

Bronze Age Agriculture on the Marginal Lands of North-East Yorkshire

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The Region and its Prehistory

THE area under study corresponds broadly to the North York Moors National Park.¹ It forms a distinct upland unit, separated from similar areas by the Vale of Pickering to the south and the Vale of York to the west, and bounded by the coast on its other sides (see map, FIGURE I). Its prehistory has been studied intensively by Frank Elgee, whose book, *Early Man in North-East Yorkshire* (1930), is still a classic regional study, and must even today provide a basis for the student of the area.

A point stressed by Elgee was the fundamental difference between the Limestone Hills and the moorland which covers much of the area. The Upper Jurassic Limestone Hills form a narrow strip of country running to the south and south-west of the moors; their southern edge slopes gently down into the Vale of Pickering, while the northern edge is bounded by a steep escarpment. The height of the Limestone Hills varies, but does not usually exceed 1,000 feet (305 metres) except in the west, where the Hambleton Hills rise to over 1,300 feet (396 m.). Much of this higher land is moorland. Nowadays the land under six or seven hundred feet (183–213 m.) is classed as good agricultural land.² By contrast, the land to the north of the escarpment, which Elgee re-christened Blackamore, is mainly moorland, apart from the dales which cut down through the plateau at intervals: Eskdale, Farndale, and Rosedale are examples. Geologically older than the Limestone Hills, the moorlands of Blackamore rise from the foot of the escarpment northwards to a maximum height of 1,489 feet (c. 455 m.) on the central watershed. North of this, Eskdale runs east and west, and further north still is the plateau of the North Cleveland Moors. Apart from the dales, therefore, most of the land north of the Limestone Hills is heather-dominated moorland—used mostly for sheep-farming, raising grouse, and recreation.

There is no doubt that throughout prehistory and afterwards the Limestone Hills provided by far the more attractive prospects for settlement. Elgee's distribution maps show that there was some Neolithic settlement here during the third millennium, resulting in the presence of long barrows, and that the

¹ I would like to thank the Trustees of the Jones Monmouthshire Scholarship Fund for a generous grant towards the cost of fieldwork.

² J. T. Coppock, *An Agricultural Atlas of England and Wales*, 1964, Fig. 10.

round barrows of the second millennium contain abundant Food Vessels and Collared Urns.¹ Both these classes of pottery are believed to have emerged as hybridizations of some kind between native Neolithic pottery and that of the Beaker folk who invaded England during the earlier part of the second millennium. Few of the local barrows have yielded Beaker pottery, however. In the Iron Age, this area came under the influence of the Arras culture, and this resulted in a few vehicle burials and probably the extensive multiple ditch systems which survive in some numbers.²

On the other hand, the moorlands, though providing excellent preservation conditions for field monuments, are largely devoid of clear indications of Neolithic settlement. By far the commonest type of monument is the round barrow, known locally as a howe; almost all the excavated examples have produced Collared Urns, normally containing cremation burials.³ Elgee's view was that the Collared Urns were largely later than the Food Vessels, and that Blackamore was settled late, as a result of population pressure, or because the colonists were expelled from better lands by intrusive groups.⁴

Dimbleby has since shown that at the time of this colonization Blackamore was forested, and that the desolation which we see today is largely man made, a creation of this agricultural activity in the second millennium.⁵ Soil which was poor in the first place—and the lateness of the settlement argues that it was recognized as such by prehistoric man—was exploited badly, so that only vast expanses of heather, and a surprisingly large number of burial mounds, remain.

In this paper an attempt will be made to assess the likely nature of this colonization; to make an estimate of the number of people involved and the time taken to reduce the land to waste; and to suggest what may have occurred after this destruction had taken place.

The Nature of the Agricultural Settlement

Little is known directly of the agricultural practices of the people making the pottery which we have come to describe as the Collared Urn tradition. Childe pointed out that they may have played a leading part in colonizing land which earlier prehistoric peoples had regarded as marginal,⁶ and our area is obviously a good example of this.

The process of moorland creation in north-east Yorkshire has been docu-

¹ F. Elgee, *Early Man in North-East Yorkshire*, 1930, Figs. 9, 28, 32.

² I. Stead, *The La Tène Cultures of Eastern Yorkshire*, 1965, Fig. 1; R. E. M. Wheeler, 'The "Linear Earthworks" of the Scarborough District', Appendix to ch. 1 in A. Rowntree, ed., *The History of Scarborough*, 1931, pp. 34-9.

³ Elgee, *op. cit.*, p. 82.

⁴ *Ibid.*, pp. 88-9.

⁵ G. W. Dimbleby, 'The Ancient Forest of Blackamore', *Antiquity*, 35, 1961, pp. 123-8; Dimbleby, *The Development of British Heathlands and their Soils*, 1962.

⁶ V. G. Childe, *Prehistoric Communities of the British Isles*, 1940, p. 156.

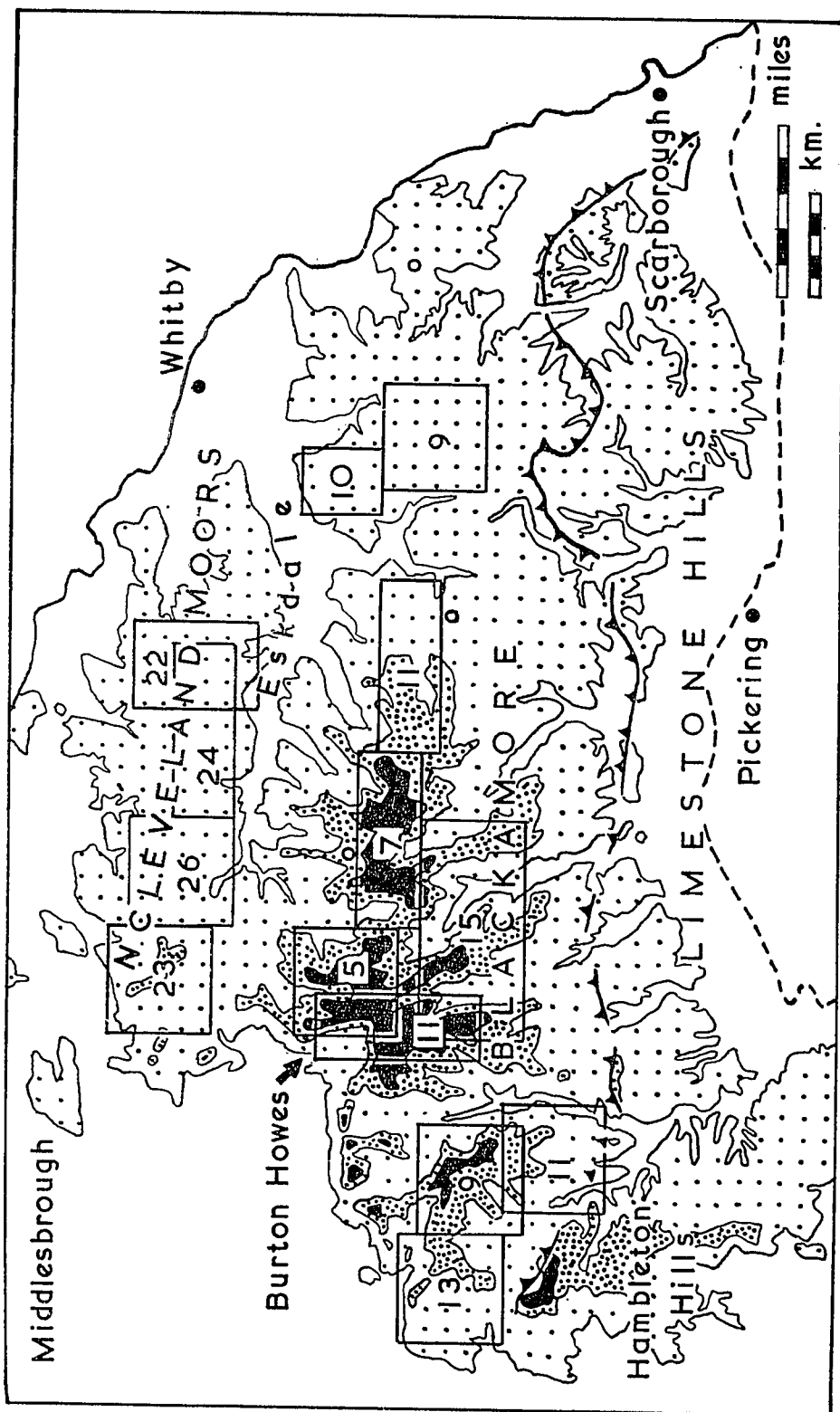


FIG. I

Map of north-east Yorkshire, showing the area studied. The contours are at 500, 1,000, and 1,250 feet O.D. (c. 152, 305, and 381 m.). The squares indicate areas for which barrow densities were calculated; small open circles indicate sites where cereal impressions have been preserved on pottery.

mented by Dimbleby.¹ Two barrows called the Burton Howes, at 1,419 feet O.D. (c. 433 m.), were sampled for pollen during excavation. It was shown that they were built in succession, in a gradually expanding clearing. The clearance resulted in a great expansion of the light-demanding heather, with some grasses, and hazel appears to have been important on the edges of the clearing. There is no evidence that the original forest recovered from these developments. Similar destructive clearances took place on the higher parts of the Limestone Hills.²

Dimbleby goes on to argue that the detailed differences between the pollen in the two areas indicate different bases of subsistence; that the Blackamore barrow builders were pastoralists, while those on the Limestone Hills were probably cereal farmers.³ It is possible, however, to raise substantial objections to this view.

The statement that the moorland people were pastoralists is based mainly on evidence from two of the Burton Howes. Here the *Plantago* count is low, and cereal pollen apparently non-existent. Dimbleby uses the low *Plantago* count to argue that there was no cereal agriculture at this site, but he later admits that plantain may be found in fair quantity on either arable or pasture land.⁴ Turner has shown that a low plantain count can indicate arable land, while high plantain figures should indicate pasture.⁵ So the argument based on plantain is not conclusive. Nor is the absence of cereal pollen at the Burton Howes impressive, when one recalls other evidence for cereal farming in Blackamore. Longworth lists three urns which have produced impressions of cereal grains—one from nine miles north of Pickering, one from Stone Rook, Castleton Rigg, and one from Greenwell's barrow 271, Fylingdales (see FIGURE I).⁶ Also the cairnfields must be considered. These are groups of small stone cairns which are found in Blackamore between 600 and 1,000 feet (183–305 m.). There are two theories concerning their function. The first is that they were intended for inhumation burials; the absence of bones from the cairns is explained by the acidity of the soil.⁷ The second is that they are simply the result of field clearance.⁸ It is possible, of course, to accept that both theories may be true, and that the burial rite provided a convenient means of disposing of unwanted stones. Graham has made a brilliant case for this view in respect of some Scottish cairnfields, suggesting that the functions of burial and land clearance are not

¹ Dimbleby, *op. cit.*, 1961.

² *Ibid.*, 1962, p. 23.

³ *Ibid.*, 1961, p. 27.

⁴ *Ibid.*, 1962, p. 31.

⁵ J. Turner, 'The Anthropogenic Factor in Vegetational History', *New Phytologist*, 63, 1964, pp. 80–1.

⁶ I. H. Longworth, *Collared Urns and Related Vessels in England and Wales*, 1964 (Cambridge Ph.D. thesis), pp. 589, 1024, 1553.

⁷ Elgee, *op. cit.*, p. 100.

⁸ N. Mitchelson, 'The Bronze Age in Cleveland', *Arch. Newsletter*, 4, 1952, pp. 127–8.

mutually exclusive.¹ Some of these cairns, however, are associated with irregular stone walls. These sometimes incorporate cairns, and can also be broken by long gaps. These must surely indicate surface clearance and enclosure of corn plots, at heights of up to 1,000 feet (305 m.) at least. The dating of these cairn-fields needs to be clarified, but some of them must start at this time. Elgee's scanty evidence for their Bronze Age date was based on associations with barrows, and with a ring-cairn on Danby Rigg.² These associations with ring-cairns have been multiplied since 1930 and confirmed for other parts of northern Britain.³

In any case there are strong common-sense grounds for rejecting the idea that the Blackamore clearances were intended for grazing animals. The colonists from the Limestone Hills already had, in their homeland, the choice of two grazing and browsing zones. Firstly, they could utilize their own abandoned fields for this purpose—the resultant manure, whether they realized it or not, would help to restore fertility. Secondly, the forest would have provided nutritious fodder, in fair quantity, at any rate for cattle and pigs, with little expense of effort. If this forest browsing was well controlled, it could have been achieved without too much permanent damage to the field and shrub layers. Clearing the forest, whatever the purpose, would have been a laborious task. Trees had to be felled or ring-barked, and left to dry thoroughly before being burnt.⁴ In one area of Finland, in 1781, this drying process took at least twelve months.⁵ Dimpleby has suggested that fire might have been used for clearance, but other writers regard this as unlikely.⁶ We are asked to believe that these people undertook these tasks to provide grazing, although they were surrounded by nutritious forest browsing; furthermore that they were content to create small patches of heather, between the tree stumps and the trunks of those trees left standing after ring-barking, without discovering that by grazing at the correct intensity they could create proper grassland pasture for their beasts.

There must be serious doubt whether such a scheme would have been possible, with the labour available. If one may be excused for using African data, some of Allan's figures are instructive.⁷ His table shows 5 pastoral peoples, having between 6·5 and 19·6 livestock units per head. The acreage per beast usually varies between 10 and 40.⁸ Thus, if a person has 6 livestock units

¹ A. Graham, 'Cairnfields in Scotland', *Proc. Soc. Ant. Scot.*, 90, 1956-7, pp. 21-3.

² Elgee, *op. cit.*, p. 100.

³ R. H. Hayes, 'Archaeology (2)', in J. McDonnell, ed., *A History of Helmsley, Rievaulx and District*, 1963, pp. 36-7. See below, pp. 21-2.

⁴ A. Steensberg, 'Some Recent Danish Experiments in Neolithic Agriculture', *Agric. Hist. Rev.*, 5, 1957, p. 69.

⁵ W. R. Mead, *Farming in Finland*, 1953, p. 46.

⁶ Dimpleby, *op. cit.*, 1962, p. 30; H. L. Edlin, *Trees, Woods and Man*, 1956, pp. 85-6.

⁷ W. Allan, *The African Husbandman*, 1965, p. 307. ⁸ *Ibid.*, pp. 292-3.

(Allan's "basic herd") and 15 acres are needed for each, he must have 90 acres of grazing.¹ Compare this with Allan's statement on forest clearance:² "The clearing of secondary forest is a less forbidding but still highly laborious task. A 'good man', I was told, clears about an acre and a quarter every year, but the average is considerably lower and may be rather less than an acre."

It should be noted that Allan is referring only to secondary forest; virgin forest is a tougher proposition. Boserup quotes figures of between 6 and 50-60 man-days per hectare for fairly rudimentary clearing.³ To clear 90 acres (36 ha.) of grazing would, on these figures, require at best some 216 man-days. Clark and Haswell, quoting other sources, give similar figures for clearing heavy forest in Ghana (50-75 man-days per hectare) and in Nigeria (37 man-days per hectare).⁴ Both these figures relate to situations where the stumps or the large trees are left standing, and they also involve the use of iron tools, which were not available to the Collared Urn folk.

It may be thought that these figures are likely to bear little relation to the situation in northern Europe. But it is possible to quote stocking figures for medieval Yorkshire which are comparable to those from Africa: Trow-Smith says that sheep were stocked at one per 7 to 8 acres (c. 3 ha.).⁵ We can assume that more land per beast would be required on the heather moorland with which we are dealing. Clearance figures, too, may be compared: Clark and Haswell quote a Danish experiment which produced figures of 245 man-hours per hectare (equivalent to about 50 man-days in African terms, or perhaps as low as 30 if one assumes a rather longer working day in the north European climate).⁶ The Danes were not clearing heavy forest, and they too had the advantage of iron tools. Further Danish figures quoted by Coles suggest that a hectare takes 2½ weeks for one man to clear using iron implements, and 5 weeks if he uses a stone axe.⁷ The extent to which our theoretically 'Bronze Age' cultivators had bronze axes is uncertain, but enough stone examples have turned up on the moors to imply that the older technology survived 'the end of the Neolithic'.

These figures compel the conclusion that if the Blackamore clearances were for pasture, they could only have formed part of a scheme which must have included utilization of the forests to a substantial degree. From a common-sense viewpoint, one is forced to conclude that a pastoral society colonizing a forest area would either turn their animals into the forest, having made small

¹ Allan, *op. cit.*, p. 309.

² *Ibid.*, p. 220.

³ E. Boserup, *The Conditions of Agricultural Growth; the economics of agrarian change under population pressure*, 1965, p. 30, note 1.

⁴ C. Clark and M. Haswell, *The Economics of Subsistence Agriculture*, 1964, p. 32.

⁵ R. Trow-Smith, *A History of British Livestock Husbandry to 1700*, 1957, p. 139.

⁶ Clark and Haswell, *op. cit.*, p. 32.

⁷ J. M. Coles, 'Experimental Archaeology', *Proc. Soc. Ant. Scot.*, 1966-7, p. 7.

clearings in which to live, or else pursue a proper policy of grassland creation, by grazing their clearances intensively and attempting to stay in one place as long as possible with this aim in mind. The kind of inefficiency postulated by Dimbleby is very hard to believe.

Another strong argument in favour of the idea that the Blackamore barrow-builders were cereal farmers is provided by the material from which the barrows are built. In many cases this is stone, in large quantities;¹ this would normally be available only after the original forest soil had been truncated by agriculture and erosion.

All these arguments support the idea that the first Blackamore clearances were intended for cereal agriculture, however many animals may have browsed in the woods or on abandoned corn land, and whatever happened to the newly created moorland afterwards. To say that the clearances were intended for cereal agriculture is not to say that this was always successful. If the cairnfields may be taken as a rough guide, one may suggest that reasonable returns might have been obtained at altitudes of up to 1,000 feet (305 m.). Above this, cereal growing might well be more difficult; perhaps only one crop was possible before the poor yield and perhaps the first signs of soil erosion forced a move. This would account for the non-existence of cereal pollen at high sites like the Burton Howes. It will be seen later that on the higher land of central Blackamore the barrow density is low, suggesting that exhaustion of fertility here may have been more rapid than elsewhere.

Population Estimates

The suggestion that the clearances in Blackamore were made primarily for raising cereals, and immediately after use became covered in heather, implies that the majority of land in the area was used only once, over a short period, and that thereafter it could usually supply only heather or coppice as fodder. This is a basic assumption for the argument which follows.

A second assumption is that the bulk of the population was buried in the barrows which occur in such numbers on the moors. Elgee thought that they were intended for chieftains,² but the numbers involved would then imply a very large population (unlikely, on marginal land) or a very long occupation (also unlikely, in view of the homogeneity of the pottery and the burial rites, and the marginal character of the land again). Usually the grave goods, for what they are worth as evidence, do not suggest high social status, though there are a few exceptions to this rule.³ Most howes which have been investigated at all thoroughly have yielded more than one cremation, and Elgee, in a

¹ Elgee, *op. cit.*, p. 90. ² *Ibid.*, p. 100.

³ E.g. F. and H. W. Elgee, 'Loose Howe: an Early Bronze Age Burial in a Boat-shaped Wooden Coffin', *Proc. Prehist. Soc.*, 15, 1949, pp. 87-106.

section entitled 'Family Mausoleums' recognizes this.¹ It is reasonable to assume that each barrow normally contained between four and ten persons, including secondary burials (those let into the top of the mound after its completion). Far from envisaging the burial of a chieftain in splendid isolation at one brief moment of time, we should envisage a succession of burials, at first in an enclosure within a wall or stake circle, and then, after the raising of a mound, in the mound itself. This is only to be expected; Collared Urns are ultimately derived from Neolithic pottery of Ebbsfleet tradition and thus from a heritage which includes multiple cremation burials within enclosures of the Dorchester type.²

Most of the north-east Yorkshire barrows are not scattered casually across the landscape; they fall into recognizable patterns, of which the most common are groups of two or three together, and a series of several strung out within sight of one another, usually along a ridge.³ The rapidity of the spread of moorland, attested at Burton Howes, suggests that here the groups should probably be considered as cemeteries in use over one stretch of time, the different barrows within a group being used either in succession or by different sub-groups within the population—or perhaps in both of these ways.

If the whole population was entitled to burial, it is possible to calculate how long it would have taken, at a given death-rate, to produce the dead represented by the average barrow or group of barrows. This has been attempted in FIGURE II, using a death rate of 40 per 1,000 and excluding infant mortality.⁴ From the graph one may read off that a group of 150 will produce, on average, 30 deaths in 5 years, or that a 4-year occupation by a group of 50 should produce 8 deaths.

It is not possible to know at the moment what exactly is a fair number to assume for the average number of burials per barrow—probably a range of between 4 and 10 would most commonly be found in well-investigated and well-preserved examples. Most cemeteries in this area comprise at most 4 barrows, though 5 and 6 are known occasionally; this may suggest that 30 burials per cemetery is a normal maximum. This maximum is marked on FIGURE II, along with three other guidelines representing other numbers of burials. It shows that in general a group of 150 cannot have stayed more than 5 years and still used the same cemetery, while a group of 75 could have continued to use it for up to 10 years, and so on. These upper limits should be borne in mind, because they become useful at a later stage in the argument.

Looking at this diagram shows also that there are several ways of thinking about these population groups. At the extremes of the diagram are small

¹ Elgee, *op. cit.*, p. 95.

² R. J. C. Atkinson, C. M. Piggott, and N. K. Sandars, *Excavations at Dorchester, Oxon.*, 1951.

³ Elgee, *op. cit.*, Figs. 41 and 42. These maps are misleading because they also include cairnfields.

⁴ Following R. J. C. Atkinson, 'Old Mortality: some aspects of burial and population in Neolithic England', in J. M. Coles and D. D. A. Simpson, eds., *Studies in Ancient Europe*, 1968, p. 87.

groups of less than 50, which are using the cemeteries for periods of well over 10 years, and larger groups, each of over 150, which are moving biennially or even more rapidly than that. But if the cemeteries equate with the middle part of the diagram, they are used by groups of perhaps 50 to 125 persons, staying

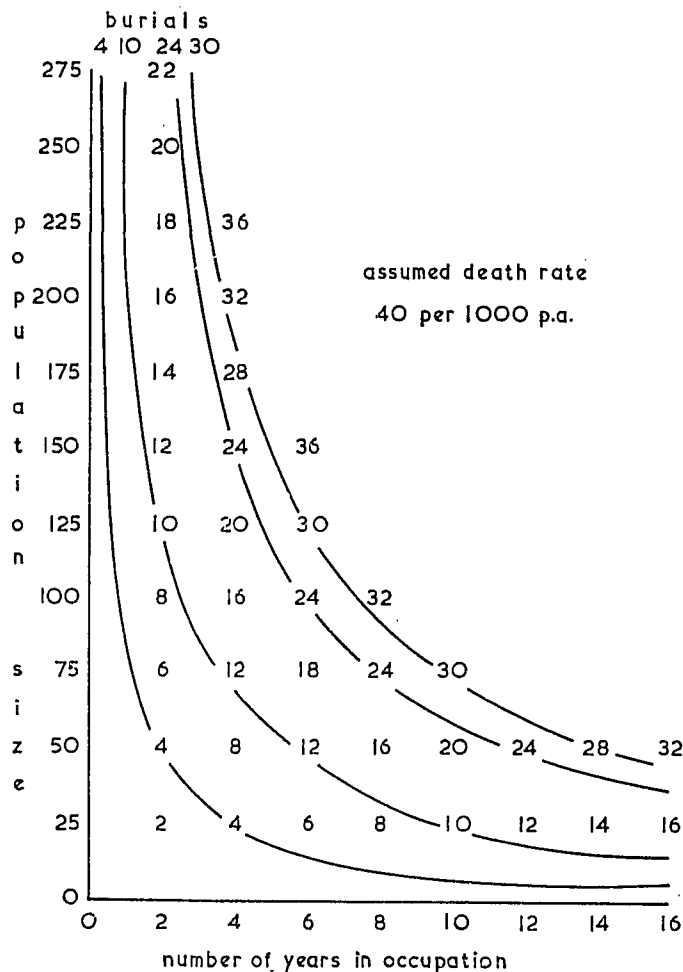


FIG. II

The number of deaths to be expected for a given population size over a given number of years, at an assumed death-rate of 40 per 1,000 per year. The lines are intended for guidance only.

near one cemetery site for up to about 5 years before moving on, and normally burying less than a couple of dozen in this time.

There is another way of approaching the problem of making a population estimate. That is to consider the amount of land under grain which would be needed to feed a given population each year. There is obviously no direct way

of knowing this figure exactly, particularly since the diet was probably made up partially from animal products derived from stock-raising or hunting. Figures for a variety of crops given by Allan suggest that in Africa between $\frac{1}{2}$ and 2 acres per head (less than 1 hectare) are normal.¹ The different crops and techniques of medieval Europe make truly comparative figures hard to come by. Bowen implies that adults who are not obtaining starch from potatoes may consume perhaps 10–15 bushels of grain per year in European conditions.² Bennett comes to the conclusion that in medieval England a yield of 8–9 bushels per acre was usual.³ Each adult, therefore, would need the product of perhaps $1\frac{1}{2}$ acres, and would have to sow rather more than this, to allow for seed corn production. This might mean sowing one-third or one-quarter as much land again, on medieval yield figures of 1:3 or 1:4.⁴ Thus about 2 acres would probably be needed per adult, or perhaps per head if one allows for the need to cover for losses of various kinds.

How far the different conditions of Africa or medieval Europe make these figures untrustworthy for use in prehistoric European contexts is uncertain. But it seems safe to suggest, on the basis of the above figures, that the land under cultivation per head per year should have been between 1 and 5 acres (say $\frac{1}{2}$ –2 ha.).

It is possible to construct theoretical diagrams to illustrate how much land would be needed by population groups of different sizes; however, some assumptions must be made as to the rate at which this land is being used up. This may be termed the utilization rate. This is the number of years taken by one person to exhaust one hectare. FIGURES IIIa and IIIb are constructed with a utilization rate of 1:2, and the tabular values are in hectares. Using this utilization rate is only another way of saying that one person needs $\frac{1}{2}$ hectare, which is exhausted in 1 year, or 1 hectare, which is exhausted in 2 years, or 2 hectares, which are exhausted in 4 years. Whichever of these figures is most accurate from the point of view of personal consumption, they all involve using up land at the same rate. Thus on both FIGURES IIIa and IIIb, at a utilization rate of 1:2, a group of 75 people will have exhausted 150 hectares after 4 years, and after 6 years 100 people will have used up 300 hectares, and so on.

Other diagrams can be drawn for a medium utilization rate (1:4) (FIGURE IV) and for a slow utilization rate (1:8) (FIGURE V). It is only when the barrow densities are known that it is possible to suggest which of these theoretical diagrams is most likely to be correct for the region.

¹ Atkinson, *loc. cit.*, pp. 55–9.

² H. C. Bowen, 'Corn Storage in Antiquity', *Antiquity*, 41, 1967, p. 215.

³ M. K. Bennett, 'British Wheat Yield Per Acre for Seven Centuries', *Econ. Hist.*, 3, 1935, p. 21.

⁴ B. H. Slicher van Bath, *The Agrarian History of Western Europe*, 1963, pp. 18–19.

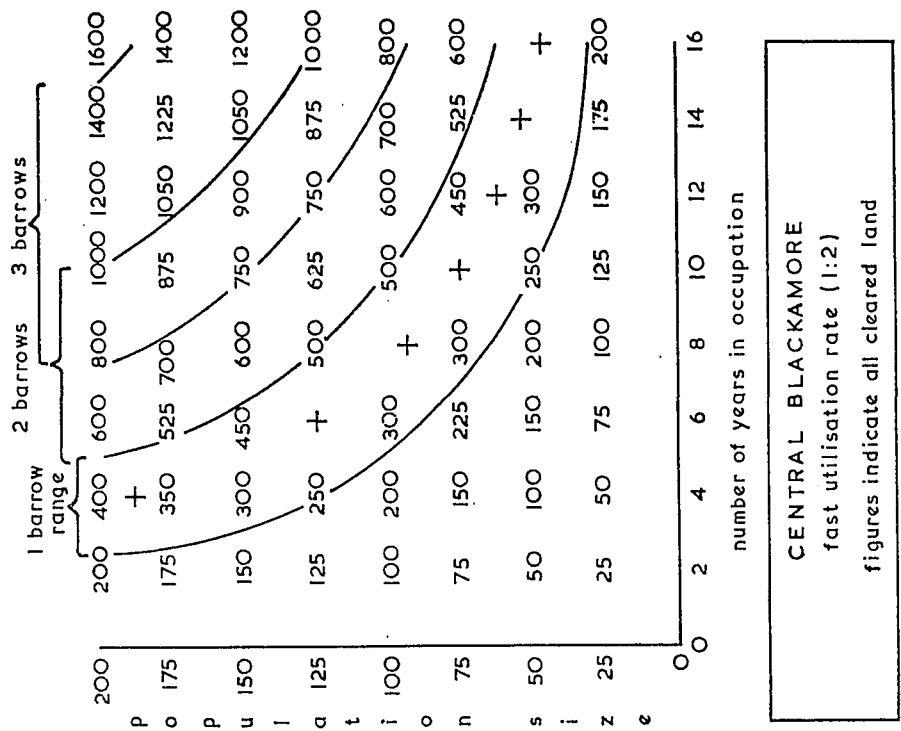


Fig. IIIb

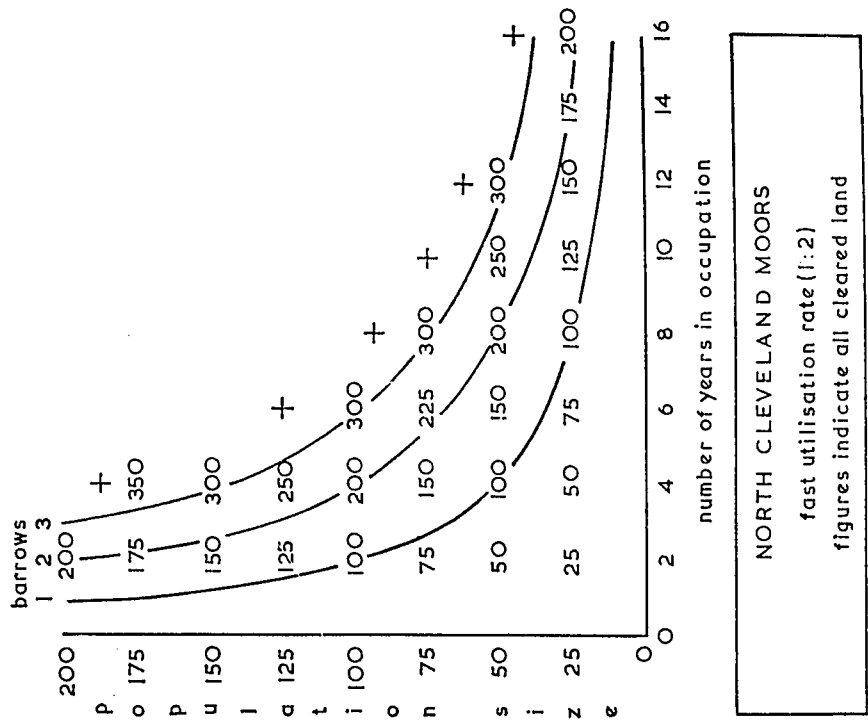


Fig. IIIa

The tabular values are in hectares. For explanation see text.

In some parts of north-east Yorkshire the barrow density can be determined with some accuracy. The moorlands have few monuments which suggest intensive later occupation, so that one may be fairly sure that barrows have largely escaped destructive agricultural operations. A few will have been entirely destroyed to build walls—but these are not common features on the moors themselves—and one or two remain to be discovered.

It may be argued that some barrows were built at the upper margins of the dalesides, and were subsequently destroyed by medieval and later farming, but none has survived in this type of position, so this case rests on negative evidence.

The density figures on the map (FIGURE I) are based on fieldwork. Information was supplied by the Ordnance Survey maps and also by Mr Raymond Hayes, whose kindness I should like to acknowledge with gratitude. On the map, the squares for which figures have been counted have been deliberately selected for position, and vary in area between 5×5 , 6×4 , and 8×3 km., giving a figure which indicates numbers of barrows per 2,400–2,500 hectares. The need for positional selection, and for the slight flexibility of the unit (of the order of 4 per cent) is obvious. A blanket coverage of the region in, say, 5×5 km. squares would include much badly drained land in the dales and many steep and inhospitable slopes. On the central watershed in particular, the barrows occur on relatively narrow strips of plateauland, often with the dale sides falling away very steeply at the edges. The map shows that densities are very regular, and that there is a profound difference between Central Blackamore and the North Cleveland Moors. In Central Blackamore there is one barrow per 250–500 hectares (the figure of 15 refers to an area of 5,000 hectares, double the normal size); the North Cleveland Moors, and Sleights Moor (the figure of 10 here refers to an area of half the normal size) have a regular density of about one barrow per 100 hectares. This is probably to be related to the difference in altitude and its effects on settlement.

Now that we know how much land goes with each barrow, it is possible to compare this figure with how much land one might expect to be used on theoretical grounds. On the North Cleveland Moors, each continuously used cemetery was using 300 hectares as a maximum (since three is the normal maximum cemetery size), while two-barrow cemeteries were using 200, and a single barrow 100. These actual use figures can now be transferred to the diagrams of theoretical use; they have been drawn as lines on FIGURES IIIa, IV, and V, linking values of 300, 200, and 100 hectares. The same thing has been done for Central Blackamore densities (FIGURE IIIb), only this time the lines express ranges, since the densities themselves can only be expressed in this way.

On diagram IIIb it will be observed that the range lines only just fall within the diagram area. If Central Blackamore diagrams for medium and slow

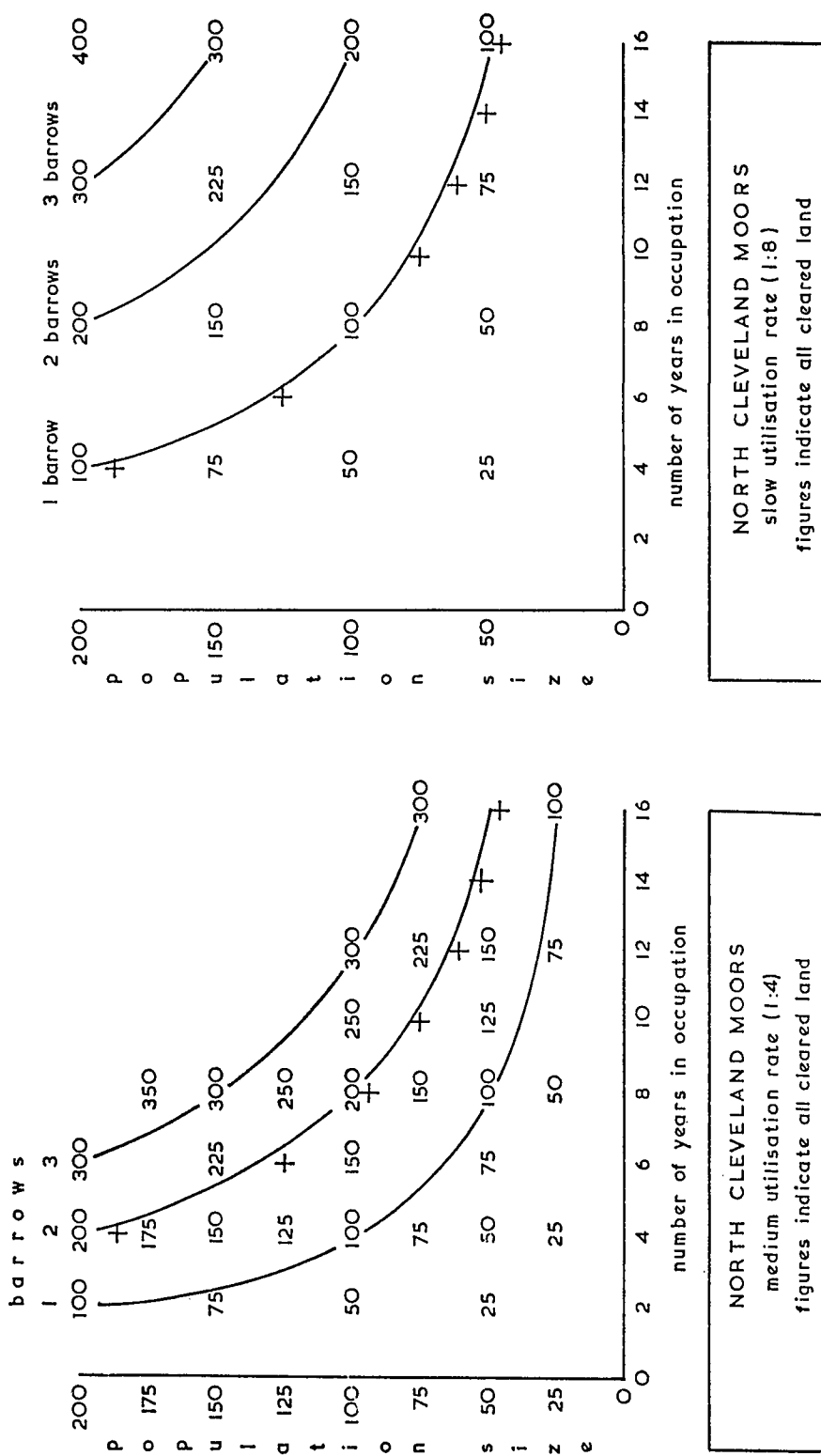


Fig. IV

Fig. V

The tabular values are in hectares. For explanation see text.

utilization rates were drawn it would mean postulating much larger population sizes and much longer occupations to make the theoretical framework fit the actual use. So these diagrams, which would obviously be inappropriate, have not been drawn.

If one considers which of the FIGURES IIIa, IV, and V suit the North Cleveland Moors densities best, there is a useful way of reaching a decision. A return to FIGURE II shows that the number of burials in the cemeteries gives a firm maximum for duration of occupation per population size. Thus, for instance, as mentioned before, 150 people cannot use the same cemetery for more than 5 years, or 75 longer than 10, on the evidence of maximum number of burials in cemeteries. On all the diagrams these limits have been marked with crosses. Seen in this light, some of the diagrams are clearly wrong. FIGURE IIIb, for instance, has the limits set well inside the lines showing the quantities of land actually used by the barrow-builders. So for this area—Central Blackamore—we must devise a diagram which will allow land to be used even more rapidly.

For the North Cleveland Moors, only the fast utilization rate (FIGURE IIIa) fits the limits imposed by the cemeteries. The slow rate of FIGURE V does not fit at all well and the medium rate—FIGURE IV—still leaves something to be desired. At this stage it might be thought that the fast rate should be accepted for the North Cleveland Moors, and that the only need is to draw an even faster rate for Blackamore. This latter has been done (FIGURE VI) at a rate of 1:1. But even this diagram will not fit the limits imposed by the cemeteries. And acceptance of FIGURE IIIa for the North Cleveland Moors implies acceptance that here, on a warm 800 foot plateau (244 m.) with land just cleared from virgin forest, one person was exhausting land at the rate of one hectare every two years, which is surely too fast.

The dilemma here is that one is forced to assume a much faster exhaustion rate than is reasonable for forest soil, with every unnecessary move involving more laborious clearance. But the problem can be resolved. The theoretical diagrams are based on the amount of land actually covered in corn-stalks which the individual needs for his subsistence. But the barrow densities are expressed in barrows per unit area—and this includes land of all categories, good, bad, and indifferent. The distinction is important. Allan has explained how in this kind of cultivation the peasant is very selective within the area which he is to sow, and knows by various ecological indicators which land is unsuitable for his crops.¹ In north-east Yorkshire the same kind of behaviour is to be expected; different vegetation types would indicate badly drained land or thin soil cover, while other areas would be palpably too stony or too steep. But even more important in a phase of clearance from virgin forest is the prob-

¹ Slicher van Bath, *op. cit.*, p. 97.

lem created by tree stumps. Whether the larger trees are felled or left to die after ring-barking, their stumps take up a considerable proportion of the surface area. At this stage the stumps are normally left to rot, and planting takes place between them, often at first in the ash patches left after the burning, and in later seasons after hoeing. These processes are admirably illustrated in W. R. Mead's book *Farming in Finland*.¹ Here the removal of decayed stumps takes place after seven years or more—and this with the aid of a horse team.²

Once we have taken these factors into account, it will be seen that a barrow from the North Cleveland Moors, although apparently attached to some 100 hectares of land, must in reality relate to a rather smaller area under crops. It is necessary to make an estimate of cultivated, as opposed to cleared, land. For Central Blackamore, on the fast rate diagram (FIGURE IIIb) the lines marking cleared land used could only fit the limits marked if the cultivated land within it was about one-quarter of the whole. This would be extreme, particularly since the original areas on which the densities were measured had already been selected for their low amounts of steep slope or dale land. It is much more reasonable to use the very fast utilization rate (FIGURE VI) and assume a cultivation percentage of about 50, giving a diagram (FIGURE VIIb) which fits the necessary limits. Here the lines have been drawn to show half the land use of FIGURE VI, representing this 50 per cent of land in actual productive use.

For the North Cleveland Moors, the same percentage of cultivated land may be assumed; although Central Blackamore would have contained more areas of steep slope and thin soil, the lower plateau would have more flat, badly drained land for the farmers to contend with. But the utilization rate chosen must be different. The lower number of barrows on the central watershed must relate to the lower, less certain yields associated with the greater altitude and higher rainfall, and so on. Land would be both exhausted and abandoned more quickly. With a cultivation percentage of 50, the medium utilization rate fits neatly, and FIGURE VIIa can be produced as the final diagram for the area.

The difference between the North Cleveland Moors and Central Blackamore is the rate at which the land is exhausted. On the lower plateau, 1 hectare per person is being used in 4 years, plus an equal amount which is unusable because of unsuitable soil or tree stumps. On the central watershed, by contrast, 1 hectare per person is exhausted every year, and as much again in waste. In other words, the land of the central part of Blackamore was being exhausted four times as quickly as that of the North Cleveland Moors, a figure which derives ultimately from the relative barrow densities.

From these figures it is possible to make a rough population estimate for the land north of the Limestone Hills. Assuming once again that the dales and the steepest slopes were not utilized for crops, a crude count was made of available

¹ Chapter 3 and Pls. 2 and 3.

² *Ibid.*, p. 49.

1 km. $\times$ 1 km. O.S. grid squares. These are tabulated according to their numbers within the larger 10 km. $\times$ 10 km. squares (TABLE I). Each of these small squares is 100 hectares in area. Each square with less than about 50 per cent of suitable land was excluded, and in general an admittedly subjective attempt was made to reflect the kind of land on which barrows occur. It is of interest that in the larger squares between 30 and 45 per cent is normally land

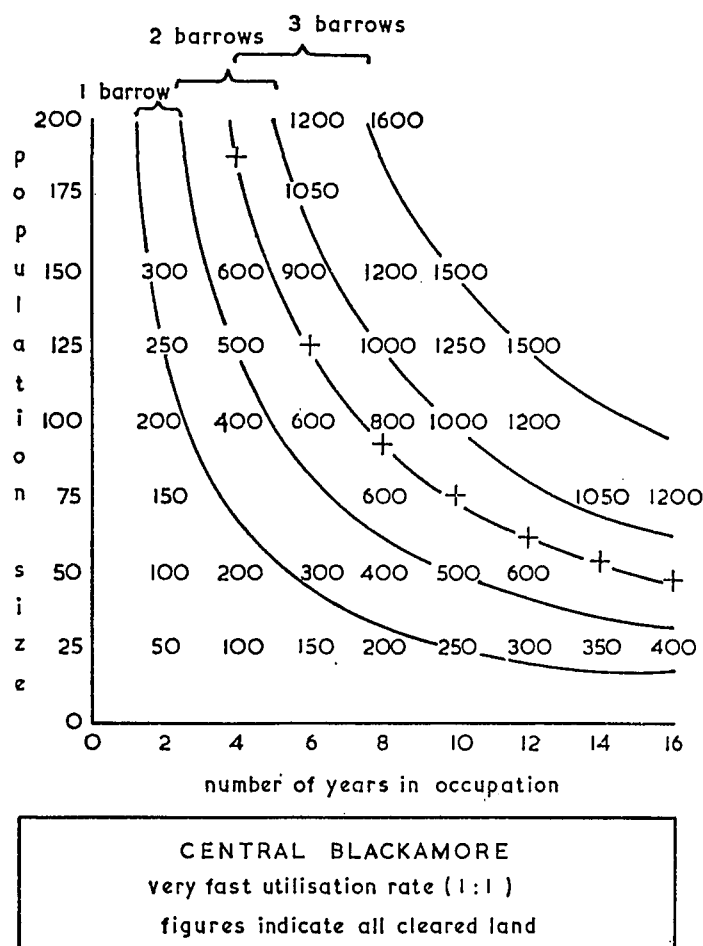


FIG. VI

The tabular values are in hectares. For explanation see text.

of this type. The total area, 43,000 hectares, has been rounded off to 50,000, and this, on a cultivable percentage of 50, gives 25,000 hectares actually used for crops.

At this point it becomes necessary to establish a utilization rate. The medium rate (1:4) has been adopted; it is appropriate for the North Cleveland Moors

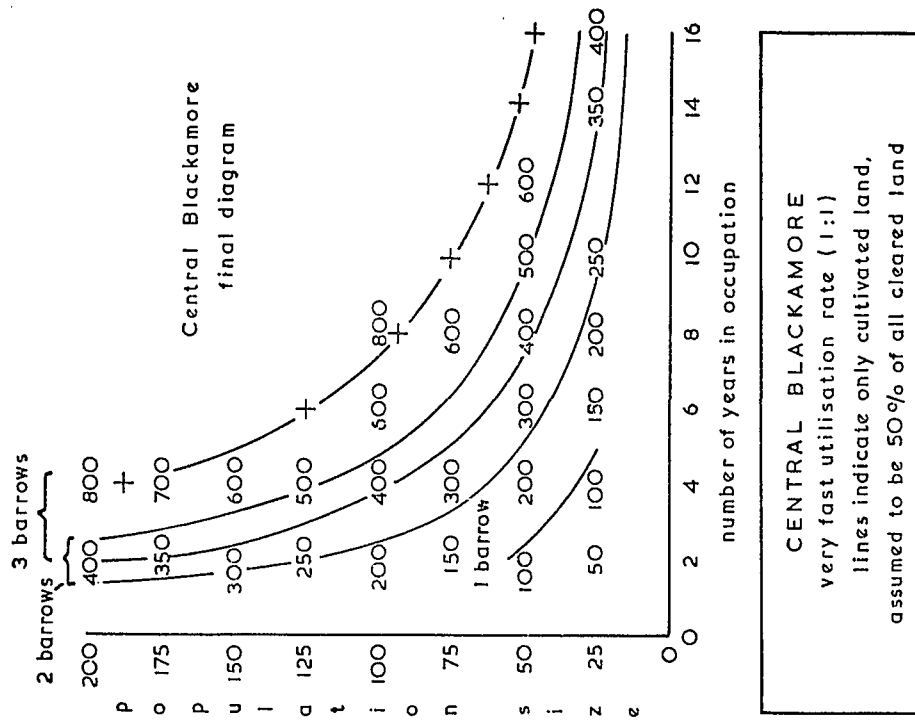
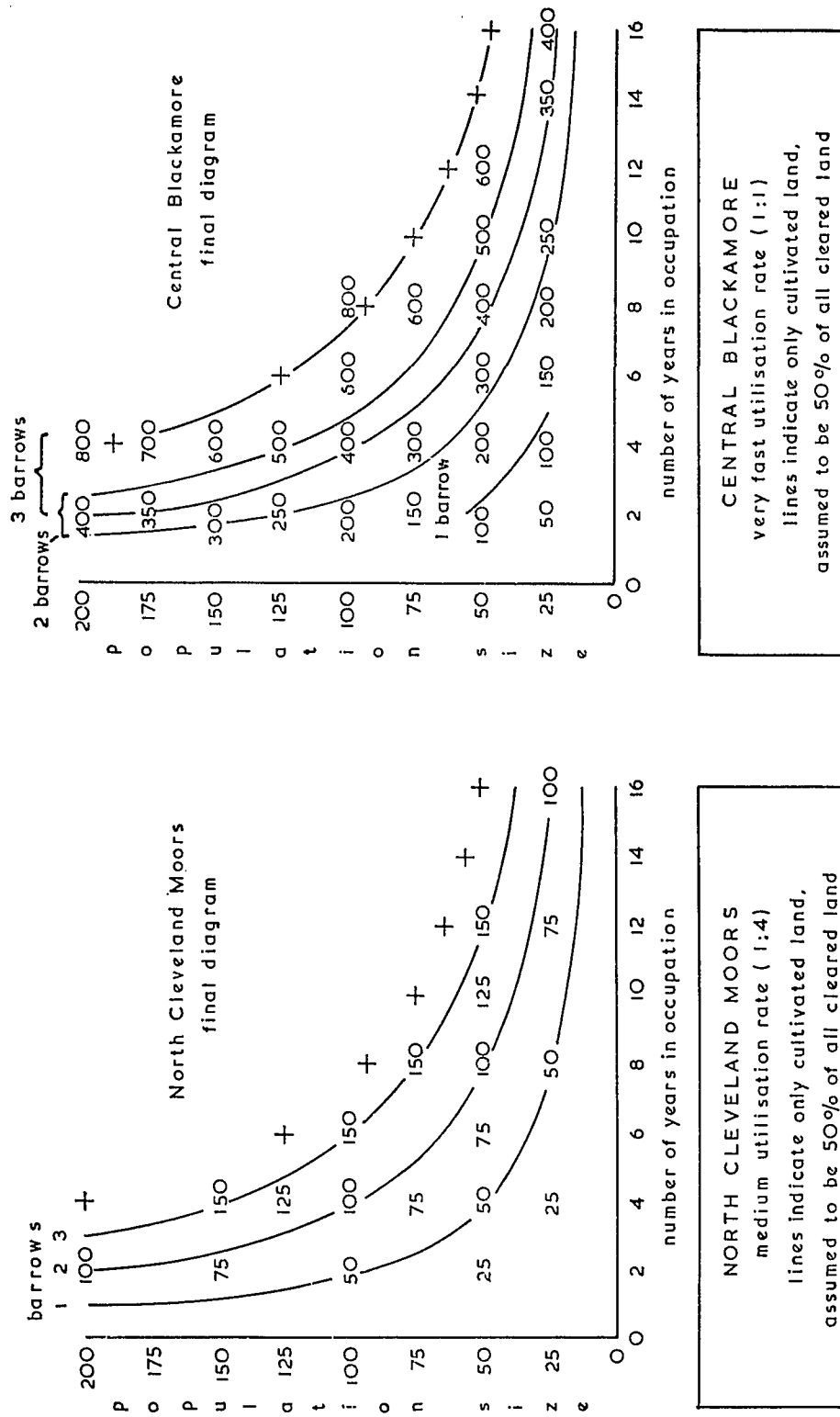


TABLE I—showing the approximate amount of land in Blackamore available for agriculture. In obtaining this approximation the dales and areas of steep slope have been omitted.

<i>O.S. grid squares</i>	<i>No. of 1 km. squares</i>	<i>O.S. grid squares</i>	<i>No. of 1 km. squares</i>	<i>O.S. grid squares</i>	<i>No. of 1 km. squares</i>
NZ 40	—	*NZ 70	36	*SE 59	43
NZ 50	17	NZ 71	18	*SE 69	39
NZ 51	3	*NZ 80	31	*SE 79	40
*NZ 60	33	NZ 90	26	*SE 89	46
NZ 61	29	SE 49	22	SE 99	45
* Full 100 sq. km. available TOTAL=428.					
TOTAL=428 sq. km.—say 430 sq. km.=43,000 hectares.					

and other areas of similar height. If it is too generous for the central watershed, it is probably too grudging for the east coast, with its patches of glacial material and its slightly longer growing season.¹ So it seems a fair average. FIGURE VIII represents on a graph the range of population estimates possible for the area as a whole, with 25,000 hectares under crops and one person exhausting one hectare in four years. The crosses represent the likely limits within which the true figures probably lie. It is difficult, for instance, to believe that the occupation lasted less than 100 years, or more than 600. A really short occupation is ruled out by the size of the area—if it was marginal, it is difficult to imagine the swift and eager colonization, by a large body, which would need to be postulated for such a short space of time; and the pottery, which includes urns both of Longworth's Primary Series and of his Secondary Series,² is normally thought of as covering a rather longer period. An extremely long occupation can be disputed by arguing that the pottery and burial rites are too homogeneous to have lasted so long.

It is most likely, then, that the Collared Urn population numbered less than 1,000, and that they were in the area for between 100 and 500 years; a more average figure still would be between 250 and 500, over a period of 200 to 400 years. It is interesting that the figure for duration accords with reasonable estimates made on archaeological grounds, though it was arrived at for other

¹ J. A. Taylor, 'Growing Season as affected by Land Aspect and Soil Texture', in J. A. Taylor, ed., *Weather and Agriculture*, 1967, Figs. 4 and 5.

² I. H. Longworth, 'The Origins and Development of the Primary Series in the Collared Urn Tradition in England and Wales', *Proc. Prehist. Soc.*, 27, 1961, pp. 263–306.

reasons; the numerical estimate is totally new. From the archaeological point of view the figures are quite valuable, because they give a time-scale over which typological changes in the pottery can be measured. This may have implications for the same type of pottery in other parts of Britain where this kind of estimate is at present impossible.

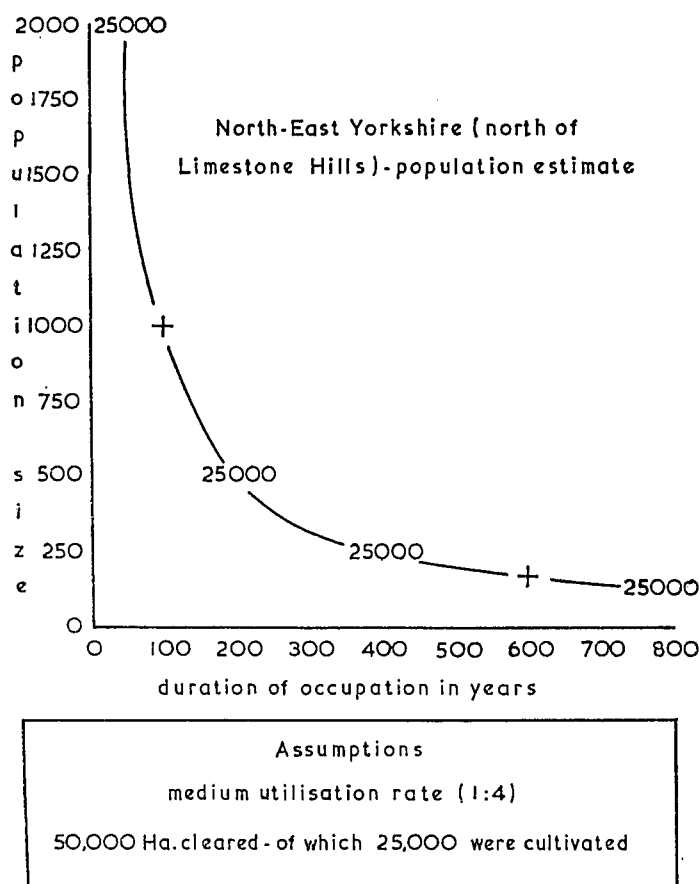


FIG. VIII

Final estimate for population of Blackamore. Crops were raised on about 25,000 hectares, one person, on average, exhausting 1 hectare every 4 years. The crosses indicate the limits within which the true population figure is likely to be: thus the overall population is unlikely to have exceeded 1,000, or to have remained in the area for over 600 years.

It must be clearly realized, though, that this calculation is empirical in nature and its results must therefore be treated as provisional. Further work could mean the changing of some of the assumptions and simplifications made here, with corresponding effect on the figures. For instance, if a proportion of

the adult population was not entitled to barrow burial (a class of slaves, for instance) this would modify the situation. Possibly also grain supplies were imported from the Limestone Hills, though if there was a surplus there it is hard to understand why the uptake of these marginal lands ever became necessary.

These figures are concerned with averages, and take no account of the size of the initial colonizing group or groups, the number of these groups, or overall rises and falls in population numbers over a period of time. They take no account of stock-rearing, in the woods, on the fallow, or on the newly created heather moors; this is impossible to gauge. If there was a substantial grazing phase after the development of moorland, but while barrows were still being built, some of these must be excluded from the density figures, which have been quoted as if they refer to the agricultural phase only. Finally, Burton Howes are, after all, situated near the very highest part of Blackamore. Possibly some forest regeneration took place at lower altitudes, allowing a second or third cropping phase. Certainly the dispositions of barrows on the North Cleveland Moors may suggest this; though in Central Blackamore barrows are not notably more numerous on the lower slopes. In so far as this is true the number of barrows to be considered for the earliest clearance phase must be less.

At any rate, a later grazing phase on the moorlands, and partial forest regeneration on the lower slopes and better ground would allow a proportion of the population to remain in the area after their disastrous progress was over; and it is perhaps in this context that the cairnfields may be seen.

The Cairnfields

A definitive study of the cairnfields of northern Britain has still to appear. For this area, however, some basic facts are known. Cairnfields occur normally between 600 and 1,000 feet (183–305 m.). Sometimes only one or two cairns are found, sometimes several hundred, as on Danby Rigg or at Iron Howe.¹ Iron Howe has been surveyed quite recently, and the plan shows well the irregular walls, sometimes enclosing small fields, which occur quite often in the cairnfields.² At Iron Howe the walls are higher and less broken than in most cairnfields, however; frequently, disconnected lengths of walling are found. The Iron Howe plan shows too that the cairns can occur within the fields, and built into the walling.

The cairns themselves are usually ovoid, but can be round or long; they tend to measure between 8 and 15 feet in length (c. 3–5 m.) and between 6 and 10 feet in width (c. 2–3 m.). The associated walling suggests that they were connected with the growing of cereals in small plots, many of which had first to be cleared of stones. This must be the primary purpose of the walls, which are too

¹ Elgee, *op. cit.*, p. 136; R. H. Hayes, *op. cit.*, p. 39.

² Hayes, *op. cit.*, Fig. 5.

broken and irregular to represent more than a tidy way of disposing of unwanted stones at the field's edge. The aspect of the cairnfields also argues for agriculture; Elgee¹ was able to show that most slopes on which the cairns occur face south, south-west, or south-east, which should have ensured better conditions for growth;² though my own analysis has shown that almost as many are found on ground which is virtually flat. Fieldwork has confirmed Elgee's statement that they are normally found on dry ground,³ and it is interesting that the same is true of cairnfields in Dumfriesshire.⁴

As mentioned above, the paucity of finds from excavated cairns has led to a debate between those who view the cairns as for burials, which have since decayed, and those who see them as a product of field clearance. One feature is commonly reported, however—the presence of charcoal and traces of burning in and under them. This was noticed by Ashbee on Kildale Moor, by Hayes on Great Ayton Moor, and by Canon Atkinson on Danby Rigg.⁵ Outside the area, traces of burning were found by Canon Greenwell at Eglingham, Northumberland and at Barnscar, near Ravenglass, Cumberland.⁶ All this suggests that before the clearing took place scrub had been burnt off from the land surface.

Northern British cairnfields may be dated rather hesitantly from the contents of excavated cairns, where these exist, and the nature of associated monuments. Jobey claims that the cairnfield at Alnham, Northumberland, is basically Bronze Age in date, because of finds within the cairns; and the evidence gathered by Hayes, limited though it is, points in the same direction for the contents of cairns in our region.⁷ In the Lake District similar cairns have been ascribed to the Bronze Age on the basis of finds in them.⁸

It can be shown that in several regions there is a fairly regular association with stone-walled enclosures—the so-called ring-cairns or burial circles. These enclosures, which vary in size, tend to produce cremations with or without Collared Urns in the same way as the barrows do. In north-east Yorkshire the most recent publication has been that of two from the cairnfield at Great Ayton Moor to add to the Danby Rigg circle, and those already mentioned by Hayes.⁹

¹ Elgee, *op. cit.*, p. 123.

² Taylor, *op. cit.*, Fig. 13.

³ Elgee, *op. cit.*, p. 123.

⁴ J. Scott-Elliott and I. Rae, 'The small cairn fields of Dumfriesshire', *Trans. Dumfriesshire and Galloway Nat. Hist. and Ant. Soc.*, 44, 1967, p. 100.

⁵ P. Ashbee, 'Excavations on Kildale Moor', *Yorks. Arch. Jnl.*, 29, 1957, p. 191; R. H. Hayes, *The Chambered Cairn and adjacent monuments on Great Ayton Moor*, 1967, pp. 23–5; Canon Atkinson quoted by Elgee, *op. cit.*, p. 99.

⁶ W. Greenwell, *British Barrows*, 1877, p. 420; D. Walker, 'Excavations at Barnscar, 1957–58', *Trans. Cumberland and Westmorland Antiq. and Arch. Soc.*, 2–65, 1965, p. 56.

⁷ G. Jobey and J. Tait, 'Excavations on Palisaded Settlements and Cairnfields at Alnham, Northumberland', *Archaeologia Aeliana*, 44, 1966, p. 46; Hayes, *op. cit.*, 1963, p. 39.

⁸ C. Fell, 'Some Cairns in High Furness', *Trans. Cumberland and Westmorland Antiq. and Arch. Soc.*, 2–64, 1964, p. 3; Walker, *op. cit.*, p. 62.

⁹ Hayes, *op. cit.*, 1967; Elgee, *op. cit.*, p. 104; Hayes, *op. cit.*, 1963, Appendix A, viii.

The association between cairnfields and ring-cairns has been noted elsewhere. In Derbyshire, it occurs on Stanton Moor, Totley Moor, and Ramsley Moor.¹ In the county of Dumfries, ring-cairns are always found close to, or within, fields of small cairns, never by themselves.² The ring-cairns in both of these areas have produced Collared Urn material.³ Longworth finds that there is an association between ring-cairns and a typologically late group of Collared Urns, the north-western style of his Secondary Series, which occurs broadly north and west of the Pennines, as well as in Derbyshire and the West Riding of Yorkshire.⁴

Thus even if some north British cairnfields are late in date, it is hard to avoid the conclusion that they started in the Bronze Age. It may be suggested that in north-east Yorkshire they were being developed at a late stage in the history of the moorland area, when the original forest soil had been truncated by erosion, and surface stones were becoming a problem. As suggested earlier, it is possible that the fertility of the lower slopes could be conserved for rather longer than that of higher ground, and that cereal farming continued here for some time after the reduction of much of the land to heather moor. Perhaps by careful stone clearance and possibly folding the animals on the stubbles to provide manure, it was possible to make a living, though not indefinitely. This would result in the cairnfields, with their restricted altitudinal range, their preference for southerly slopes (noted also in Dumfriesshire⁵), and their walling. This would naturally only provide a solution for some of the previous population; the others would have to emigrate, or perhaps concentrate more on pastoralism.

Some of the cairnfields contain barrows, which may relate to the earlier occupation of the area or else have been the cemeteries of the cairnfield farmers themselves. Other cairnfield builders, though, were using ring-cairns. It is possible that the ring-cairn developed from concentration on an early phase in the ritual which culminated in the erection of a barrow; many old excavation reports from this area, as from elsewhere, mention that the barrows contained internal perimeter walling or orthostatic stone circles, and presumably these formed pre-barrow enclosures which stood while primary and satellite burials were being made.

It looks as if the cairnfield farmers were concerned with building these primary enclosures, and burying within them in the accustomed way. Perhaps the

¹ J. P. Heathcote, 'Further Excavations on Stanton Moor', *Derbyshire Arch. Jnl*, 10, 1936, Fig. 7; J. Radley, 'A Bronze Age Ring-Work on Totley Moor and other Bronze Age Ring-Works in the Pennines', *Arch. Jnl*, 123, 1966, Fig. 1 and pp. 9, 15; D. N. Riley, 'Circles and Barrows on Ramsley Moor', *Trans. Hunter Arch. Soc.*, 8, 1958, fig. 1.

² Scott-Elliot and Rae, *op. cit.*, 1967, p. 101.

³ *Idem.*, 'Whitestanes Moor (sites 1 and 80)—an Enclosed Cremation Cemetery', *Trans. Dumfriesshire and Galloway Nat. Hist. and Ant. Soc.*, 42, 1965, pp. 51-60.

⁴ Longworth, *op. cit.*, 1964, pp. 195-6.

⁵ Scott-Elliot and Rae, *op. cit.*, 1967, pp. 99-100.

circles were intended not only for burial but for important ritual activities, the need for which would have redoubled at these difficult times of diminishing yields. Certainly some of the circles contain puzzling 'ritual pits', while others, which are rather larger in diameter than the average barrow, suggest that an evolution in their status and function may have occurred.

Perhaps in not converting pre-barrow enclosures into barrows, but leaving them standing as ring-cairns, the farmers were making a virtue of necessity. By this time it is probable that the average size of the social group had decreased, leaving less labour available for building impressive memorials, especially since stone clearance and manure carting may have been consuming by now rather more time and labour than previously.

According to this argument, then, it is most likely that the cairnfields represent the aftermath of the colonization of this most unrewarding area—the inevitable decline and fragmentation of the original population, and the development of a slightly different type of agriculture on these lower slopes. How long this cereal-farming continued we do not know, but probably pastoralism was on the increase. The cross-ridge dykes of the Iron Age, known better from the Limestone Hills and the Wolds, may be associated with cattle-raiding and its prevention, and a few occur in Blackmore. Perhaps too the lapse of any pottery tradition in the region after the Collared Urns is an expression of the redundancy of pottery which would occur with this increased interest in stock-raising.

Conclusions

It has been suggested that the moorlands of north-east Yorkshire were not created by the activities of nomadic pastoralists, but by shifting cultivators. Since the barrow densities for the area have been worked out, it is possible to compare theoretical land needs with land used per barrow, on the assumption that most of the land was not available twice. Thus an estimate of the rate at which land was exhausted has been reached, and this has formed the basis for an estimate of the duration of the occupation and the numbers of people involved. Chronologically this has agreed with what conventional prehistory suggests, but the numerical estimate is new. A final suggestion is that the cairnfields represent clearance by small groups of farmers, who were forced by the depredations of their immediate ancestors to cultivate the lower slopes only.

It should be emphasized that these conclusions apply only to one area. It is not suggested that all Collared Urn users were primarily growing corn, or that this pottery tradition can everywhere be compressed into two or three hundred years, or that all barrow burials represent only one continuous occupation per cemetery, or that in all areas barrows were provided for the majority of the

people. Indeed, there must have been considerable local variation in the economies of the Bronze Age, just as was the case in medieval England, and to some extent the customs and locations of burials must reflect these. In this area the data are relatively complete, local relief is very well defined, and some pollen analysis has been carried out; the same could not be said of many other regions and we must await more information, or devise new ways of looking at distributional evidence, before attempting elsewhere the kind of study presented here.

Notes and Comments

J. D. CHAMBERS, 1898-1970

Professor J. D. Chambers, the distinguished economic and social historian, died suddenly after a short illness on 12 April 1970. He was one of this country's leading scholars in agrarian history and readers of this journal will know him as a frequent contributor of reviews.

David, as he was known to his many friends, was associated throughout his life with the University of Nottingham. The son of a small Nottinghamshire farmer, he was educated at the then University College, and his earliest teaching years were spent in the University Department of Adult Education. In 1947 he was placed in charge of Economic History in the University, and in 1958 he became the first holder of the Chair of Economic History, from which he retired in 1964.

Chambers's reputation was founded on his pioneering study of life and labour under the squirearchy, *Nottinghamshire in the Eighteenth Century* (1932, 2nd ed. 1966). His most prolific period was between 1953 and 1966 when, in addition to his well-known and important papers on 'Enclosure and Labour Supply' and 'The Vale of Trent', and a variety of other articles and pamphlets, he published two major studies, *The Workshop of the World* and *The Agricultural Revolution, 1750-1880*. He continued to work up to the day of his death, and he left an almost completed book on popu-

lation growth which had occupied him for some years. This, it is hoped, will appear in the near future. In 1967 a group of his former students and colleagues produced for him a *Festschrift*, in the form of a volume of essays based on his life-long interests, *Land, Labour, and Population in the Industrial Revolution*. This includes a full list of his writings up to 1966.

Everything that Chambers produced was carefully considered, thoroughly researched, and beautifully written: he belonged to that sadly unfashionable school who regard history as a form of literature; and in his hands it always was. Although he thought of himself as primarily a regional historian, and much of his work was concerned with Nottingham and its region, his contributions have undoubtedly made a permanent impact on the general history of agrarian change and population growth in this country.

Perhaps his greatest influence, however, was a personal one. He presided over, and inspired a department of Economic and Social History which although never large in numbers has proved one of the most fruitful in the country. His teaching was always vital, his enthusiasm unbounded and infectious. He had the gift of bringing his subject alive and of making it absorbing to even the most casual of listeners.

(Continued on page 64)