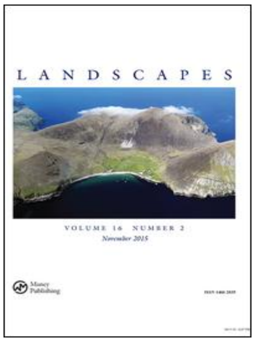

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Springs, Woods and Transhumance: Reconstructing a Pennine Landscape during Later Prehistory

Tim Laurie

Biogeographical conclusions only find definite confirmation when it is possible to base them on a geological foundation, which historical geology can alone provide.

E. V. Wulff (1943) cited below the title to Godwin (1975), *The History of the British Flora.*

Abstract

This article explores evidence for the nature of a Pennine landscape – the Wensleydale, Swaledale and the Swale/Tees-Greta Uplands (Figure 1) – in Later Prehistory. It portrays an environment with a complex mosaic of woodlands, different from the moors and dales we know today but with important continuities between the present and the past. It reveals how human activity was often linked to the sites of springs and other related water features, and how these were foci for human utilisation of the resources available in the landscape.

The article begins by outlining the geological structure of the area, and by introducing the general occurrence, characteristics and natural history of springs and their offspring – haggs, gutters, sikes and becks. We can attempt to reconstruct the fully developed woodland environments of this area as they were soon after 4000 BC: after the establishment of all tree species but prior to extensive human interference. Evidence comes from available pollen reports but also from the fragments of semi-natural woodland which survive today on the dale sides and at the head of tributary streams. The article argues that past woodland communities should be defined by reference to the national classification of contemporary vegetation types (Rodwell 1991 et seq). This approach is especially relevant in this area, where soils of abruptly changing pH, derived from frequently faulted alternating calcareous/siliceous strata, control the reactive composition of the woodland canopy, field and shrub layers. The article describes existing examples of woods which together provide a sample of the woodland mosaic which may once have covered the dale sides. The evidence

of tree remains in blanket peats demonstrates that woodland on the highest plateau was stunted, species poor and may not have extended much beyond the 'shelter' of the gills formed by in-cutting streams.

Across Wensleydale, Swaledale and Teesdale, from the end of the Mesolithic through to the establishment of the first settled farming communities at about 1200 BC, there is evidence for transient human activity. It is found in the vicinity of springs which rise below the uppermost limestone scars and at passes across the interfluves – as predicted by Penny Spikins (Spikins 1996). The article discusses the distribution and preferred location of three categories of this evidence – lithic scatters, rock art and the numerous burnt mounds – in the context of the disposition, detailed composition and density of the woodlands in which these people lived.

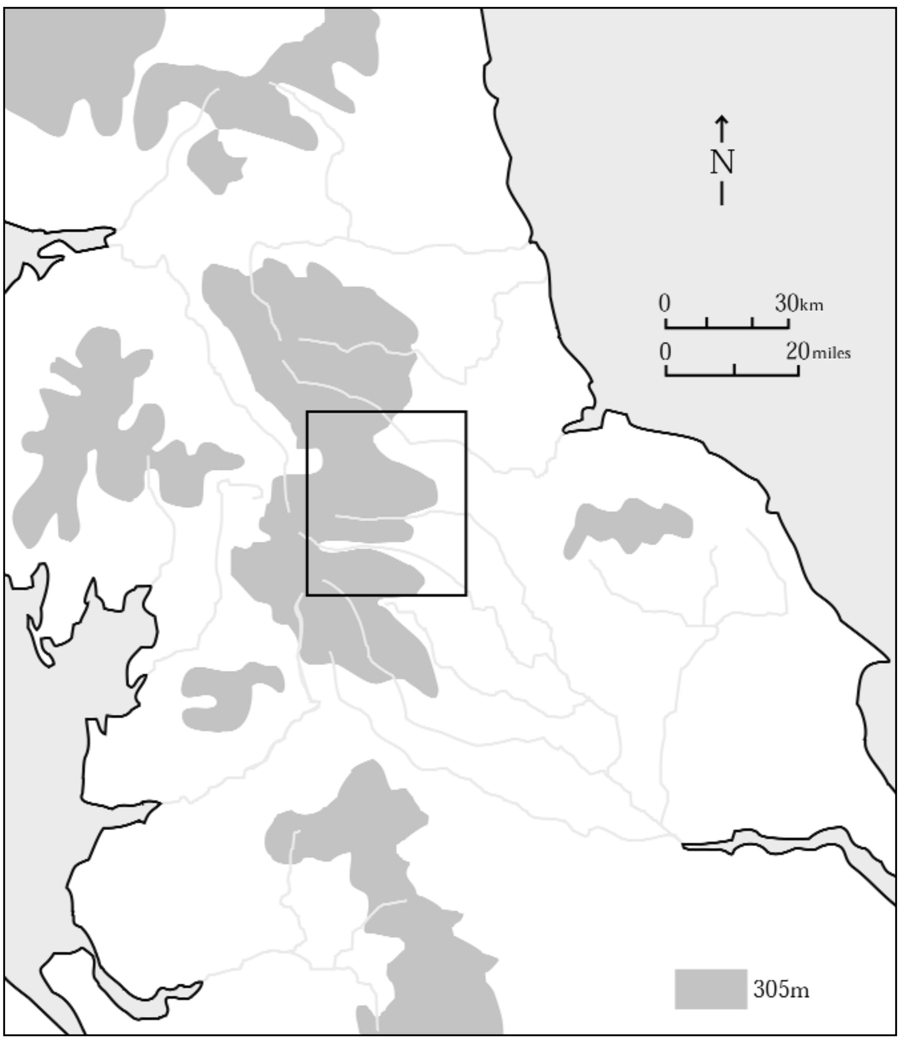

FIGURE 1.
The location of the Ure, Swale and Tees/Greta Uplands in Northern England.

Geology

The North East Pennines are a faulted, uplifted and dissected plateau. The principal rivers, the Ure and Swale occupy glacially enlarged troughs, dales, and have their source in the west at 700m Ordnance Datum (O.D.)[1] on Mallerstang Edge (Figure 2). The Tees rises on the high, faulted escarpment of the Cross Fell Range which overlooks the Vale of Eden. The high moors of the study area form the source of Swale and Ure (the Askrigg Block) and are separated from those forming the catchment of the Tees, Wear and Tyne (the Alston Block) by the Stainmore Depression, beloved by users of the A66, which is drained by the Greta – the principal south bank tributary of the Tees. The hard rock geology is all of Carboniferous Age with the Lower Dinantian, Great Scar Limestone forming the bed of the river Ure in mid Wensleydale. (Dunham and Wilson 1985). The strata of the dale sides are at the top of the Dinantian, previously known as the Yoredale Series, comprising repeating series, cyclotherms, of alternating limestone, thin coal, mudstone, shale and

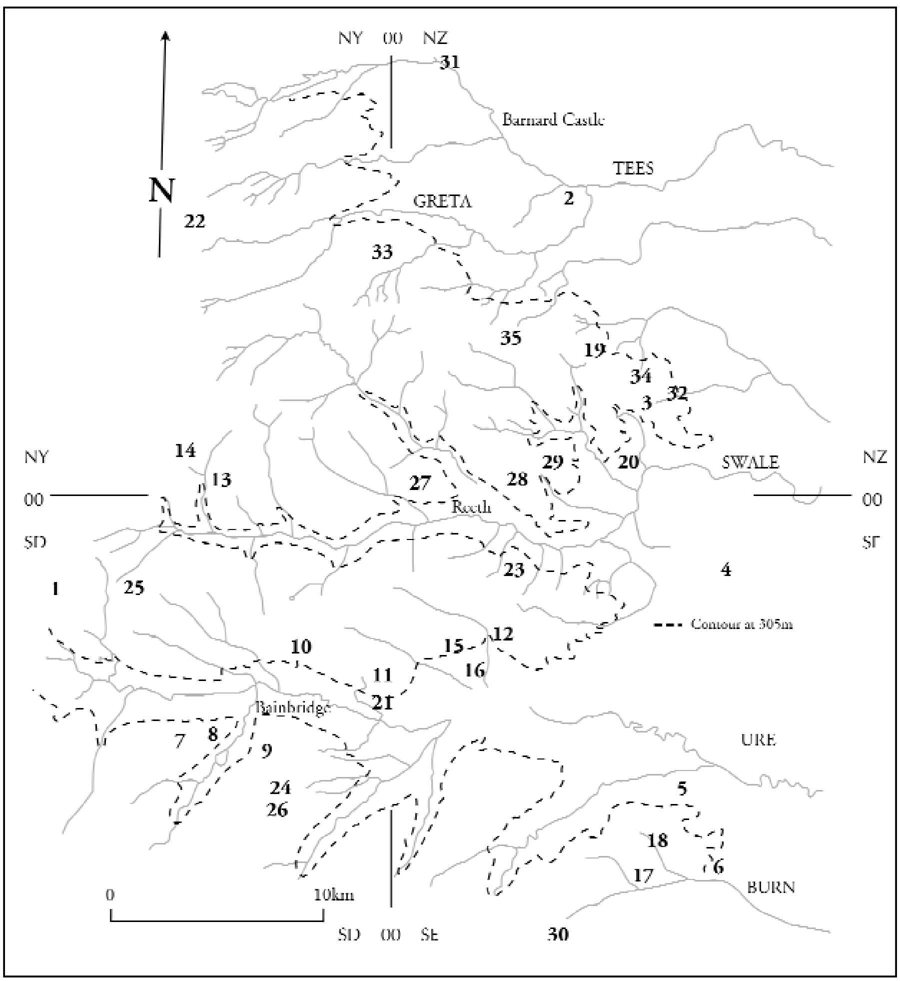

FIGURE 2.
The Ure, Swale and Tees/Greta Uplands: locations mentioned in the text.
Key: 1 Mallerstang Edge; 2 Rokeby; 3 Feldom; 4 Barden; 5 East Witton; 6 Agra; 7 Yorburgh; 8 Counterset Crag; 9 Addlebrough Hill; 10 Ellerkin; 11 Carperby Moor; 12 Redmire Scar; 13 West Arngill; 14 Kisdon Force; 15 Ellerlands; 16 Castle Bolton; 17 Colsterdale; 18 Birk Gill; 19 Waitegate Wood; 20 Marske; 21 Haw Bank; 22 Stainmore; 23 Ellerton Moor; 24 Thornton Mire; 25 Lovely Seat; 26 Stake Fell; 27 Calverside; 28 Marrick Moor; 29 Skelton Moor; 30 South Haw; 31 Egglestone; 32 Sturdy Springs; 33 Scargill Moor; 34 Gayles Moor; 35 Barningham Moor.

sandstone strata. The mineralised beds received names from lead miners and can be recognised across the study area (Tyson 1995). Of these, the most important in the context of woodland composition and resource are the Underset and Main Limestones and the overlying Richmond Cherts and thin limestone of the Crow Lime cyclotherms. Each cyclotherm includes very thick beds of sandstone – the 27 fathom, 12 fathom and 10 fathom grits. Local faulting, frequently mineralised, bring the hard limestones and grits to the surface with prominent scarps, scree slopes and wide terraces. Cherts, cherty limestone, mudstones and sandstones outcrop above the highest scars of the Main Limestone – the lowest strata of the Namurian Series. These siliceous hard and insoluble strata may be covered with glacial clays giving rise to soils of variable pH. Coarse sandstones, the Millstone Grits, cap the highest summits (Dunham 1948; Johnson and Dunham 1963; Dunham and Wilson 1985; King in Millward 1988). The only igneous intrusion, the dolorite whin cill, forms dramatic scars and falls in Upper Teesdale and the upper scars of High Cup Nick on the North Pennine escarpment (Mills and Hull 1976).

FIGURE 3. (*opposite*) Wensleydale, Ellerkin Scars, Main and Underset Limestones. The view south east to Penhill. Springs rise at junction of underlying sandstones with impervious shale.

The characteristic stepped terraces of the dale sides are formed by resistant hard limestones. Underlying sandstones, with inter-bedded mudstones provide less steep, concave slopes. All strata can be and usually are masked by glacial drift deposits, periglacial scree and postglacial hillwash. Lines of swallow holes where surface water disappears underground mark the upper outcrop of the main aquifers, the limestones, sandstones and flagstones. The Main Limestone forms the bed of the Tees and Greta at Rokeby, below Barnard Castle, where the scenery has received attention from John Sell Cotman, Turner, Macaulay ('Scargill's whispering trees') and Sir Walter Scott (Hill 1984; Miller 1992). The eastward dip of the strata brings Namurian cherts and sandstones to the surface of the lower slopes of the eastern Pennine fringe, on Feldom, Barden, East Witton and Agra Moors. Limestones are largely absent from these strata.

Springs

Occurrence

Throughout Wensleydale, strong springs rise at an elevation of 300–400m at the junction of sandstone aquifers with impervious shale bands below the outcrop of the Underset Limestone and the overlying Main Limestone. The Underset Limestone caps the isolated hills of Yorburgh, Countersett Crag and Addlebrough and together with the Main Limestone provides prominent scars further east, at Ellerkin (Figure 3), Ivy and Blue Scars on Carperby Moor and Redmire Scar, where extensive quarrying has removed the greater part of the limestone pasture above the scar.

Further strong springs rise at the outcrops of the underlying Three Yard, the Five Yard and Middle Limestones. These limestones are within the sequence of cyclotherms and form more or less prominent scars and terraces on the dale sides. Springs also rise at low elevation among drumlin swarms,

FIGURE 4. (*below*) Burnt mound at Low Wanless Springs, West Witton, Wensleydale.

just above the river floodplain as at Low Wanless Springs in West Witton Parish (Figure 4). Evidence for early human activity is most concentrated in the vicinity of all these springs. There is no visible evidence for prehistoric human activity on the floodplain itself.

FIGURE 5.
Arndale Bog in the Swale – Tees/Greta Uplands. Massed birch stratified within peat of one to two metres thickness at Black Hag Gutter.
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Throughout Swaledale and Teesdale, springs rise below equivalent limestone and sandstone strata at 300–400m. Above 500m, on the highest plateau, blanket peat has formed to depths of often two to three metres. Small, low-energy, dendritic streams – sikes – rising at weak springs, erode the thick peat to form haggs. These are deep, steep-sided and black, and cut down sometimes through visible tree remains – the remains of previous woodland – to the mineral soil and into the underlying glacial clay (Figures 5 and 6).

Evidence for prehistoric human activity in the form of Late Mesolithic microliths associated with the horn cores of prehistoric cattle, *Bos sp.* has been found stratified within the blanket peat of eroding peat haggs at Hard Hill, at 700m in Upper Teesdale (Johnson and Durham 1963). In the area analysed here, finds have been of three types. Lithic finds – indicative of Late Mesolithic and Neolithic occupation sites – rock art and burnt mounds have been located in the vicinity of springs on the upper dale sides (Figures 7–9). Burnt mounds are the most widespread and numerous of prehistoric sites in the area, and are interpreted here as sweat houses or saunas (Barfield 1991). These have been dated to the Middle Bronze Age (Ehrenberg 1991) and their distribution reflects that of the most constant springs (Figure 9).

Natural history and resources

To understand where and how people lived in a landscape, we need to understand the resources available within it. The resources available at a spring locality are largely controlled by the character, i.e. disposition, composition and density, of the contemporary vegetation, principally of the woodland. Mobility and visibility are equal in importance to productivity (Mellars and Reinhardt 1978). Detailed consideration of the contemporary vegetation

FIGURE 6.
Whitaside Moor, Swaledale: Morley's Folly. Birch at the base and in the second layer within eroding peat on Namurian chert at the edge of the plateau. A Mesolithic flint blade has been found nearby.
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within the locality is fundamental to an understanding of human activity at that locality. The vegetation of the North East Pennine Dales reflects the suddenly variable geology discussed above, as well as the soils. It is a mosaic and is not stratified.

We need, therefore, to reconstruct the vegetation during Later Prehistory of the daleside woodland – including the shrub and field layers – and also the vegetation of the plateau. It can be accepted that from about 4000 BC all tree species had arrived, and that fully developed woodland communities were established. No attempt will be made to extend this reconstruction to the period after about 1200 BC, when settlements were first established in the dales, as at Bracken Rig in Upper Teesdale (Coggins and Fairless 1984).

We can make use of the few relevant pollen reports, but also the evidence of semi-natural (predominantly native) woodland which survives on the dale sides and at the head of tributary streams. The stunted and species-poor character of the woodland of the high plateau will be confirmed by reference to tree remains in blanket peat. References of vegetation codes below are to *British Plant Communities, Volume 1 – Mires and Heaths* and *Volume 2 – Woodlands* (Rodwell 1991 *et seq.)*. The dales vegetation is further described for Wensleydale by Millward (1988), for Upper Teesdale by Clapham (1978), for Cumbria by Halliday (1997) and for Durham by Graham (1988).

Archaeologists can gain much by adopting the countrywide classification of contemporary vegetation to define those of the fully developed vegetation after

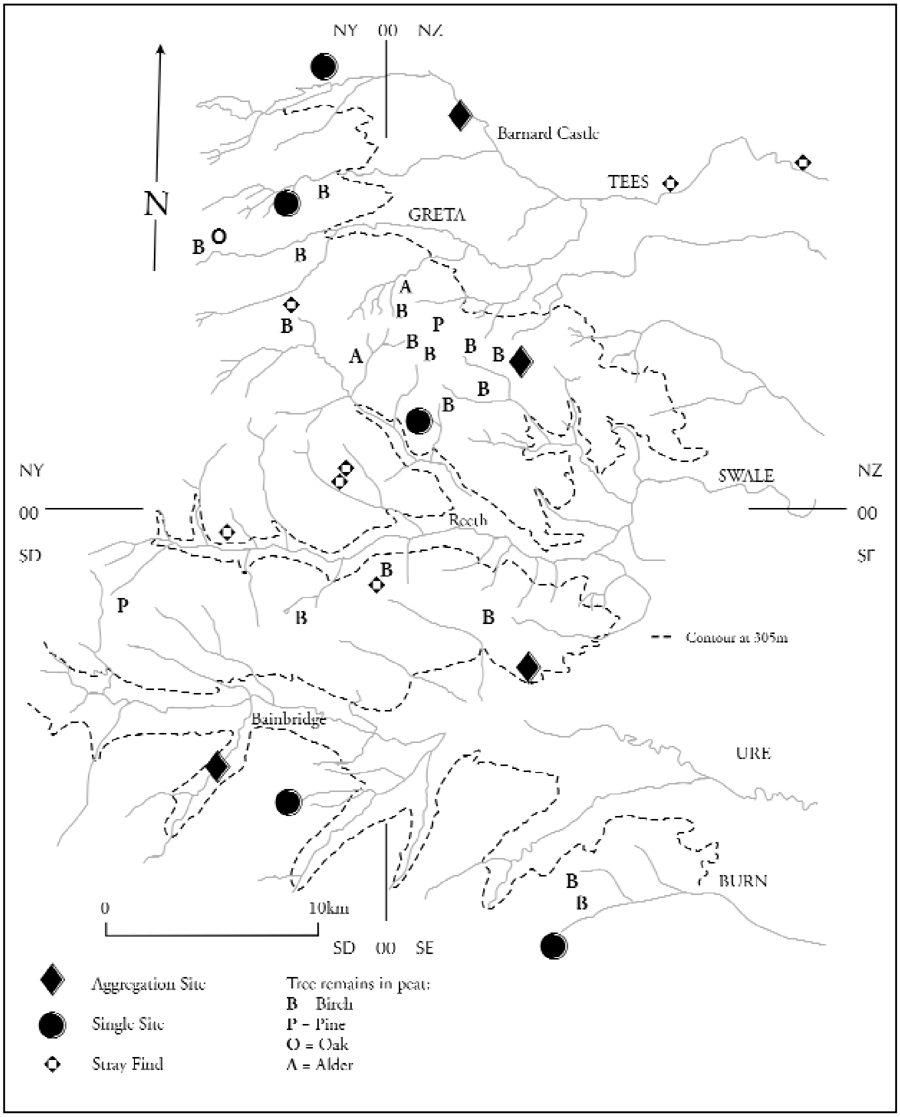

FIGURE 7.
Lithic evidence for occupation after 4000 BC and tree remains in peat.

about 4000 BC. Not only are the woodland canopy associations defined, but also the shrub and field layers. The woodland edge can be described from the closest applicable moorland heath/mire codes. The codes adopted can accurately reflect the geological and soil controls present – *at district or locality level.* The resource implications and density controls on access through the woodland can then be fairly considered.

Space here permits reference only to those vegetation communities necessary to define the (woodland) environment of springs after 4000 BC which developed in response to the abruptly changing geological and climatic conditions of the dale sides and of the moorland plateau. No attempt has been made to select sub communities, although this would be possible with botanical advice. The species composition of the plant communities selected will be

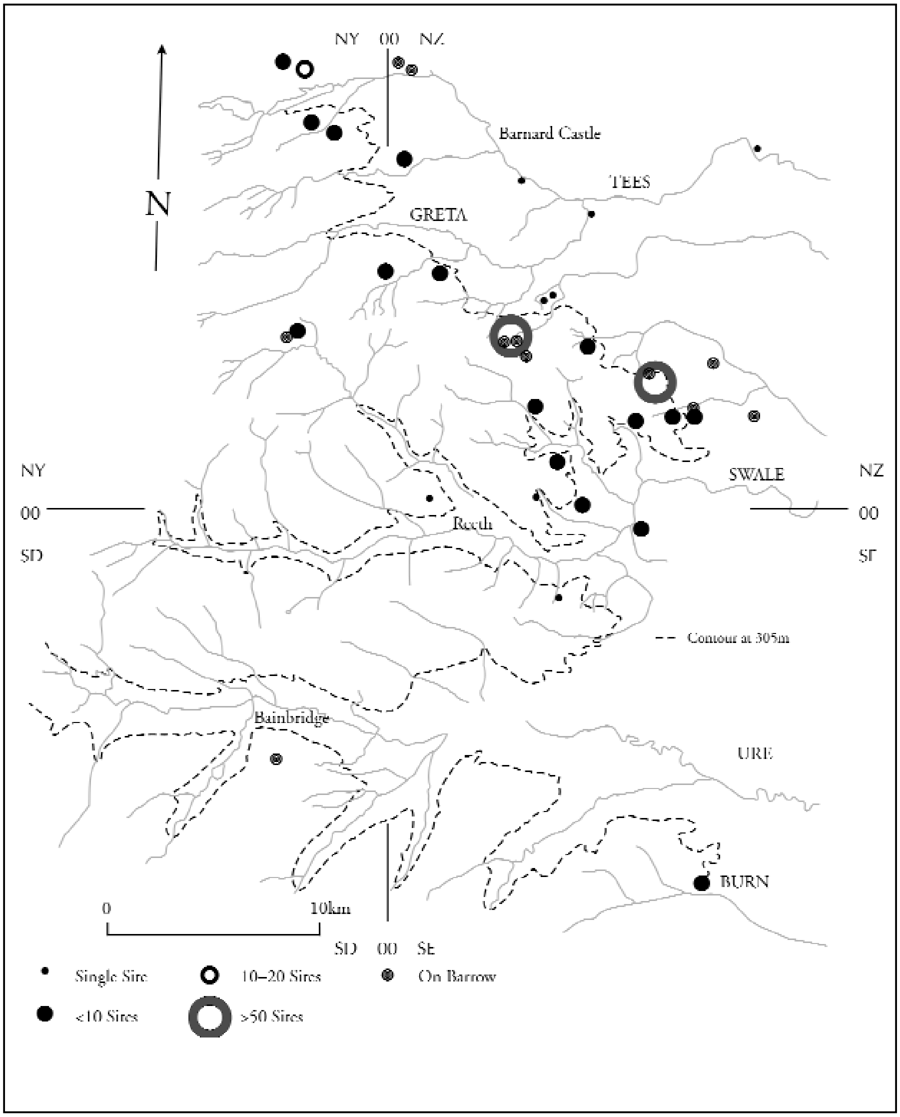

FIGURE 8
The distribution of rock art.

briefly described in the text, however, full plant lists, the more recent of which are referenced to Rodwell codes, are available from the local floras cited above.

Springs and spring flushes are either base poor/neutral with moss vegetation, rising below drift and sandstones, calcareous, very calcareous (tufa forming). Tufa forming springs and calcareous flushes are among the most interesting habitats in the Pennines (Figure 10).

Ground water may be above atmospheric pressure and below limestone strata will carry dissolved carbonate of lime which is deposited on emergence. Tufa springs are formed when ground water emerges below the outcrop of the thickest limestones. Springs and flushes are botanically interesting throughout the Pennines and provide the habitat for arctic/alpine plants, for example the dwarfed form of marsh marigold, birdseye primrose, common butterwort,

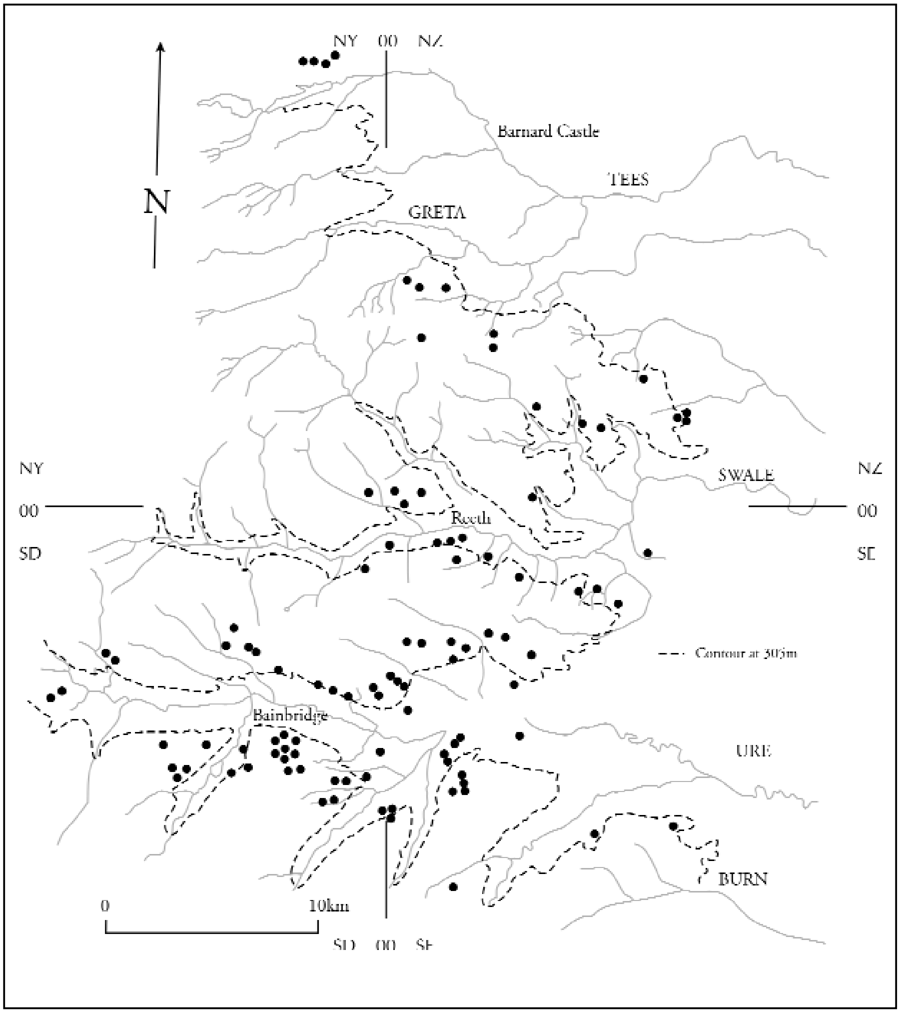

FIGURE 9.
The distribution of burnt mounds. This correlates closely with the distribution of the most constant springs.

starry, yellow mountain and marsh saxifrages, least clubmoss and variegated horsetail. This botanical evidence suggests these habitats may have been open and unshaded throughout post glacial time.

It is no accident that these elevated valleys became the focus for early human activity. Springs form the source of low energy streams which may have provided ideal habitat for beaver, an important resource (Butler 1995) and other game. Cray fish are found at these tufa springs today and may be predated by short eared owls, I have found carapace fragments and owl pellets together at a spring rise below Addlebrough, Wensleydale. Rarely, oncolites – concentrically laminated stones formed by crusts of blue green algae and diatoms which in turn colonise and precipitate the deposition of tufa – form the gravel bed of the rill below the spring rise where water of constant temperature, depth and flow ripples to the benefit of these ancient single cell organisms (Deborah Millward, pers comm.). Close examination of these tufa springs also reveals the existence of stromatolitic colonies of red brown algae. These oncolites and

FIGURE 10.
Thornton Rust Moor. A tufa spring, with oncolites and stromatolitic colonies revealed after drought. A total of nine burnt mounds have been located at this spring complex.
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stromatolites (Figure 10) are similar to algal colonies which formed during pre Cambrian times, and their presence should be savoured.

Woodland fragments

The environment of springs today is of open moor and rough grassland, the consequence of decades of high density sheep and suckler cow pasture. The evidence for the existence of previous woodland on this pasture can be seen almost everywhere in the form of isolated fragments of a woodland, once providing a mosaic of very different contemporary woodland communities which differed greatly one from another in species composition and resource potential. These woodland communities arise from and were controlled by the abruptly changing soils of the plateau, dale sides and the river floodplain. A total of 20 different soil types with a number of ancillary sub types have been recognised and mapped in Upper Wensleydale (Millward 1988, 150).

Wensleydale, Swaledale and Teesdale possess a wealth of hidden gills (small ravines) and scars (low cliffs) inaccessible to sheep where native trees and vegetation survive. Woodland consisting predominantly of native trees and shrubs which have not been planted can be seen on the dale sides, for example the mixed deciduous woodland at West Arn Gill and below Kisdon Force in Upper Swaledale. More often, areas of alder wood with occasional ash trees and copses of hazel and blackthorn indicate the former presence of mixed woodland, as at Ellerlands above Castle Bolton in Wensleydale. Isolated thorns on open dale sides, sole survivors of heavily grazed woods, mark the final stage of degraded woodland.

Three very different relict woodland communities survive at intermediate level on the dale sides today. These survive as representative of the woodland mosaic which formerly must have been widespread on the dale sides and plateau now open peat covered heather moor.

Palynology provides a list of species present in the pollen rain and does not provide a reconstruction of the actual woodland composition and disposition – the ingredients for a four course meal but not the menu.

The three woodland communities selected to represent the woodland present in the survey area are briefly described below. A full list of species present cannot be provided for reason of brevity; however, visitors to the dales can see for themselves fragments – examples of each of the communities described – in all the dales and tributary gills. To assist, representative native woods are noted below. These can be viewed as representative analogues of the woodland mosaic composition after 4000 BC.

Upland oak/birch wood (W11, W16, W17)

Occurs today on very acid, free draining soils developed over sandstone on the Pennine fringe. Species poor, oak and birch equally or severally dominant, holly, rowan, aspen are present, 'more calcicolous plants never find a place here and even more tolerant species – like hazel, hawthorn – are largely excluded' (Rodwell 1991, 268). Relict pine trees may also have been present, either as isolated trees, as they are today in Colsterdale, or as small stands.

The absence of hazel thicket, an open bilberry heath field layer and stunted oak and birch on more exposed ground of the fringes allows for easy passage above or through these woods, especially in sheltered gills – a more significant factor than the possibility that this woodland may have been resource poor. (Mellars and Reinhardt 1978). This woodland is that which would form the fully developed woodland environment on slopes of sandstone and shale where limestone strata are absent. It is the birch dominant scrub woodland which is seen at the base of blanket peat over the Namurian sandstones, cherts and mudstones of the plateau and of the lower eastern moors.

This woodland is present on most gritstone slopes where some protection from grazing is available. Two representative woods are Birk Gill, in the upper reaches of Colsterdale – and Waitegate Wood, Marske, Swaledale (Plate 9). In the former, there is woodland on both banks of the stream in-cutting Namurian sandstones on the lower eastern moors. Oak is dominant below 250m, birch with occasional oak above 250m, and at the unfenced upper margins, oak trees are stunted and multi-stemmed and less than 150mm in diameter. Alder and aspen grows by the stream; hazel and willow present but scarce. On the open moor, heather/bilberry heath (H12) is found, with isolated trees including birch, holly, rowan and pine.

At Waitegate Wood, woodland composition is abruptly contrasting where limestone strata are faulted against sandstone, as above Waitegate Farm (at

National Grid Reference NZ 0840 0468) (Dunham and Wilson 1985, 152). To the east bank of the stream, on sandstones, upland oak/birch wood (W11, W17) is present. Oak is co-dominant with birch on acid sandstone scree. Bilberry, great woodrush, and wavy hair-grass form the field layer, with male fern, broad buckler fern and mountain fern also present. Hazel is absent except occasionally at flushed streamsides.

On the west bank of the stream, on the scree below the scar formed by Underset Limestone and on the east bank below the line of the fault, we find limestone ashwood (W8) with abundant hazel and other calcicole shrubs.

Ashwood (W8); mixed deciduous woodland (W9, W10); limestone scrub (W21)

Mixed deciduous woodland with ash dominant occurs today on more base enriched soils in most gills below 400m, on glacial till with a calcareous component, i.e. derived in part or mainly from limestone. Ash and wych elm (now mostly dead) are the main tree species here. Small-leafed and the rare large-leafed lime, birch and crab apple are present, with very occasional rowan. Hazel, two species of willow, bird cherry, holly, hawthorn and sloe provide the understorey. Ash may have replaced elm after previous disease episodes.

This woodland and scrub is species and resource rich. The hazel canopy is tall and casts a dense shade. The field layer is confined to seed heads of bluebell, leaves of primrose and low ferns. Natural clearings occur and access through the hazel understorey is possible today.

Ash woodland (W8, W9) is the woodland which would have finally developed on glacial drift with a calcareous component and scree below the limestone scars – potentially over all areas except the bare, frost shattered grit plateau summits. By analogy, this woodland and scrub together with alderwood (W7) in wetter flushed areas formed the general environment of the dale sides at mid elevation springs below limestone scars.

Fragments of ashwoods are present at the head of many tributary dales. Two representative ashwoods are Haw Bank, Carperby, in Wensleydale, and in Swaledale near Muker, both banks of the Swale at Kisdon Force and at West Arn Gill.

Haw Bank woods are located on limestone scree above Ellerbeck, the lower reaches of Thackthwaite Beck and have recently been fenced to encourage regeneration. Some replanting has occurred following the loss of elms. Mature sycamore trees are prominent at the western end of the wood. Mature hazel coppice forms 80 per cent of the canopy today. The wood consists of scattered ash trees, a surprising amount of willow (two species), some rowan, holly, bird cherry, wild cherry (gean) and crab – together with openings left from the demise of wych elm – the remaining 20 per cent. A single small-leafed lime tree and a small copse of the rare large-leafed lime is also present (Deborah Millward pers. comm). Alders border the stream with a rich meadow herb flora at the local nature reserve below the lead mine spoil heaps on the Disher Force vein. The fringes of the wood beside the path on the slope above the stream are infested with bracken. However the field layer below the hazel coppice is bare earth with some ferns and seed heads of blue bells in July. Passage below the hazel canopy on foot is not difficult.

In the woods at Kisdon Force we find ash, wych elm, birch, alder copses, willow, rowan, bird cherry, elder, sloe, hawthorn and holly. Hazel is abundant throughout. The small woodland fragment at West Arn Gill provides a full transect from river flood plain to the outcrop scar of the Main limestone. For zonation of species from rich limestone ash wood (W9) to upland birch woodland (W11) on base poor shales and sandstones above the Underset Limestone here, see Rodwell 1991, *Vol 1*, 165, Figure 20.

Alderwood (W7)

Alder is the single dominant tree in W7, which grows today not only along the wet edge of the floodplain but also at higher elevation – on the concave slopes of the sandstones which underlie the Underset Limestone and on wet clay slopes anywhere. Willow and bird cherry may be present as single trees. The field layer is of open tussock forming grasses and rush, with meadowsweet and nettles. Alderwood occurs today as extensive copses isolated or within W8 or W9 woodland on the upper dale sides and at abandoned channels on the flood plain.

The fragment of alder woodland at Ellerlands Castle Bolton, Carperby, Wensleydale is of considerable interest and provides a valuable insight into the woodland environment of the upper dale sides where springs rise below the Underset and Main Limestones. Here, alder is dominant; however, copses of hazel and sloe with occasional ash, rowan and willow indicate that this alderwood was once a copse *within* a larger area of ashwood (W8, W9). This ashwood with extensive alder copses may once have covered the whole of the upper dale sides in mid Wensleydale.

One kilometre to the east of Ellerlands and less than one kilometre northeast of Castle Bolton there are three large burnt mounds; one is illustrated here (Figure 11). These sites are at springs on open acidic grassland with no trees except plantations. From the above it is clear that the immediate contemporary environment of the burnt mounds when in use was alder wood (W7) within mixed ashwood (W8, W9).

Palynological evidence

Peat deposits on the moorland plateau and mid elevation basin deposits of the catchments of the Ure, Swale and Tees/Greta have not been the subject of the intense investigation of other areas of the Pennines or the North York Moors. Areas which have been studied include the South Pennines (Tallis and Switsur, 1983, 1990), Soyland Moor (Williams 1985) above Marsden (Spikins *et al.* 1999, 2000), the western limestone around Malham Tarn (Pigott and Pigott 1959) and the head of the Tees, in advance of the construction of the reservoir at Cow Green in 1974 (Turner, J. in Clapham ed. 1978, 88–101).

Table 1 summarises the results for dated studies on the area's peat deposits, at mid elevation. All of the listed pollen diagrams can be interpreted as

FIGURE 11. East of Ellerlands, Castle Bolton, Wensleydale. A burnt mound on acidic grassland, previously alder copse (W7) within ash wood (W8).
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showing that mixed deciduous woodland (W9, W10) had developed within the catchments of these pollen sampling sites (for comments on pollen influx from lower elevation see Tallis and Switsur 1990). The dominance of birch with hazel should be considered carefully since birch and/or oak together or severally are the dominant trees of upland oakwood where hazel is absent. Hazel is abundant within ashwood (W8). Two or more woodland communities may be represented in the pollen record. Hazel pollen at high elevation pollen sites may denote the existence of limestone scrub on calcareous soils (W21), if present and not already leached, over limestone outcrop on daleside terraces and at the plateau edge.

Peat development and tree remains in blanket peat

Tallis and Switsur (1983) detailed the evidence for former forest cover at 53 localities across a 400 km sq. area of the South Pennines, with 15 radiocarbon dates. No such data is currently available from the survey area. The deposits forming the blanket peat of the high plateau, which is often more than two metres thick, often with tree remains at the base level, are generally accepted as having commenced to form under increasing cold and wet climate conditions during the early Atlantic period from about 6500bp (Spikins 1999, 88). This commencement has recently been confirmed in the survey area by work on Stainmore Summit in advance of road widening of the A66. Five hundred metres east of the Rey Cross Roman marching camp, at NY 907124, at 425m, the base of 2.2m deep blanket peat has been dated to 4339–3999 Cal BC – UB3285 (Annabel Gear and Judith Turner in Vyner 2001, 32–4).

TABLE 1. Palynological results from the Wensleydale, Swaledale and Swale/Tees-Greta Uplands

Location and reference	*Dating and vegetation*
Stainmore Pass, below col, 3 km west of summit. NY871130, 420m OD. (Donaldson 1977, pers comm.)	Before about 2500 bp (before present):- Open woodland with birch, alder and hazel predominant. Oak, ash elm and lime present. 2480+/- 70bp:- Tree pollen falls from more than 30% to 9%. Grasses, herbs and weeds increase dramatically. The Brigantian Iron Age clearance.[a]
Stainmore Summit, 400m east of Rey cross, at NY907124, 425m. Gear, A. and Turner, J. in Vyner 2001,32–34.	4339–3999 Cal BC:- Base of 2.3m deep peat with pollen of mixed woodland reflecting the nearby outcrop of the Little Limestone.[b] 3639 Cal BC:- Elm decline and charcoal fragments taken as human interference with woodland. 399–99 Cal BC:- Area becomes treeless. Brigantian clearance.
Ellerton Moor, Swaledale. Infilled channel at SE0578 9640, 365m OD, m OD. Fleming, A. F. and Laurie T. C. Swaledale. Ancient Land Boundaries Project Interim Report No 10, 1993. Pollen diagram by Elizabeth Livet.	Undated (probably post elm decline). Basal 1.0m of silts and peat show birch and hazel co-dominant at first then birch alone dominant with some elm, hazel, oak, ash, lime, field maple and alder. Cereals and weeds of cultivation present. Native oak and field maple do not grow in mid Swaledale today. 510–380 Cal BC:- Brigantian clearance.
Thornton Mire, Bainbridge, Wensleydale. SD950870, 387m OD. Honeyman unpubl.	8480+/–80bp:- Basal peat. High levels of pine pollen. Wood fragments in peat. 4550+/–50bp:- Pine at low levels. Birch, alder, hazel co-dominant with some elm, lime and willow. 2690+/–50bp:- Brigantian clearance.

Notes

[a] The Brigantian Clearance refers to the fall in tree pollen and corresponding rise of heather, grasses and sedges widespread across the Pennines and dated to the Middle Iron Age.

[b] The outcrop of the Little Limestone at Stainmore Summit is of limited, local extent and the vegetation here may not be typical of the remainder of the Forest of Stainmore where soils and drift derived from base deficient Namurian sandstones and shales are predominant.

At the maximum extent, deciduous woodland covered the whole of Upper Teesdale (Judith Turner, in Clapham ed. 1978, 95). By analogy, Swaledale and Wensleydale, where not already covered with peat at higher elevation, should also have been tree covered at this time. At lower elevation, the mainly birch woodland was overwhelmed by the rapid onset of growth of peat on the lower moors, below 400m, at or soon after the Brigantian clearance dated to the early Iron Age – at around 500 BC (Table 1).

In support, I have found tree remains stratified within eroding peat at many locations across the survey area (Figures 5, 6, 7 and 12). Tree remains are however absent from large areas of deep blanket peat on the plateau and are confined to the vicinity of in-cutting becks. Exposure on the highest plateau may have prevented woodland development.

Stratigraphic relationships of these tree remains conform closely but not exactly to those of the southern Pennines described by Tallis and Switsur (1983), in that:

1. Birch, pine, oak and willow, growing severally or together were the species most commonly present in the southern Pennines. Oak has been reported in peat above Teesdale (Mills and Hull 1976).
2. Tree remains, predominantly of birch, are widespread below more than one metre deep peat in the vicinity of in-cutting becks or sikes at the highest elevations, to 540m on the Swale/Tees-Greta interfluve and to 630m on the Tees/Wear interfluve.
3. Tree remains are most visible as a crowded layer of branches just above the base of the peat. (Figure 5) Occasionally more than one layer occurs at different levels in the peat, thus regeneration occurred on the

FIGURE 12.
Teesdale, Scargill Moor, Black Gutter, 500m O.D. Alder branch from base of 1–2m deep blanket peat.
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surface of deep peat. Birch remains are stunted – thin stemmed and the birch is calloused.

4. Evidence for burning, in the form of visible lumps of charcoal below less than one metre deep peat, is present at one site – on Stainmore, at 473m. This charcoal has been identified as oak (Jacqui Huntly and Charlotte O'Brien, pers comm.).
5. Lithic finds of Late Mesolithic character, when stratified, have been found below 500m and are always within the mineral soil which underlies thin blanket peat over the plateau at lower elevations, not in the peat. Remains of birch are present in peat in the vicinity of Late Mesolithic sites on Barningham High Moor, at 430m.
6. Two to three metre deep blanket peats, often as wasting haggs completely devoid of tree remains, cover very large areas of the highest plateau. Where these peats are uniformly fibrous eriophorum/ericoid peats down to the basal interface with frost shattered siliceous Namurian grits and cherts it is probable that trees were not present and the area was open heath (H12) at the onset of peat growth. Similar heath can be seen today at the highest and most exposed elevations, for example on Lovely Seat above Swaledale. It is apparent that thick blanket peat entirely without visible tree remains has formed directly over limestone bedrock (pavement) especially to the south of Wensleydale, for example, on Stake Fell. Hazel has not been recognised at any exposure of blanket peat in this area.

There can be no doubt that the fossil birch within peat represents more or less stunted, species poor upland oak/birch wood (W11, W17) at the tree limit and this was the prevalent woodland community present on soils developing from the Namurian coarse siliceous grits, cherts and mudstones and drift of the plateau below 530m, and on the similar strata of the lower eastern moors. There is evidence, from the absence of tree remains in deep peat over the high plateau and from the example provided by contemporary native woodland, especially that at Birks Gill, Colsterdale, that this W11/W17 scrub woodland did not extend far above the comparative shelter of upper slopes of the gills of in-cutting becks. Exposure to high winds, possibly at intermediate elevations, has always been a very significant control on the disposition of woodland in this area.

The woodland environment after 4000 BC: a reconstruction

If we draw together the evidence from woodland fragments, palynology and peat deposits, we can attempt to reconstruct the environment relevant to late prehistoric activity at spring locations. There were three distinct environments.

The plateau edge and the plateau

On the evidence from tree remains in peat, the woodland environment above the springs after about 4000 BC was similar to that which survives today on exposed gritstone slopes: oak and/or birch scrub that was stunted, species poor and lacking hazel. This woodland gives way to Calluna/Vaccinium heath (H12) on exposed moorland of the plateau. The highest ground would have had thin scrub of similar composition, sometimes regenerating on blanket peat already of considerable thickness. Alders would have grown with birch and oak beside in-cutting becks up to 500m. The present altitudinal limit of alder is 470m (Pearman and Corner, 2003).

Where the plateau edge is of outcrop of the Main and Underset Limestones or covered with calcareous glacial drift derived from these uppermost limestones, species rich scrub woodland (W21) may have been present. However, soils on this drift are leached and acidic today and this process may already have commenced by 4000 BC. Severe wind exposure would have limit the growth of tall shrubs here. In the absence of overgrazing, the herb layer may have been rich.

The dale sides

The natural woodland vegetation of the dale sides is and was a mosaic of communities, each with very different composition and resource potential. The zone of most relevance to human activity from 4000 BC to 1200 BC, where the available evidence of lithic scatters, rock art and of burnt mounds is concentrated, is the elevated terraces and the vicinity of streams: the sikes which rise at springs below the highest limestone scars.

Here, on calcareous soils, a distinctive woodland developed, with ash, wych elm and willow growing together or as individual trees, surprisingly large amounts of alder wood not only at the floodplain level but on the upper dale sides, copses of lime, hazel woods – both trees and coppice – sloe thickets and natural clearings. On sandstone and shale, species poor oak/birch woodland with occasional aspen, holly and rowan replaces ash and elm wood. Hazel, willow, sloe and bird cherry disappear. Bilberry and ferns provide the field layer.[2]

Pollen evidence indicates that ash arrived very late and was not a very significant component of the tree pollen. This requires further comment. Firstly, the low quantities may be due to low pollen productivity of ash. Secondly, wych elm may have been more abundant, being replaced by ash when disease offered the opportunity at the elm decline. Godwin considered that ashwoods were to an extent anthropogenic in origin (Godwin 1975, 312). It is unlikely that oak or birch formed a significant component of the established W8, W9 woodland. Oak is no more than occasional in Wensleydale today and is not considered native (Millward 1988). Oak is absent from Swaledale today except where planted and at Waitegate Wood. Birch is dominant or co-dominant here, with sessile oak on sandstone scree. Birch is not a major component of limestone ashwoods today.

Cleared woodlands

Andrew Fleming has described the development of the past and present day settled landscapes of Swaledale (Fleming 1998). I consider that the organised landscapes of coaxial fields of Swaledale dated on Calverside to the Prehistoric Iron Age developed from pioneering unenclosed settlements of the Middle Bronze Age and were likely to have been established during the Later Bronze Age (Laurie 1985, 2003). Their use extended through the Iron Age to the Roman occupation and beyond.

These field systems can be interpreted as managed prehistoric grazing or parkland, with mature hedgerows visible now as very substantial banks of stone, over large areas of what are now heather moor or acidic grasslands – indicating that leaching and podsolisation causal or subsequent to their abandonment has been widespread. I refer here to areas of present day moorland on calcareous drift at intermediate elevation below the outcrop of the Main Limestone. Soils derived from Namurian cherts and sandstones above the Main Limestone are unlikely to have any significant calcareous component and are unlikely to have supported more than stunted oak and birch woodland, with acidic grassland or heather/bilberry heath on exposed ground. The constant presence of species poor, thin-trunked, calloused, stunted birch within blanket peat confirms this.

Field systems, cairnfields and other settlement evidence is entirely absent from the lower moors on siliceous Namurian strata of the eastern Pennine fringe – from Feldom, Barden Moor, East Witton and Agra Moors west of Ellingstring and from Colsterdale. In contrast, the drift covering the Underset and Main Limestones above Swaledale supported extensive field systems before reversion to heath after leaching and podsolisation: for example, those to 435m in Swaledale north west of Marske on Marrick Moor and those further east on Skelton Moor (Laurie 1985).

Human activity at springs

The evidence of lithic scatters, rock art, and burnt mounds supports transient if not transhumant occupation rather than that of established settlement (Figures 7, 8 and 9). Details of all locations mentioned below including gazetteers of the sites are available elsewhere (Laurie 2003; Beckensall and Laurie 1998; Coggins *et al.* 1984).

The most constant springs are located at the source of tributary becks at intermediate or high elevation. This location is the most advantageous for access to the high plateau and to the limestone terraces of the upper dale sides. The springs and their sikes converge to form low energy becks flowing across wide terraces or, where their descent is barred by lateral moraines through shallow elevated valleys, often aligned parallel to the main dale, before changing direction and descending over falls to the flood plain. These elevated valleys would provide ideal habitat for beaver. Sediments which accrue behind beaver dams may have formed upland streamside meadows, formed as described for the mesas of North America (Butler 1995, 148–83).

Lithic scatters

Lithic scatters – those with very minute scalene triangle and rod microlith forms which continued in use in the Southern Pennines until slightly later than 4000 BC (Spikins 2000) – are accepted here as indicators of Latest (Terminal) Mesolithic. They have been found at vantage sites on limestone outcrops or low moraine ridges at the springhead of tributary streams, on the interfluve, or overlooking streams crossing the terraces formed by the outcrop of the thicker limestone strata of the upper dale sides.

Few of the sites shown on Figure 7 have been excavated. At South Haw, high on the watershed between Nidderdale and Costerdale, a Late Mesolithic aggregation site is currently being examined by Richard Chatterton. Here, hearth pits have produced charcoal identified as of oak, birch and hazel. The oak has been described as extremely slow growing with annual rings so close as to be almost indistinguishable (Richard Chatterton pers comm.) This confirms that the woodland at or below South Haw may not have been very different from that to be seen today in the upper reaches of Colsterdale.

Most, if not all the sites indicated on Figure 7 include Neolithic and Early Bronze Age arrow points and it is clear that these favoured sites were revisited over long periods. A few sites without microliths have also been found. Where these sites include numbers of scrapers, sometimes of local chert and occasionally of high quality black translucent flint, a Neolithic date can be assumed for the occupation.

Rock art

Rock art in this area is all in the cup and ring tradition. It will be noticed (Figure 8) that the main concentrations are on the southern and western edge of Teesdale, with one group of carved rocks north of the Tees. There are no rock art sites in Upper Teesdale, above Egglestone. A number of these sites are located in Swaledale, on the line of Marske Beck, principal north bank tributary of the Swale. There is just one example in Upper Swaledale, a small cup marked boulder from Calverside – probably from a cairn. Wensleydale has just one site, the cup marked round barrow on the summit of Addlebrough Hill, south of Bainbridge. A very interesting group of rock art sites has recently been recognised. In Colsterdale at the south-east limit of the area (Plate 10, Figures 13 and 14). These sites are close to springs rising below gritstone outcrops. Their woodland environment was almost certainly sessile oakwood – as that of the lower reaches of the inaccurately named Birk Gill, five kilometres to the west. The distribution of rock art continues south of the survey area with considerable numbers of sites in Nidderdale and in Wharfdale.

The 'art' comprises panels of cups, small circular depressions, cups with concentric rings and more complex arrangements of cups within enclosing grooves, and also grooved enclosures without cups. All are pecked on surfaces of sandstone, usually on rather small earth-fast erratic blocks but occasionally on bedrock. All the figures are geometric, abstract in conception. There is no certainty as to their meaning. They are dated to the Neolithic and early Bronze

Ages by association with funerary structures (Bradley 1997). In this area they are found on and within the body of round barrows of Early Bronze Age date.

FIGURE 13.
Colsterdale. Cup marked outcrop of Namurian grit. View west to South Haw (Late Mesolithic occupation site).
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Here we are concerned with the location of these decorated panels of sandstone, specifically in relation to springs and to the contemporary woodland

FIGURE 14.
Colsterdale. Cup marks, detail.
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environment. With very few exceptions the decorated rock surfaces are not located on the high plateau or on the plateau edge. The only exceptions are a few false crested cup marked round barrows and a single cup and ring marked rock on the southern edge of Teesdale, on Barningham Moor. A few decorated slabs, probably cist or grave covers have been found at lower elevation, on terraces or bluffs overlooking the Tees River. All other decorated rocks, and there are more than 200 separate rock panels in the survey area (Beckensall and Laurie 1998), are located in the vicinity of springs or sikes crossing more or less wide terraces at intermediate elevation, below the outcrop of the uppermost limestones.

The locations of these rocks are today treeless and open with wide horizons. The contemporary environment of the rock art of Swaledale and of Teesdale, which is generally above 300m and below about 400m, was woodland composed of limestone ashwood (W8) on well drained ground, with extensive copses of alderwood on wetter areas. The cup marked round cairn on the summit of Addlebrough in Wensleydale was probably on open ground.

Burnt mounds

Burnt mounds (Figures 4, 9, 15 and 16) are crescentic mounds of fire-cracked stone. They are interpreted as debris mounds accrued through time from sweat houses or saunas, where hot stones were used with water to produce steam inside tent-like shelters (Barfield 1991). This does not exclude the possibility of multiple hot-stone and water-based technology use, for cooking, fulling of cloth (Jeffrey 1991) or for brewing. Burnt mounds have been the subject of extensive research elsewhere throughout Britain and many radiocarbon dates have been obtained from secure contexts, namely from timber linings to troughs which are a constant feature on these sites. Without exception all dates are from the second and earliest first millennium BC. The shared distribution of burnt mounds with Middle Bronze Age metalwork has been noted (Ehrenberg 1991).

By analogy with anthropology, without which it is said archaeology is blind in both eyes, and with the recorded use of sweat house saunas by indigenous peoples throughout northern latitudes, for example by the Mandans,[3] burnt mounds are accepted here as *indicators* of the existence of transient settlements in their vicinity, perhaps in the form of tented villages which have left no other surface trace of their presence. The spring locations are the most favourable for such campsites, with access to water, the dale side terraces and elevated valleys and to the plateau above. An alternative explanation requires contemporary Middle Bronze Age settlements, possibly at lower elevation, from where the sweat houses were visited for ablution and cleansing, possibly of mind as well as body.

Figure 9 shows the distribution of more than 100 burnt mounds in the survey area which cluster slightly above the 305m contour – the level of springs rising below the Underset Limestone cyclotherm. Individual burnt mounds vary in size from 4m to 18m (any one dimension) and from 0.5m to 2.5m in

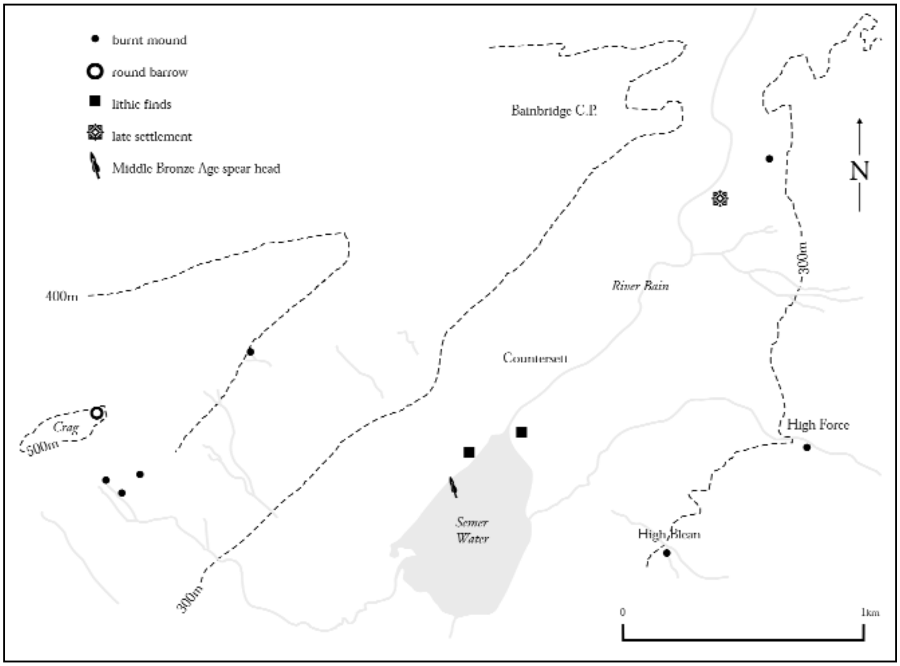

FIGURE 15.
Wensleydale. Bainbridge. Burnt mounds and other sites near Semer Water.

height above the present ground surface. Many sites are in the range of 10m–15m x 8m–10m x 1–2m high and represent multiple use over perhaps two centuries, as at Titlington Mount, Northumberland (Topping, P. 1998). Without exception, all burnt mounds are located at springs or on the brink of low energy streams – rills or sikes, close to the spring rise. Their distribution can therefore be taken to reflect the minimum extent of human activity, of whatever nature, at springs during the middle Bronze Age. Burnt mounds are found in apparent isolation from other prehistoric sites, especially in Wensleydale. More usually though there is a palimpsest of sites and finds from the vicinity of the burnt mounds representing a continuum of activity in the locality, as at Semerwater, Bainbridge CP in Wensleydale (Figure 15) and at Haw Beck, Thoralby, also in Wensleydale (Figure 16).

Burnt mounds frequently occur at the head of elevated valleys with rock art nearby, for example those at Sturdy Springs, Washton, Teesdale and below Seeley Spring, on Scargill Low Moor, both in Teesdale. Equally typical are springs which rise below scarp slopes which overlook elevated terraces located high above and remote from the dale flood plain. In Teesdale, the complex landscapes of prehistoric sites on Gayles Moor and on Barningham Moor are located on elevated terraces which overlook the Tees Valley, although the rock art sites and burnt mounds here would almost certainly have been within closed canopy within ashwood (W8), mixed deciduous woodland (W9,W10) or alderwood (W7). Visibility would however have been available from the limestone outcrop immediately above the spring rises. This is the preferred location for the rather few false crested burial mounds in the area, for example that known as How Tallon on Barningham Moor (Coggins and Clews 1980).

FIGURE 16.
Haw Beck Springs, Thoralby, Wensleydale. Two burnt mounds at spring rise. Castle Dikes Henge is 800m to the east.
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The resources and mobility characteristics of each of the woodland communities cited above are different but need not be fully detailed here. Hazel would have been entirely absent from oak/birch wood (W11, W17) on the plateau, though ease of mobility and good visibility across open heath and stunted woodland would have made this zone of considerable value to both hunters and pastoralists (Mellars and Reinhardt 1978).

Species rich ashwood (W8, W9) and limestone scrub (W21) on the dale sides would have been rich in faunal and other resources. The presence of natural clearings at limestone scars, over limestone pavement and at the boundaries with upland heath and woodland communities would have ensured the existence of maximum woodland fringe.

Conclusion

The intention of this article has been to draw attention to springs as foci for human activity throughout Later Prehistory. Initially, I expected simply to describe the archaeological evidence. I soon realised that the need to reconstruct the contemporary woodland environment of springs in the area on the basis of the few relevant available pollen diagrams was impossible and that a different approach was required. Hence, the emphasis on the wealth of semi natural woodland and reference to visible tree remains in peat as analogues for woodland communities developing naturally on suddenly changing soils.

In the context of district landscapes rather than of regions, this article is a plea for the identification of appropriate vegetation communities. Reference to the altitudinally stratified dominant tree does not describe the complex mosaic of woodland which can be seen to have developed naturally on the geologically complex dale sides and upland moors of Wensleydale, Swaledale and Teesdale.

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Appendix: visible tree remains in peat

Note. Tree species other than those identified below, including pine, are likely to be present at some localities. However further work to identify the remains is required.

Location	*Height m. O.D.*	*Geology, soils, morphology, aspect, exposure*	*Tree remains*
Wensleydale and Colsterdale			
Colsterdale Sreet House Moor Beldin Gill SE091 800	430m	Sandstone, shale. Base poor soil over local drift with 1.5m deep blanket peat eroding at stream side on plateau.	Birch
Colsterdale Sreet House Moor Long Gill Head Two locations: SE089 803 and SE088 804	435m	Sandstone, shale with 0.5m shallow blanket peat. Erosion patch on slope 200m S of stream, on plateau. 1.5m deep peat eroding at stream side.	Birch Struck flint flake found nearby.
Castle Bolton Apedale. Greets Hill. SE929 820	460m	<1m Deep peat over drift.	Birch
Swaledale			
Muker Common Bull Bogs NY872 977	540m	Thin peat at spring line. Slope above col.	Pine. Inf. Deborah Millward.

Location	*Height m. O.D.*	*Geology, soils, morphology, aspect, exposure*	*Tree remains*
Summer Lodge Moor Hog Gill SD957 951	510m	1–2m Peat above Hog Gill Hole.	Birch
Summer Lodge Tarn sike	525m	1–2m Peat	Birch at base and also higher in profile.
Whitaside Moor Morley's Folly NY996 956	535m	2m deep peat on chert. Exposed north facing slope.	Birch at base and also higher in profile.
Arkengarthdale Hurgill Head NZ007 079	530m	2m deep peat at gutter. South facing. Very exposed.	Birch at base and also higher in profile.
Arkengarthdale Faggergill Moor Black Sike NY996 073	480m	1–2m deep peat at sike. 2–3m deep gutter above 480m.	Birch at base, calloused. Not above 480m.
Faggergill Moor The Howl NY992 075	440m	1–2m deep peat at sike.	Birch and alder at base.
Arkengarthdale Booze Moor Moresdale Head NZ028 049	460m	1–2m deep peat at gutter.	Birch
Arkengarthdale Mud Beck, several locations NY973 074 and 956 078	380m	<1m deep peat at sikes.	Birch Stone circle and cup marked rock nearby.
New Forest Kexwith Moor NZ040 054	440m	1–2m deep peat at gulley.	Birch
Hope Moor. Arndale Hill Black Hag NZ024 065	500m	2–3m Deep peat over clay on chert and sandstone.	Crowded birch at base of peat with second layer of birch 0.8m from turf.
Teesdale			
Stainmore NE of Maiden Castle, SW edge of Beldoo Moss NY879 131	477m	Very exposed. Gulley at scarp edge. 1–2.0m thick eroded blanket peat at gulley	Birch at base of peat. Greater woodrush 0.8m above base.

Location	*Height m. O.D.*	*Geology, soils, morphology, aspect, exposure*	*Tree remains*
Stainmore NE of Maiden Castle, SW edge of Beldoo Moss NY883 130	473m	Very exposed. Gulley at scarp edge. 1–2.0m thick eroded blanket peat at gulley.	Birch at base of peat. Second layer of birch 0.8m below turf. Charcoal spread (Oak) at bottom of gulley.
Stainmore. SE edge of Beldoo Moss Rowtonbridge Sike NY893 133	456m	2–3m thick blanket peat. Slight shelter, shallow stream valley.	Birch
Stainmore Forest Wytham Moor NY958 117	350m	1.25 m peat over clay on sandstones and shales.	Birch at base. Second layer 0.5m below turf.
Scargill. SW corner of Stang Forest Elsey Crag, Black Gutter NZ013 076	500m–540m	1.0–3.0m deep blanket peat over clay on sandstone or shale.	Birch and alder at base of peat (Figure 12), crowded at grid reference, 500m O.D. thinning towards top of gutter, at 540m O.D.
Stang, Hurgill Rigg NZ015 073	520m	<1.0m deep blanket peat.	Birch and pine at base of peat.
Deepdale West Stoney Keld Ellers Sike NY968 152	320m	<1.0m deep blanket peat.	Birch

Notes

1. height measurements hereafter omit 'O.D.'
2. No attempt has been made here to assign woodland to sub communities, however this would be possible, with botanical advice.
3. see George Catlin's *Letters and Notes on the North American Indians* (Mooney 1975, 152, 3).

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PLATE 9. Swaledale, New Forest, Waitegate Wood. W17 Upland oak wood (hazel absent) on acidic soils over sandstone on east side of beck. W8 Limestone ash wood (hazel frequent) over limestone scree below Kersey Green Scar, west side of beck. Burnt mounds on Buzzard scar in distance.

PLATE 10. Colsterdale. Cup and ring marked rock.