but seldom doing serious damage. However, because they move forward systematically as they feed (Wells 1974b, 180), they do far more damage than cattle to seedlings, killing the vast majority and severely impeding the growth of survivors, especially if herbs are limited (Bjor & Graffer 1963[30]). They particularly favour birch seedlings, which is usually amongst the first species to recolonize clearings, and can impede the regeneration of clearings even when present at

[26] Over a few decades, however, the loss of young shoots may have adversely impacted beaver colonies, as observed in Yellowstone National Park (Farquhar 2021).

27 Kristiansen's (1984, 94) proposal that the use of turf in monument construction represents conspicuous consumption underestimates the capability of turf to regenerate.

[28] For example: Forbes 1910, 7; Fleure & Whitehouse 1916, 130; G. Clark 1945, 69-70; Piggott 1954, 6; 30; Trow-Smith 1957, 2-3, but very few scholars in recent decades have made this point explicitly.

[29] More correctly, their conviction that sheep transhumance must have occurred drove their interpretation of field remains they observed, just as Hubbard & Hubbard (1904; 1907) interpreted all dewponds and hollow ways on the South Downs as symptoms of prehistoric cattle transhumance.

[30] Summarized in English in Adams 1975, 144; I am grateful to a friend for translating the original.

Figure 6.13a: Cattle grazing rough pasture in a small clearing in Galloway Forest Park, Dumfries and Galloway, photographed at the end of August.

Figure 6.13b: An Aubrac bull, his cows and their calves, sheltering from late August heat in a patch of oak woodland in the Vézère region of south-western France. Note the damage being done by poaching and trampling of the surface, despite the small number of cattle and the dry conditions, and the damage inflicted on the central oak tree by browsing.

the very low density[31] of 1.5 sheep/ha (Vinther 1983; Buckland & Edwards 1984, 246). Consequently, their impact on vegetation is apparent even in the short-term and they must have played a key role in deforestation over decades and centuries. If they browsed the same area for a prolonged period, even if not in a regular annual cycle, this would 'stop the clock' on the process of regeneration, during which period turf formation would accelerate and the actions of other domesticates and humans might further impact the surrounding forest.

Cattle fundamentally graze on the herb layer, but also routinely browse accessible leaves of most trees and shrubs (Figure 6.13a/b), a habit confirmed in Neolithic cattle by scientific analyses (Hedges *et al*. 2007). Although Early Neolithic cattle are all *Bos taurus* (*i.e.* the same strain as modern European cattle), they were probably less selective in what they ate, and drank less, like *Bos indicus* (Clutton-Brock 1981, 197; Serjeantson 2011, 18). Aurochs probably favoured riparian meadows[32] in summer, resources from which domesticated cattle were perhaps deliberately excluded, but their feeding habits were otherwise similar (Vuure 2005, 72-3; 216; Noe-Nygaard *et al*. 2005; Lynch *et al*. 2008). Although oxen were slightly larger, most domesticated cattle stood *c.*1.2m tall at the withers (Grigson 1984, quoted in Serjeantson 2011, 18), making them slightly smaller than some modern European beef steers (Bene *et al*. 2007, Table 2[33]) and close to African Zebu and Zebu/*Bos taurus* crosses (Fon Tebug *et al*. 2016, Table 2).

Cattle often prefer browsing[34] to grazing (Pryor 1998, 40-1; Rackham 2006, 21; *contra* Legge 2010, 27), potentially with implications for remote perception. Like deer, aurochs and other wild ruminants, they strip off all leaves within reach and consume thinner stalks, up to about 8mm thick, creating a regular 'browse line' at their maximum reach. My own measurements indicate that this is *c*.1.35m above ground level for modern cattle of similar stature to Early Neolithic animals. Damage can be more severe: where young trees and shrubs are sufficiently pliant, cattle use their weight to push over main stems up to *c.*5cm thick to bring leaves above the normal browse line into reach. Pulling at side branches often tears a 'heel' from the main trunk, leaving a distinctive vertical scar which can be conspicuous for many years. This, and/or the habit of bark-gnawing can introduce fungi, disease or pests which can eventually kill the tree. In extreme cases, bark-gnawing itself is sufficiently deep to 'ring-bark' the tree. All smooth-barked tree and shrub species are

[31] For comparison, a density of 24 sheep per hectare would be considered high.
[32] In these wetland environments grew 'bisongrass', famously used for flavouring the Polish vodka of the same name, but actually formerly known as 'aurochs-grass' (*turówka*). On the European mainland, bison (*Bison bonasus*) had similar feeding preferences.
[33] The smallest of the 9 breeds analysed are Herefordshire (1.30m), Aberdeen Angus (1.31m) and Red Angus (1.32m). Dexters, which are close to Iron Age breeds, are mostly 1.05-1.15m tall (Gidney 2013).
[34] This is partly because the more fibrous material is essential to a healthy diet. For a limited time after calving, lactating cows need additional fat, which can be obtained from tree-seeds (P. Evans 1975, 45). Thus, browsing increases the overall capacity of a herd to survive through winter on fodder which seems inadequate by today's standards. Cattle also browse, apparently, simply because they enjoy the variety.

Figure 6.14: Selection of damage done to trees by browsing cattle on Walmgate Stray, York, and elsewhere.

vulnerable to bark-gnawing, particularly in winter, but herds will sometimes develop a habit of concentrating on one particular species (Kinnaird *et al*. 1979). Consequently, even the brief presence of cattle in a patch of forest leaves tell-tale signs for years or even generations to come (Figure 6.14).

Although availability is key, the leaves of different tree and shrub species are palatable to different degrees (Rackham 2006, Table 1). Cattle never touch yew, which is poisonous except to goats and Soay sheep. Oak leaves, often said to be less palatable because of their high tannin content, are sometimes browsed nonetheless. The thorns of hawthorn and blackthorn deter cattle from browsing anything larger than young growth and thinner shoots. Sheep, however, because of their ability to work around the thorns and between the branches, will continuously browse young growth, restricting the growth of the trees to low, dense clumps from which a taller shoot (or a seedling of a different species) may eventually escape to form a tree.

Cattle are particularly partial to elm[35], which is consequently named 'friend of cattle' and 'sustenance of cattle' in early Irish law (Kelly 2000, 42). Lime, which is also very attractive to browsing wild ungulates and cattle (Step 1903, 39; Edlin 1969, 126), may have developed a co-evolutionary mechanism. *Tilia* produce a rash of 'epicormic growth' around the base, which periodically has to be trimmed back[36] to the bole to ensure the continued health of the tree. Deer and/or cattle perform this task continuously, in the process trampling the ground under the canopy and suppressing competition for water across the root-mat (Figure 6.18a/b).

The cessation of grazing does not immediately lead to regeneration of clearings. This is not only because wild ungulates will continue to impede regrowth of seedlings and trees. In clearings with a well-established herb layer, the cessation of grazing causes an immediate surge in the growth of more dominant herb species, which will itself suppress the growth of tree seedlings for several years, with only rare 'accidental' germinations (Vinther 1983, 87). Consequently, grassy clearings could be revisited by herders at irregular intervals without trees regenerating significantly. In modern environmental management, intervals of 2-3 years are considered optimal for maintaining diversity in the herb layer while also controlling scrub regrowth (Wells 1974b, 188).

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[35] This preference may be linked, somehow, with elm's liking for rich soil (see Chapter 5.2).

[36] In modern urban environments, this pruning is done by humans, usually biannually. The more regular and thorough impacts of browsing can be observed where limes grow in common land and parkland.

Figure 6.15: Shepherd Janine Massoubre and her dogs watch over her flock in the Diois region of south-eastern France. The photograph was taken in late October, soon after the descent of the flock from the high summer pastures. Note the two dogs: one for herding; the other for guarding. Janine considered one guard-dog to be insufficient for a flock this size (84) and had lost a sheep to a wolf-pack the week before.

6.6 Livestock predation and its consequences

Post-processual analyses of faunal remains suggest that people in the Early Neolithic developed social bonds with their livestock, especially their cattle (see Chapter 4). They must, therefore, have gone to considerable lengths to protect them from predators. Protective measures would distort the impacts of browsing and grazing on vegetation, potentially with long-term consequences for remote visual perception.

Piggott's (1954, 92) picture of sheep and cattle straying freely over wide areas to obtain sufficient grazing[37] is implausible. European wolves (*Canis lupus*), and to a lesser extent European brown bears (*Ursus arctos*) and smaller predators, represent a significant threat to domesticated livestock, especially young animals. Wolf bones occur rarely in Early Neolithic faunal assemblages throughout north-west Europe, seldom exceeding 1% of assemblages and often absent altogether (Murray 1970[38]; K.M. Clark 2006, 38; Zeiler 2006, 29; Serjeantson 2011, 46-7). However, the inference that they were not hunted, reached by most of these authors, is untenable. Lacking natural predators apart from humans, wolves and bears were undoubtedly widespread, and would inevitably be an important consideration for herders (Boyle 2006, 19), particularly in areas remote from places where humans were usually present, especially with forest or scrub nearby. Domesticated herds, including deer (Pluskowski 2010, 71 and references), inevitably attract predators. Without hunting, predators get bolder as they become habituated to humans (Ciucci *et al*. 2020). Early medieval Irish law advocated a wolf-hunt every week, while herders in charge of someone else's livestock were only deemed culpable if a wolf killed more than one animal, indicating acceptance that predation was inevitable (Kelly 2000, 186-7). On the moorland vaccaries of a single Lancashire estate in the summer of 1295, wolves were responsible for killing seven cattle, and there is no indication that this was considered unusual (Trow-Smith 1957, 108). Analysis of predation in France since six wolves were reintroduced in 1993 indicates that their population increases by 20% per year, reaching *c.*580 in 2019. These 580 killed or fatally injured over 15,000 sheep, goats, cattle and horses, or around one domesticate per wolf per fortnight, plus unknown numbers of wild animals (INRAE 2021). Importantly, 90% of the prey belonged to farmers who had adopted all permitted non-lethal protections (guard-dogs, electric fences and

[37] This seems to be an idea hatched with Curwen (1954, 79). It also perhaps drew on contemporary understandings of medieval upland vaccaries (*e.g.* Trow-Smith 1957, 107-8), although Hoskins (1958) considered that Trow-Smith underplayed the role of cattle at the expense of sheep. Case (1956, 43) also argued that the concentric circuits of some causewayed enclosures suggested the division of livestock from humans, although it is now apparent that the sites on which he based this suggestion are not typical in their plans, nor are multiple circuits likely to be contemporary in their construction and use.

[38] In Murray's (1970) wide-ranging overview, Tables 17a, 20a, 26, 28, 29, 36, 38, 64a, 71, 77, 83, 85, 86, 87, 88, 91, 92, 101, 103, 105, 115, 128, 132, 148a, 151, 154, 156, 157b, 163a, 168, 173, 204, 205, 207 all contain examples of wolf bones in Early Neolithic faunal assemblages.

Figure 6.16a: Products of a hunting trip in Romania *c.*1900. Image: Wikimedia Commons/Fortepan 96112.

Figure 6.16b: A herd of *c.*100 sheep being guarded by a single dog tethered to a tyre. As in Figure 6.15, the photograph was taken in late October, soon after the descent of the flock from the high summer pastures. The dog has noticed an approaching hiker. Note the stripped ash regrowth in the foreground.

extra herders). The study concludes that resuming hunting around livestock is the only way to make livestock farming (especially transhumance) sustainable. The unavoidable conclusion is that Early Neolithic herders must have hunted wolves and taken other measures to protect livestock.

If causewayed enclosures were sometimes used for excarnation (see above), these places would be even more attractive to wolves (M. Smith 2006). Brown bears, too, scavenge on the fringes of settlements, once habituated. Although no definite wolf-gnawing and little dog-gnawing was observed at Hambledon Hill, Legge's belief (pers. comm.; McKinley 2008, 494) that wolves would avoid the area runs counter to historic evidence and McKinley's (*ibid*. 516) observation that much more scavenging probably occurred than the direct evidence indicates.

In early medieval Ireland, lambs and piglets did not leave the relative safety of the farm until August, aged about 5 months (Kelly 2000, 69; 81-2). Oxen and bulls, being larger and more aggressive than milk-cows, might offer some protection if kept with the herd (Kelly 2000, 32), but bulls might only join the cows for mating, in July or August. The same is true of rams, but goats, having more aggressive natures and greater intelligence, were perhaps kept with sheep year-round. Ethnographically, young girls or boys, supported by guard-dogs, were commonly given responsibility for defending herds against predators (see Section 6.6). Unlike wolves, dogs are fairly common in Early Neolithic faunal assemblages throughout north-west Europe (Murray 1970, 51-82) and, to judge from gnawing on the bones of other domesticates, were kept by every family or settlement[39] (Serjeantson 2011, 14).

To protect a herd effectively in open country, livestock must be kept close together in a single 'mob', moved in a close-knit group and carefully watched over day and night[40]. Historically, a herd of up to 150 sheep would be guarded by 3-10 trained guard-dogs, some staying within the flock and others patrolling the perimeter (Janine Massoubre, shepherd, pers. comm.). Cattle and sheep can be combined in a single unit, because the animals graze differently (Wijngaarden-Bakker 1998, 176). It is difficult for lone herders in open country to defend against wolves, because, unlike bears, they often hunt cooperatively. Wolves carefully avoid human structures, however, particularly when occupied (Carricondo-Sanchez et al. 2020). In post-medieval contexts, therefore, herders often clustered together, their shelters forming a loose protective perimeter around areas where livestock were gathered overnight (*e.g.* Herring 2012, fig. 7.2; Figure 6.17). Purpose-built 'nightfolds'[41] protect livestock more effectively, so perhaps this was one

[39] This observation itself supports the theory that wolves were widespread and sometimes came into contact with humans, since dogs almost certainly originated as domesticated wolves.
[40] *Contra* Piggott 1954, 92, who neglects to mention wolves in his discussion of wild animals on pp. 10-12). Surprisingly, Bogucki (1988, 34-5) too overlooks wolves.
[41] While numerous medieval and later examples survive, this also appears to have been common practice in the early medieval period (Kelly 2000, 45; Herring 2012, 95; Everson & Stocker 2012, 165-6).

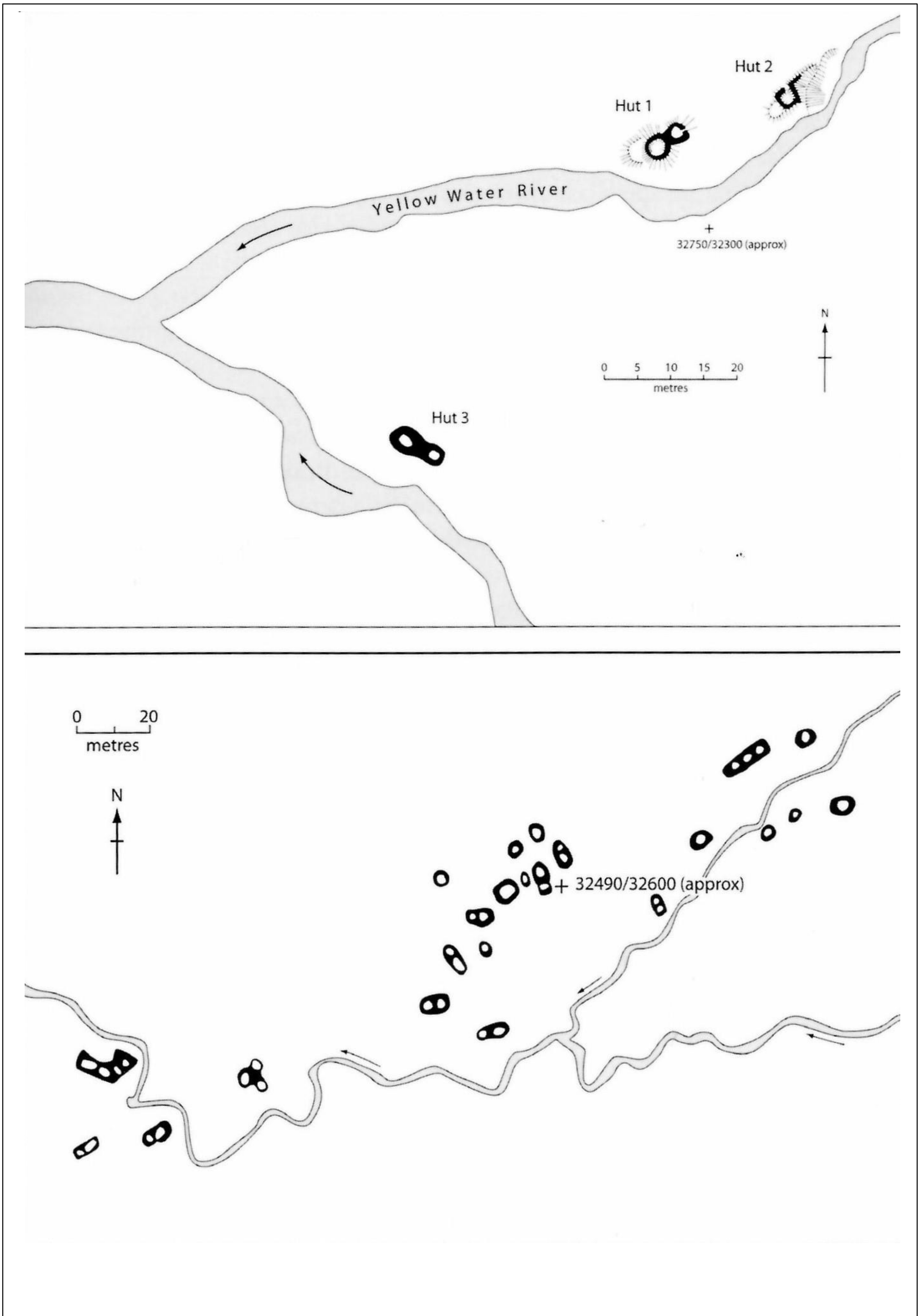

Figure 6.17: Clusters of post-medieval 'booley huts', once occupied by transhumant herders in the Mourne Mountains of Northern Ireland. Below, note how the central arc of huts loosely encloses a space alongside the stream. Image: Gardiner 2012, fig 8.7.

function of causewayed enclosures (Piggott 1954, 29, 92-3; Case 1956, 43[42]). In central France, Early Neolithic herders penned their flocks in caves overnight, leaving multiple layers of dung (Thiébault 2005, 250-56). High phosphate levels inside the causewayed enclosures at Etton and nearby Northborough[43], Cambridgeshire, perhaps also resulted from the dung of livestock penned overnight (Pryor 1998a, 355; 1998b, 65; Wessex Archaeology 2005, 16). Wolves in Yellowstone National Park are particularly wary of gateways, which they recognize as likely points of human contact (Bearman 2019). If herders varied their use of the different entrances into enclosures, as suggested by Piggott, this might further deter wolves, although this is clearly unlikely to fully explain the causewayed technique. Moving between different grazing areas from year to year would also have advantages. On one hand, wolves become emboldened in places where they have previously hunted successfully (Meuret *et al*. 2021, 13); on the other, livestock can be so traumatized by attacks that for 2-3 years they refuse to graze in that place (INRAE 2021).

The possibility of human cattle predation, or at least theft, should be mentioned: 'rustling' is well-attested in societies where livestock are highly valued (*e.g.* G.M. Fraser 1971; Lamphear 1988). Isolated instances of violence evidenced by human pathology at causewayed enclosures could represent cattle raids. The potential consequences for livestock husbandry were probably similar to those associated with animal predation, except perhaps for the social composition of the herders[44]: it seems unlikely that children and grandparents would be expected to repulse raiders.

If, then, livestock grazed and browsed in concentrated units in and around a scatter of clearings, which in some cases eventually hosted monuments, clearance of the vegetation in those areas would be greatly amplified. Over time, as the regeneration of browse was extinguished, the herb layer would become dominant. This, in turn, would provide grazing for larger numbers. Yet if numbers increased well, or others were attracted to the improving resource, the grass might still be insufficient. So perhaps the livestock themselves gradually enlarged the original gap, a slow ripple-effect occasionally intensified by wind and/or human actions. This scenario is in keeping with the expansion of causewayed enclosures through time, as revealed where appropriately sensitive dating has been carried out. Whether or not the original clearing was large enough to allow people within it to see beyond its perimeter, over the course of decades or generations, the potential for remote visual perception would greatly increase.

[42] Thinking the circuit at Offham was incomplete, Drewett (1977, 224) rejected this interpretation, but actually it was probably complete and nearly circular (Oswald *et al*. 2001, fig. 4.8).
[43] However, the findings at Northborough were influenced by those at the former, and there has been too little phosphate analysis at other sites to tell whether this reflects a wider pattern.
[44] It also seems likely that cattle might be deliberately scarred or ear-marked to allow their incontestable identification, but that has little bearing on the argument presented here.

Figure 6.18a: A suburban broad-leafed lime, with untrimmed epicormic growth.

Figure 6.18b: A broad-leafed lime on Walmgate Stray, York, with its epicormic growth systematically removed by browsing cattle. Note, too, the browsing of the lower branches and the resulting trampling under the canopy of the tree, which has effectively suppressed all competition for nutrients.

6.7 Livestock-oriented management of forest by humans

In the British Isles, on average grass stops growing at the end of October and most tree species have lost all their leaves by mid-November[45] (Table 6.4). The provision of sufficient fodder to maintain a herd from then until mid-March has always been a challenge (G. Clark 1945, 69; Lambrick & Robinson 1988, 72). Medieval[46] yeomen were advised to 'lop and top' trees in late summer to guard against winter shortfalls (Figure 6.19a; Orwin & Orwin 1938, 52-6[47]). In early medieval Ireland, holly and ivy were routinely harvested as winter fodder (Kelly 2000, 46; Figure 6.19b; 6.20).

Consequently, use of leafy branches as fodder has long been sought and found[48] in the archaeological record[49]. About 1,000 bundles of leaf fodder would be required by one cow for 6 months and lime, field maple, elm, ash, ivy and clematis[50] were all used as fodder in the well-preserved Swiss lake-edge settlements (Rasmussen 1990[51]). Elm is well suited to this, often developing a secondary growth of twigs and leaves in August[52] (Edlin 1969, 120; M. Parker 2015, 17), possibly a co-evolutionary development. Elm, ash and lime branches form flat 'fans', making them easy to transport and to pile neatly in dense, space-efficient heaps (Troels-Smith 1960, 23). Ethnography records use of tall ladders to lop elm branches in central Europe (Troels-Smith 1960; 1961, translated in summary by J.G.D. Clark 1965, 59-60). In the context of the extensive forests of the Neolithic, it perhaps seems more likely that people would lop lower, more accessible branches. However, phototropism would drastically reduce the number of low-hanging branches (see Chapter 5), especially of less shade-tolerant species. Low-hanging branches would therefore be abundant only around the fringes of established clearings, but here the lowest branches would be quickly depleted by the browsing cattle themselves, or by wild ungulates when cattle were absent. Lower-growing shade-tolerant trees and shrubs within the woodland would also be targeted disproportionately by animals and humans alike.

Furthermore, sodium, potassium and phosphorus, all of which are vital to livestock's health, are gradually lost[53] from areas cleared of woodland (Limbrey & Cleere 1974, 46), but are concentrated in the crowns of trees (Ovington & Madgwick 1958, 276). Clearly, Neolithic herders could not understand the science involved, but they perhaps recognized

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[45] These dates reflect the situation prior to the onset of the most serious effects of climate change.

[46] This practice also continued into the 20th century in the Lake District, producing the region's characteristic ash pollards, which were cut above the reach of sheep rather than cattle (Quelch 2015).

[47] And to gather moss and ivy when this fodder was spent

[48] Although stable isotope analysis in southern Scandinavia has not been able to confirm the practice (Noe-Nygaard *et al*. 2005).

[49] For example: Iversen 1946; Troels-Smith 1960; Heybroek 1963; Coles *et al*. 1978, 24-5; Rasmussen 1989; 1990; 1993; Akeret & Rentzel 2001; Balasse *et al*. 2012.

[50] Usually known colloquially as Old Man's Beard.

[51] See also Troels-Smith (1955), quoted in translation in Sakellaridis (1979, 171).

[52] This was traditionally known as 'Lammas growth'.

[53] Though accumulated dung and urine will eventually restore the levels (Wells 1974b, 180-2).

Figure 6.19a: Poplar pollards in the Diois region of south-eastern France, traditionally harvested as winter fodder, but now only for ecological reasons. Poplars can reach in excess of 30m, but none of these trees is taller than *c.*8m. Photographed in mid-October.

Figure 6.19b: Ancient hollies in the New Forest, Hampshire, photographed in late March. Historically, the trees were pollarded for winter fodder; they continue to be browsed by cattle and ponies, allowing views of c.75m beneath the canopy.

that livestock benefited from eating lopped upper branches. So perhaps people did climb trees to cut higher branches[54], particularly in late summer and autumn, thus placing themselves in similar elevated positions to honey-gatherers (see Chapter 5), with consequent opportunities for long-distance views.

Alternatively, perhaps suitable branches were harvested by felling slim trees, again potentially with consequences for remote views. The sparse herb layer on forest floors starts to increase in response to increased light once the canopy is thinned by 50% (Ehrenreich & Crosby 1960), so felling trees, or killing them, would also increase the grazing resource. In some cases, ring-barking or notching, especially if undertaken in autumn or winter, or relatively high on the trunk (as perhaps implied by short-handled axes), will effectively coppice the tree. New basal growth the following spring would provide browse, but years of regular browsing would eventually kill the tree. A density of about 3.75 cattle per hectare is enough to prevent most coppiced trees from regenerating (Vinther 1983). Even at lower densities, more palatable species are still severely damaged or killed (Adams 1975, 144). Alternatively, perhaps patches of coppice were deliberately retained for gathering fodder. Rasmussen (1990) estimates that a herd of 10 cows or 20 sheep would require the produce from 3-4ha per winter.

Finally, we must consider where this late summer 'harvesting' of forest fodder would have occurred. As with hay, people would probably avoid transporting large quantities of awkward, heavy loads further than was necessary. This facet of livestock husbandry, therefore, perhaps represents a mechanism by which the clearings that hosted home-bases would be gradually enlarged, year on year, without any deliberate intention to clear forest or prepare arable land. If smaller trees were first coppiced to provide fodder and eventually killed by intensive browsing, larger trees were perhaps left isolated. If these too were pollarded to promote leafy branches, the forest beyond the initial clearing would gradually transform into something resembling medieval parkland or wood pasture, as proposed by Vera. In other words, edges of clearings might be continuous walls of trees when occupation began, presenting a well-defined horizon to those who dwelled there, but in time the increasing openness of the original clearing's environs would afford glimpses of the world beyond.

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[54] The short-handled hatchets of the Early Neolithic, whilst less effective than long-handled axes for felling trees, would have been much easier to use when hanging onto a ladder or sitting astride a high branch.

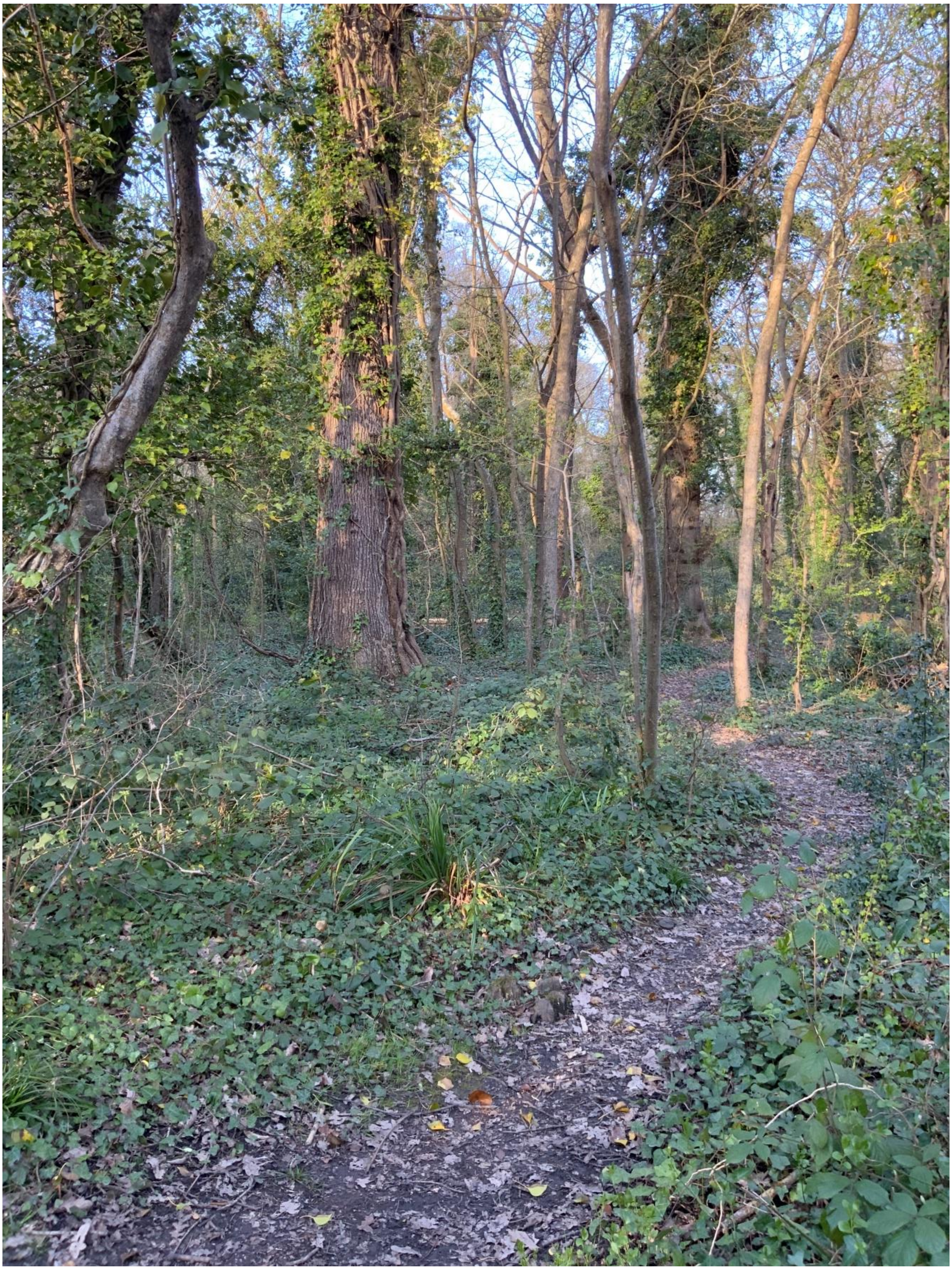

Figure 6.20: Uncontrolled ivy growth in an ancient coppice-with-standards near Combe Hill, photographed at the end of March. Although ivy now impedes many distant views year-round, historically it was important as winter fodder and consequently 'harvested', especially when flowering (October- November).

6.8 Summary: livestock husbandry and remote visual perception

Within years of the arrival of the first Neolithic immigrants, some form of transhumance would have become inevitable in order to preserve sufficient feed to maintain growing numbers of livestock (especially cattle) through winter. As the first few generations of the 4th millennium BC successfully increased the sizes of their herds, this need must have become more acute, making *ad hoc* solutions unsustainable. Despite general acknowledgement that transhumance took place, archaeologists have not considered the practice sufficiently carefully, in part because it leaves so little incontrovertible material evidence. This chapter has sought to develop a more refined model of different aspects of transhumance, partly to further explore physical affordances for remote views, partly to understand the qualities of life in remote places that perhaps made views in both directions meaningful *i.e.* perception.

The distances, timings and likely routes of the herders' journeys through the forest, must have afforded particular viewsheds. Based on historic patterns, the timings of the principal journeys can be estimated as late April/early May and late October/early November. At these points in the year, the condition of the vegetative environment would have increased opportunities for distant views along the trail. Based on historically documented scenarios and the natural propensities of livestock, the distances travelled to reach summer pastures can be hypothesized as being towards the lower end of a 3-25km range. Taking into account the needs of cattle for drinking water, and the opportunities for browsing on the hoof afforded by vegetation alongside watercourses, we can begin to develop a predictive model for the sort of routes likely to have been followed.

This chapter has also worked through the potential impacts of intensive browsing and grazing on the vegetative environment, both on the hoof along transhumant routes and at remote pastures. Over time, this would have increased the availability of remote views. The recent recognition that sheep were more numerous than previously believed, at least in the prime study area of this thesis, is also important. Though they are more likely to have been kept close to the 'home base' than cattle, there is no reason why they could not have accompanied cows to remote pastures, if only occasionally. Of course, practices may have varied from one community to another, and through time. Their mode of grazing provides a plausible mechanism whereby, even if herds did not return to particular places in a strictly annual cycle, forest regeneration could have been almost completely stopped. This would eventually have led to localised eradication of the forest within the 400-500 years that some causewayed enclosures were used. Within the same timespan, the continuous but sporadic damage done by browsing cattle would gradually enlarge the original natural or semi-natural clearing. Given that cattle need free access to water to increase their milk yields, it seems likely that these effects would be concentrated along

Figure 6.21: A broad transhumant trail through woodland in the Diois region of south-eastern France, offers shepherds occasional glimpses of the distant hills.

the ‘least-cost path’ to the nearest watercourse, as well as along watercourses themselves.

This chapter has also explored the social dimensions of the practices bound up in transhumance, which must have shaped people’s perceptions of place. Over time, people gradually came to favour particular clearings as remote pastures, perhaps because they were more conveniently located, held particular associations or were simply nicer places. Thus, transhumance evolved from economic necessity to social custom. Different sectors of a community would participate to varying degrees at different times of year, and at different stages in their lives. Since herding is best undertaken cooperatively, especially where predators pose a threat, the practice would stimulate contact with others, perhaps from different communities, and for pooling resources. This development seems to coincide with the time when causewayed enclosures began to appear. It has long been suspected that these monuments hosted autumnal gatherings, which, among other things, facilitated the exchange of stock and human partners, as demanded by life in small, dispersed communities. As discussed in Chapter 5, obtaining the timbers used in some of these construction projects undoubtedly caused a local surge in forest clearance.

The confirmation of dairying is extremely important, because it suggests that once remote pastures were reached, daily patterns of movement would be ‘tethered’ to the milking place. Using the forest fringes as cover, predators (especially wolves) could inflict serious losses on isolated herds. This too argues that stock would be re-gathered before dusk in open settings that denied predators cover. Therefore, causewayed enclosures may well have served as nightfolds, as suspected decades ago. Milking and cheese-making, like protecting herds, are cooperative, social tasks that would shape people’s experience of particular places in the landscape.