

Agricultural Innovation and Detectable Landscape Margins: The Case of Wheelhouses in Northumberland¹

By J. A. HELLEN

FARM buildings, in both plan and layout, are an important aspect of the rural landscape because they indicate something of the past history of the farm and its economy; they are, to use Harvey's phrase, "structural documents."² In their original function, certain farm buildings are significant relict features of technological stages in agrarian history and are, therefore, potentially valuable in the study of innovation and the analysis of agricultural margins. A case in point is the wheelhouse, a relatively small element in the farm-building complex, but a common feature of many Northumbrian farms. Originally designed to house the horse-wheel, a source of rotary power for threshing machines and similar implements, these wheelhouses were subsequently converted to other uses, where they were not demolished when rendered obsolete by technical advances or changes in land use. Although these buildings are of common concern to architectural and agricultural historians, as well as industrial archaeologists, their distribution patterns merit attention, and this short paper is intended to place on record the findings and implications of a survey of them conducted in 1969 and 1970.³ They call for more widespread study, not least because so many are now being demolished.

Development of the wheelhouse

It would be injudicious, in the absence of documentary evidence, to infer too much about agricultural innovation from the survival of wheelhouses alone, and this paper will attempt only to set Northumbrian wheelhouses in their historical context, and to isolate certain suggested subjects for further research

¹ The author wishes to thank Mr H. E. D. Beavis for his kindness in permitting the reproduction of his plans of the wheelhouse at Berwick Hill, to acknowledge the practical help given by students of his department in carrying out the survey, and to thank Dr Joan Thirsk for her comments and advice on the first draft of this paper.

² N. Harvey, *A History of Farm Buildings in England and Wales*, 1970, p. 277.

³ J. A. Hellen, 'Some provisional notes on wheelhouses and their distribution in Northumberland', *Jnl Geog. Soc. Univ. Newcastle upon Tyne*, 18, 1970, pp. 19-29. A check-list of all intact wheelhouses in Northumberland is to be published in the Archaeological News Bulletin for Northumberland, Cumberland, and Westmorland.

which arise from the preliminary survey. Wheelhouses are generally single-storeyed farm outbuildings, round, square, or polygonal in plan, and having, in many Northumbrian cases, conical or pyramidal roofs. Owing to demolitions and the activity of scrap merchants they have become separated from the horse-wheels and threshing machines once functionally associated with them, and they form today conspicuous and incongruous elements of the agrarian landscape.

With the invention of the threshing machine incorporating fluted rollers on the principle of the flax mill, the antiquated flail gradually disappeared from British agriculture in the face of one of the most important technical innovations of the period. Indeed, William Marshall, commenting on Northumberland, called it "the most valuable machine of agriculture that has been discovered for ages past,"¹ and the work of months was reduced to that of weeks. George Meikle, a Scot from Houston Mill near Haddington in East Lothian, is generally credited with the perfection, if not the invention, of the first effective threshing machine constructed at Kilbogie in Clackmannanshire in 1786 for which he took out an English patent. This superseded machines using rotating flails, which had been unsatisfactory when introduced much earlier in the century.

The early threshers seem to have spread quickly from the Scottish corn counties to those of north-east England, a distribution according with "farms where the extent of tillage land requires two or more ploughs."² Some indication of the numerous parallel developments by millwrights and others is given in a standard text on farm implements,³ and the contemporary, mechanical patents, and farming magazines contain numerous references, as does the *Journal of the Royal Agricultural Society*. Various rotary power sources—hand, horse, water, and wind—were harnessed to the new machinery before the much more expensive steam engines were introduced. Atkinson has described in detail the use of the horse, and makes specific reference to wheelhouses, which he records as being "common in Northumberland, in the eastern parts of Co. Durham, the North and East Ridings of Yorkshire, Devon, parts of Cornwall and Dorset," together with a few in the Midlands.⁴ This list could be extended to include many Scottish counties, as well as Cumberland, but although there appears to be some local interest in wheelhouses, as evidenced by local history societies, countryside magazines, and newspapers, no specific work on their geographical distribution at the county scale is known to the author.

¹ W. Marshall, *The Review and Abstract of the County Reports of the Board of Agriculture*, 1, 1808, p. 64.

² J. C. Loudon, *An Encyclopaedia of Agriculture*, 1883, p. 435.

³ G. E. Fussell, *The Farmer's Tools, A.D. 1500-1900*, pp. 152-79.

⁴ F. Atkinson, 'The Horse as a Source of Rotary Power,' *Trans. Newcomen Soc.*, 33, 1960, p. 46.

Contemporary farming encyclopaedias include illustrations and descriptions of the horse-wheel, which was in fact less a 'wheel' than a triangular, square, or polygonal frame, varying with the number of horses involved, and supporting a crown wheel.¹ Wheelhouses or wheel-sheds were built to shelter the permanent overhead or 'overshot' horse-wheel; only later was this contraption replaced or outmoded by the cast-iron 'undershot' or ground-wheel, or light but more costly portable threshing sets. The heavy wheel revolved horizontally on a centre-post set between a base-plate and plummer block, and the overall dimensions were commonly up to 24 or 26 feet in diameter and 7 or 8 feet in height, giving maximum wheelhouse dimensions of 30 and 15 feet respectively. An inner wheel carried the cast-iron crown-wheel, from which a pinion transferred the drive along a tumbling shaft to the threshing machine in an adjacent barn. Horizontal horse-beams radiated from this wheel and centrepost, the horses being harnessed by yoke-bars and moving clock-wise round the circular course. In some instances provision was made for both the horse and water-wheel, but these were probably rare.

Loudon makes the interesting comment that "where windmills are erected, it is found necessary to add such machinery as may allow them to be worked by horses, occasionally, in very calm weather." He further notes that "Meikle's threshing machine to be driven either by wind or six horses" occurred on large corn farms, there being "frequent instances in Berwickshire and Northumberland of farmers incurring that expense on the security of twenty-one years' leases." Another type driven by water or by four horses was described as "a powerful and convenient machine, as advantage may be taken of water when it is abundant, and in dry seasons horses can be applied."²

Reducing, as they did, the number of farm buildings needed to store grain, no less than the size of the labour force, and increasing the quality, quantity, and speed of delivery of grain, the new machines spread quickly in the progressive farming areas of Scotland and northern England, although progress in the south was much slower. As steam power became more common on the large farms, it is probable that by about 1840 new horse-wheels were installed only by small to medium-scale farmers, although existing plant continued to be used until well into the present century and farming manuals described various models for another fifty years thereafter. The fifth edition of a popular farming encyclopaedia included three plates of farm-steadings complete with horse courses as late as 1908; commenting on the threshing machine the author wrote of the marvel of "their venerable age and great capacity."³ In many cases,

¹ D. Low, *Elements of Practical Agriculture*, 1843; H. Stephens, *The Book of the Farm*, 1844, III, plate xxiii.

² Loudon, *op. cit.*, pp. 438-9.

³ J. Macdonald, *Stephen's Book of the Farm*, 1908, I, p. 178 and plates I and II.

the wheelhouse was retained for other purposes after the wheel had been removed, proving particularly valuable for small livestock or grain, fertilizer and machinery storage.

Local Conditions in Northumberland

In their *General View* of Northumbrian agriculture, published in various editions after 1794, Bailey and Culley record the steady rate at which the thresher was adopted: in 1794, for example, they noted that threshing machines were "now becoming general in northern parts of the county; they are all upon the principle of the flax mill, which principle was first introduced into this county for threshing corn . . . near 20 years since" by a Mr Gregson of Wark, and elsewhere, that "about this time Mr Oxley erected a threshing machine at Flodden (near Coldstream) moved by horses;" in the 1797 edition, a Mr Ilderton is reported as having "erected two threshing machines, one at Ilderton and another at Hawkhill (both near Wooler), worked by horses."¹ Details of costs are included by them—a machine of small dimensions could be erected "for about £50, which, with two horses, will thresh and dress 120 bushels of oats, or 60 of wheat, in 8 hours;" a larger machine apparently cost up to £100.² In fact Arthur Young had recorded a Mr Clarke of Belford as "very famous for his knowledge of mechanics . . . the grand machine on which he most builds his reputation, is that of one for the threshing of corn: how far it will answer has not been tried, because the machine will not be produced until a subscription is filled."³

In view of Mingay's comment that the advance of machines "for lightening some of the laborious tasks of the farm" from about the 1780's was slow, and that "only from about the 1850's did machinery become commonplace,"⁴ the existence of numerous wheelhouses in Northumberland is interesting. Fussell has noted that by 1840, "the improved farming of Northumberland and the Lothians was considered a pattern for all England, an honour shared then only by Lincolnshire,"⁵ and contemporary writers confirm the advanced nature of local agriculture by about that time.⁶

¹ J. Bailey & G. Culley, *General View of the Agriculture of the County of Northumberland*, 1797, pp. 46, 53.

² J. C. Morton, *A Cyclopaedia of Practical and Scientific Agriculture*, 1845, II, pp. 967 *et seq.*

³ A. Young, *A Six Month Tour through the North of England*, 1790, IV, p. 58.

⁴ G. E. Mingay, 'The Agricultural Revolution in English History: a Reconsideration', *Agric. Hist.*, 26, 1963, pp. 123-33.

⁵ G. E. Fussell, 'High Farming in the North of England, 1840-80', *Econ. Geog.*, 24, 4, 1948, p. 296.

⁶ J. Grey, 'A View of the Past and Present Status of Agriculture in Northumberland', *T.R.A.S.E.*, 2, 1840, pp. 51-92; T. L. Colbeck, 'On the agriculture of Northumberland', *T.R.A.S.E.*, 8, 1847, pp. 422-37.

Wheelhouse Survey and Method

From contemporary farm plans and encyclopaedias it is clear that the wheelhouse or horse-course was generally sited on the north side of the farm, adjacent to the stack-yard and threshing barn. All possible wheelhouse sites, whether round, polygonal, or square in plan, were identified from close study of all the 25-inch O.S. sheets for Northumberland, the second edition (1896-8), surveyed in 1858 and revised in 1894, being used. In practice every rural building in Northumberland's 2,018 square miles was scrutinized from the plans and a provisional inventory of sites drawn up. It was fully appreciated that such cartographic 'evidence' was not conclusive, and ice-houses and similar buildings might be confused; similarly it was considered impracticable, short of visiting every farm in the county, to check on 'wheel-sheds' or 'threshing mills' of a more orthodox rectangular shape, although these functionally identical buildings are illustrated in some farming encyclopaedias, and are known to exist in the south of Co. Durham. Prior to fieldwork it was possible to check tentative plan identification from air-photo coverage of the coalfield area.

Fieldwork as such was carried out between the spring of 1969 and the summer of 1970 by members of practical classes, and involved visits to every site in the county, necessitating weekend excursions. Standard data sheets giving details of architectural and site characteristics were compiled for each wheelhouse site and the majority of surviving buildings were photographed. In many cases it was possible to identify a demolished wheelhouse from the remains of foundations or roof timbers, as well as the opening in the barn wall through which the lying shaft had passed. In other cases farmers or farm workers were able to specify when demolition had obliterated a wheelhouse—locally known as 'gin gan'—or how often repairs or reroofing had been necessary. It is felt that very few intact wheelhouses were overlooked, although it would be surprising, in view of the number of personnel involved, if some errors had not materialized at this scale of operation.

Wheelhouse Distribution

Prior to field work, 575 sites were identified from the Ordnance Survey sheets; of these, 276 were found intact and 299 proved to have been demolished or remained unauthenticated and the distribution map (FIGURE I) differentiates between these two categories. In fact, considerable regional variation in both the design and building materials of wheelhouses was found, although this is not mapped; of the intact wheelhouses, 184 were round in plan and 92 polygonal—generally hexagonal. Roofs were most often supported by massive dressed stone columns, piers, or solid stone walls enclosing all or most of the circumference; other were supported by columns of brick, rounded stone blocks, or cast-iron. In very many cases the interstices or 'eyes' of the wheel-

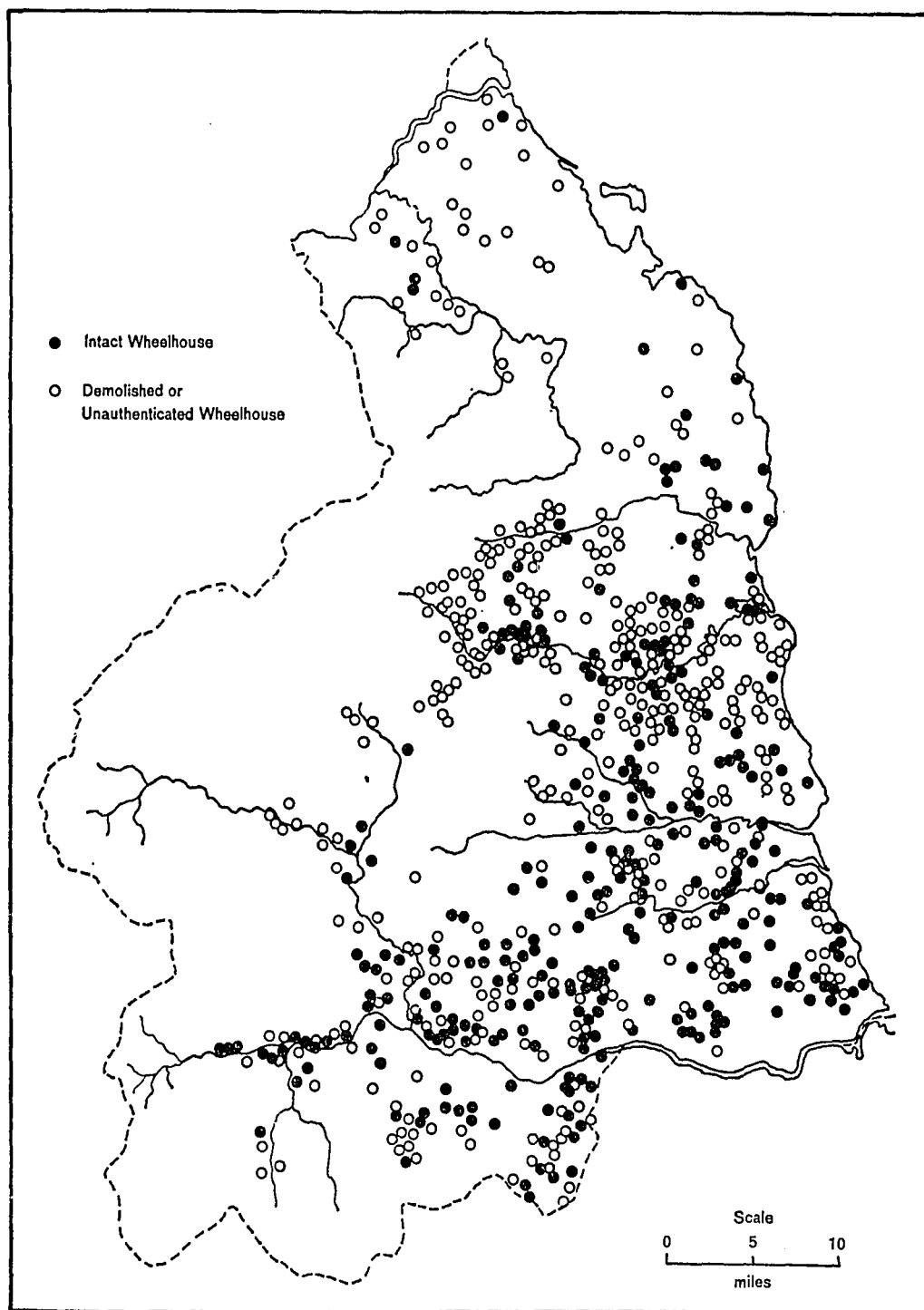


FIG. I

DISTRIBUTION OF WHEELHOUSES IN NORTHUMBERLAND IN 1969-70

house, designed to allow free passage of air, had been neatly filled in with brick or stone or more crudely blocked up with boards or corrugated iron.

The roofs are probably the most striking feature of wheelhouses, and the majority were conical or pyramidal, with a minority having five or six sides but the central roof couple linked direct with the barn by a horizontal or sloping tie ridge. The elaborate roof timbering is a feature of the sheds, the Northumbrian type often lacking the roof couple and having instead a king post supported by the main cross beam, from which the rafters radiate to the walls or piers. Harrison has commented that the faceted pyramidal roof is a "less satisfactory construction and presumably cheaper to erect."¹ A further major variation was found in the roofing materials. Presumably the earliest wheelhouses may have been thatched with straw, although none were found with this material. Red-clay pantiles, manufactured locally or imported cheaply as ballast from the Low Countries by the coal boats, were common near the coast, and necessitated a faceted pyramidal roof type. The later or more expensive structures used slates, tapered to make perfectly conical roofs. It was evident that most wheelhouses had been periodically repaired and that in the case of the large landowners, timbers were probably prefabricated in estate workshops and specialist workmen regularly 'serviced' the installations. In no wheelhouse, however, was an intact wheel located, although several had pieces such as the centre-post, horse-beams, foot-step, or the thresher. Many of the wheelhouses had been completely obliterated by later farm buildings, and no check was possible where tenants were newcomers; many gin gans were reported as having been demolished either in the 1920's or after 1960, and further demolitions are imminent due to high maintenance costs.

Wheelhouse distribution accords broadly with the areas of better soil in the county, although attention will be directed below to the crucial feature of agricultural margins. FIGURE II illustrates the major land-use regions of Northumberland, and the considerable importance of the moorland blocks, occupying some 800 square miles and penetrated by the more fertile valleys of the north and south Tyne, Coquet, Aln, and Breamish, is apparent. Indeed, the moorland fringe assumes considerable importance as a sensitive indicator of changing economic conditions in agrarian history. The greatest number of wheelhouses were apparently situated in the coastal plain and intermediate zone south of Alnwick, together with the valleys of the Aln, Coquet, and Tyne in particular; by contrast in the northern third of the county in the Breamish-Till Basin, Tweedside, and the northern coastal plain, relatively few wheelhouses were located, although this may be a function of the relative size and hence absolute numbers of farms there. It is useful to compare the distribution with the overall

¹ A. & J. K. Harrison, 'The Horse Wheel in North Yorkshire', *Bulletin Cleveland and Teesside Local History Society*, 8, 1969, 12 unnumbered pages.

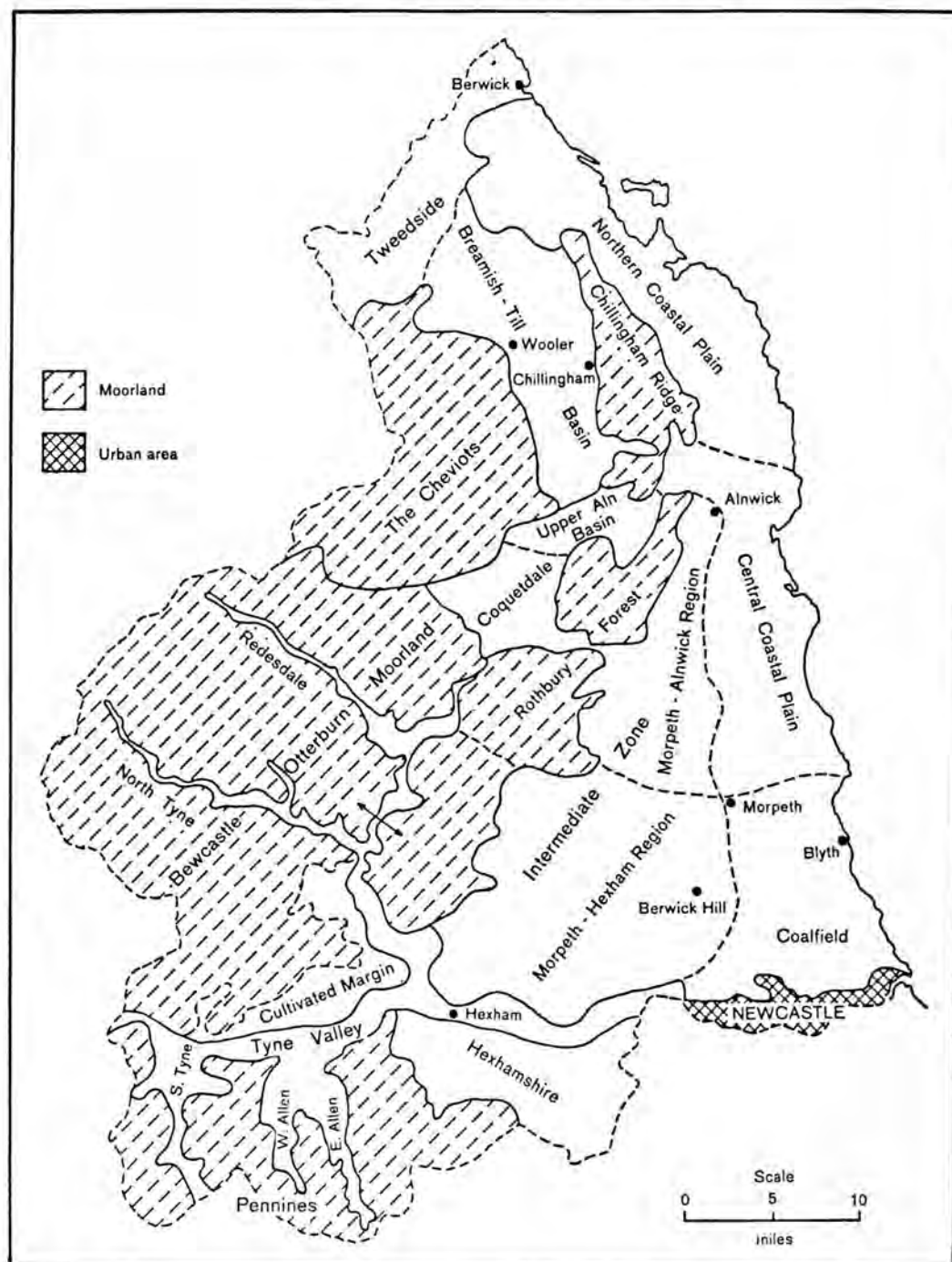


FIG. II

LAND-USE REGIONS OF NORTHUMBERLAND

density of rural settlement, however. Conzen's map of settlement morphology, for example, identifies both 'large' and 'medium or small' dispersed farmsteads in the county, and confirms the dominance of large farms in this northern area.¹ Some explanation of these regional differences may be sought in the agrarian history of a county, already noted as outstanding in the nineteenth century, for in general terms Northumberland was particularly well placed to benefit from rapid technical change and economic prosperity in agriculture. Not only were many farmers progressive, their holdings large and well organized, and their leases long, but industrial Tyneside provided a major market outlet as well as providing a source of capital and the products of engineering skill and industry.

Colbeck's designations of farming regions and land rents in 1847 are useful in any interpretation when taken in combination with modern land-use regions. From about 1770 the five-fold rotation began to transform the northern area and high rents of 35 to 45 shillings per acre were paid for the "excellent turnip soil" of the Breamish-Till Basin and Tweedside.² These dry loams formed the centre of the new turnip husbandry and sheep-fattening which superseded an earlier rye-based farming. Considerable grain surpluses were exported by sea from Berwick and Alnmouth according to contemporary records. The relatively small numbers of wheelhouses located in the area may be explained by a fundamental contrast between the northern and southern parts of the county commented on by Grey, who in 1840 described the "extensive farms" of the area along the line of the Cheviots from Whittingham to the banks of the Tweed and from Warkworth to Berwick; by contrast with the "over-small" farms of the southern parts, farms were generally of 300 to 400 acres, two or three times the county average, and ranged up to 1,000 to 1,200 acres with exceptional holdings of 2,000 to 3,000 acres.³ This bore out Arthur Young's earlier findings from a small sample, which had given the following average farm sizes in acres: Fenton (Wooler district), 500; Belford, 300; Morpeth and district, 265; Hetton (Glendale), 250; Gosforth, 225; Rothbury and district, 100; Cambo, 65; and Glenwelt (Tyne Valley), 30.⁴ The agricultural depression of the last quarter of the nineteenth century saw a conversion to stock-rearing and the scale of farm operations may have caused an unusually high number of wheelhouses to be demolished or replaced by the more costly steam-driven plant.

The Tyne Valley apart, in the southern areas the soils generally show a significant increase in their clay content, but notwithstanding these heavier conditions land prices evidently reached levels of 20 to 40 shillings an acre in 1847, albeit falling rapidly towards the intermediate zone except in the cement-

¹ M. R. G. Conzen, 'Forms of rural and urban settlement in north-east England', in *Scientific Survey of North-eastern England*, 1949, Newcastle upon Tyne, map in end-paper.

² Colbeck, *op. cit.*, p. 429.

³ Grey, *op. cit.*,

⁴ Young, *op. cit.*, p. 343.



stone vale of the Upper Coquet and Aln. The arable assault on the margins was particularly marked in this area and led eventually to the exhaustion of soils, despite the application of shell marl and seaweed; in the coastal plain of eastern Northumberland the proportion of arable land in the total of cultivated

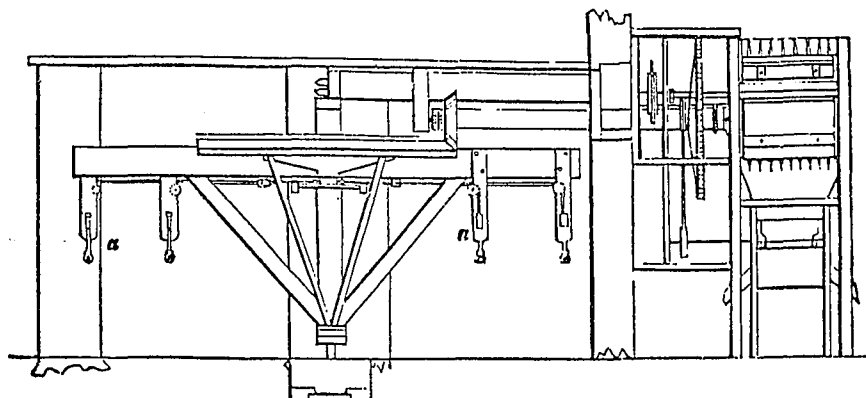


FIG. IV

MEIKLE'S TWO-HORSE THRESHING MACHINE (AFTER LOUDON)

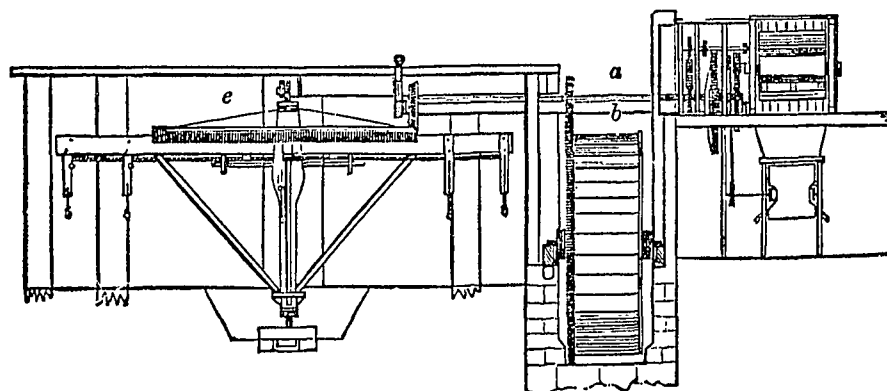


FIG. V

MEIKLE'S THRESHING MACHINE TO BE DRIVEN BY WATER OR BY FOUR HORSES
(AFTER LOUDON)

land fell, according to the Board of Agriculture returns, from 67·6 per cent to 32·3 per cent over the period 1870 to 1929, and wheat, hitherto the dominant grain declined from 8·7 per cent to 0·2 per cent of the total over the same period.¹ The irregular boundary of arable farming, particularly over marginal soils towards the south and west is shown in FIGURE III. Farms were notably

¹ C. J. Knell, 'The evolution of Northumberland's agriculture', unpublished dissertation, Dept. of Geography, Univ. of Newcastle upon Tyne, 1970.

smaller, although rents in 1847 were in the range 30 to 60 shillings per acre, and the Tyneside market provided a ready outlet for bread grains, vegetables, meat, and dairy products.

An interesting aspect of the distribution pattern today is the relationship of wheelhouses to marginal areas. In Figure III the area above the 500-foot contour and the 30-inch isohyet have been superimposed on the county map to separate those wheelhouses situated in areas marginal to agriculture today. In terms of the limits of cereal cultivation, the considerable number of wheelhouses revealed may be taken as evidence of the way high grain prices induced farmers to advance their grain fields to the altitudinal and ecological limits. Not only were the valleys penetrating the Northumbrian moorlands and the northernmost Pennines ploughed up, the heath itself was temporarily burned and cleared.

An equally remarkable decline in the total arable acreage of Northumberland is apparent in official returns: land under tillage in 1866 fell from 327,165 acres to 133,771 acres in 1939, recovering to 186,600 acres by 1969.¹ By comparison, today's outer margin of cultivation, according to J. W. House, "has been well maintained, even extended upwards since the 1930's by a policy of price supports and subsidies to the hill and marginal farmer,"² whereas these areas in the nineteenth century were well beyond the threshold of unstable equilibrium and no political intervention or subsidy counteracted their unprofitability once grain prices fell significantly.

More detailed Board of Agriculture returns show a fall in the percentage of cultivated land under corn crops in the highly critical period between 1870 and 1890: in the coastal plain the decline was from 33 to 23·6 per cent, in the moorland areas from 6 to 2 per cent, in the cultivated uplands from 16·0 to 5·8 per cent, in the Cheviot Hills from 28·1 to 19·5 per cent, and in the Breamish Till Valleys from 33·6 to 29·1 per cent.³ This retreat or instability was clearly proportionally greatest in the moorland and cultivated upland areas, and FIGURE III does show the particularly heavy concentration of wheelhouses on the moorland fringe north and south of Hexham and in the upper sections of the Aln and Coquet. Most of these farms are today involved wholly or largely in non-arable activities and the upper reaches of the Wansbeck, Coquet, and Aln are conspicuous for the large proportion of demolished wheelhouses. The diffusion of wheelhouses to these unlikely areas is made the more remarkable in view of Loudon's comment that threshing machines were justified where the extent of tillage required two or more ploughs and by the size of investment

¹ L. D. Stamp, *The Land of Britain. Part 52—Northumberland*, 1946.

² J. W. House, 'Margins in regional geography: an illustration from north-east England', in *Northern Geographical Essays*, 1966, Newcastle upon Tyne, pp. 139-56.

³ Knell, *op. cit.*, p. 20.

involved: assuming a sevenfold reduction in purchasing power since 1800, a wheelhouse and thresher might well have cost in the range £500 to £1,500 at current prices—an outlay comparable with the cost of a modern grain silo.

The altitudinal location of these wheelhouses and wheelhouse sites, summarized in the table below, indicates that of the intact wheelhouses no less than 54 of the round type, or approximately 29 per cent of their total, plus 18 of the polygonal sort with 19 per cent, are situated above 500 feet. The figure for demolished wheelhouses or unauthenticated sites rises to 103, or over 34 per cent of the total. In aggregate therefore, around 175 of these farm sites are located in what are today highly marginal to semi-marginal agricultural areas.

TABLE I
ALTITUDINAL ZONES OF WHEELHOUSES IN MARGINAL AREAS

<i>Altitudes:</i>	<i>500-599 ft</i>	<i>600-699 ft</i>	<i>700-799 ft</i>	<i>over 800 ft</i>
Intact Wheelhouses:				
Round	24	21	8	1
Polygonal	12	4	1	1
Demolished Wheelhouses	49	32	14	8
Totals	85	57	23	10

Conclusions

Although these notes are intended primarily to place on record the outcome of a fieldwork survey, they also suggest further lines of enquiry. To investigate a technical innovation it is necessary to identify not only all potential adopters by also such diffusion centres as estate workshops or agricultural engineering works in the county and adjacent areas. Dating of wheelhouses is rendered difficult by the repairs and renovations that have occurred since they were first built, and requires detailed study of documentary evidence such as estate and farm records and accounts. It seems likely that a dominant role was played by the major landowners, but the influence of agricultural societies and their publications was probably considerable. Any detailed study of the regional pattern of farm ownership, land rents, and farm size might reveal significant statistical correlations with the phases of wheelhouse building leading to a saturation stage when the majority of grain-producing farms had adopted the invention.

A further subject for enquiry is presented by the pattern of wheelhouses in so far as this indicates 'relict agricultural margins'. In aggregate their distribution depicted in Figure III might be tested as evidence of what have been

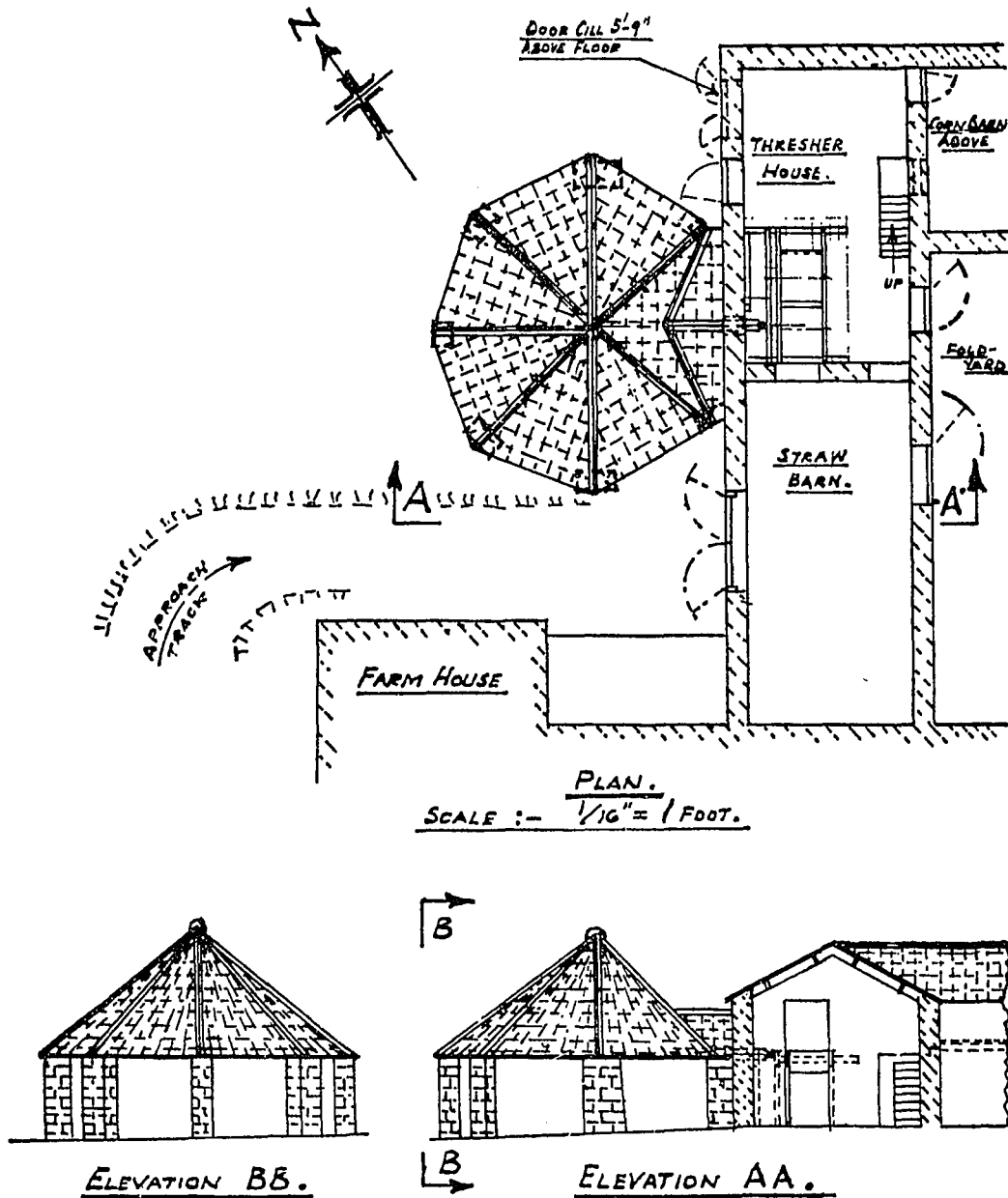


FIG. VI

PLAN AND ELEVATION OF FOUR-HORSE THRESHING PLANT AT BERWICK HILL,
SOUTH NORTHUMBERLAND (H. BEAVIS)

termed "detectable landscape margins." Such interrupted margins are physical evidence of changing patterns of land use, and in particular the marginal economic utility of a specific farm and ecotope. As J. W. House has observed, "in the freer working economy of past times margins shifted with changing technology and demand; some became stranded as relict margins of worked-out resources."¹ In this context an apparently insignificant farm building can assume a useful role in explaining something of the process of historic agricultural innovation as well as fluctuations in the boundaries between unstable forms of land use and the circumstances which caused them to become stranded as incongruous relics.

¹ House, *op. cit.*, p. 144.

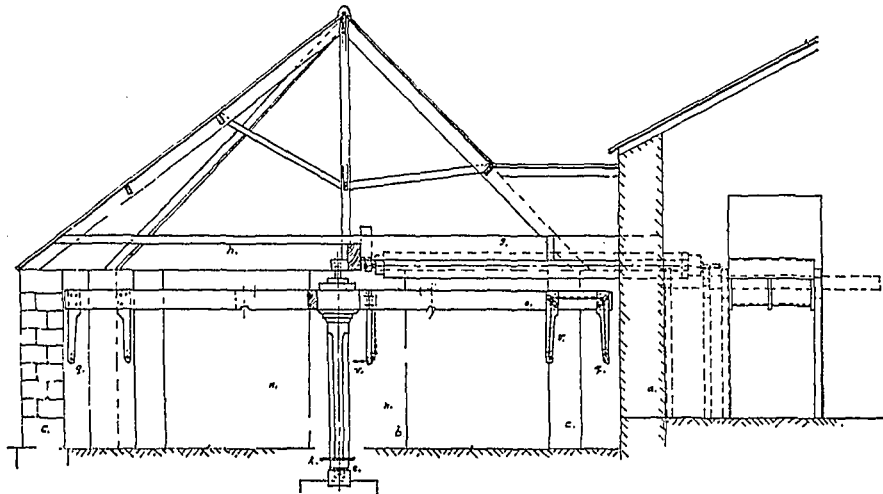


FIG. VII

SECTION THROUGH BERWICK HILL WHEELHOUSE