

# AGRICULTURE AND THE EFFECTS OF FLOODS AND WEATHER AT BARNHORNE, SUSSEX, DURING THE LATE MIDDLE AGES

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The muniments of Battle Abbey, so aptly described by Lower as "a perfect treasury of local topographical literature"<sup>1</sup>, include a great number of charters, account rolls and other documents relating to the manor of Barnhorne, a "home farm" of the Abbey lying in the parishes of Bexhill and Hooe in Sussex. The few sources for the period before 1350 are more than amply compensated by the richness of the material covering the late fourteenth and fifteenth centuries<sup>2</sup>. Sequences of accounts long enough to establish the rotation of crops and other agricultural matters have not commonly survived and information concerning farming in the late middle ages, a period when most large estates were leased, is particularly deficient. For these reasons the exceptionally well documented agriculture at Barnhorne is of considerable interest. Covering the period from 1332 to 1495 are 101 account rolls, including 74 relating to the fifteenth century. Outstandingly informative of these is the almost complete series of rolls covering the years 1382-1388 and 1397-1420 which contain particulars on the dorse of the actual fields sown. These, and the other documents, have been examined for evidence of the interaction between the agricultural activities on the demesne and changes in the relationship between land and sea and in weather conditions.

Barnhorne, as the second element of its place-name signifies<sup>3</sup>, is sited on a horn-like protusion of upland which projected into the

<sup>1</sup> M. A. Lower, *A compendious history of Sussex* (1870) vol. 1, p.34.

<sup>2</sup> All but eight of the ministers' accounts of Barnhorne manor are deposited in the Henry E. Huntington Library, San Marino, California. A check list of the Battle Abbey accounts in this institution was made by E. Swift, "Obedientary and other accounts of Battle Abbey in the Huntington Library," in the *Bulletin of the Institute of Historical Research*, 12(1934) pp. 83-101. The remaining accounts, long separated from the main collection, are now in the East Sussex Record Office (E.S.R.O.) ADD.MSS. pp. 4928-4935. The main collection of charters and deeds (listed by Thorpe) is also in the Huntington Library; a smaller collection forms part of the Fuller Papers deposited in the University of London Library. I am greatly indebted to Mr. W. E. Fagg, Reader in Palaeography, University of Durham, for making available to me photostats of the accounts in the Huntington Library and to Mr. C. Holland, Archivist, East Sussex County Council, and his staff for generously providing facilities for their study.

<sup>3</sup> A. Mawer and E. M. Stenton, *The Place Names of Sussex* (1929-30), English Place Name Society, vol. 7, part 2, p. 490.

shallow waters and marshes of the wide bay which formerly existed at Pevensey. This peninsula of firm ground is severed from similar land in Hooe to the north by the wide alluviated valley which contains the large marshy hollow called Barnhorne Pond, inadequately drained by the East Stream. Since the floor of this valley is not above four metres above present Ordnance Datum it was probably a tidal creek as late as the Roman period. On the southern margin of the "horn" is an old shoreline, well marked by cliffing at the edge of Dennetts Marsh, from which the sea had probably retreated by the early Saxon period allowing the accretion of the salt-marsh which figures so much in the early manorial history.

The Battle Abbey estate at Barnhorne<sup>1</sup>, which was held in severalty, stretched for more than a mile in each direction from the *curia* located at the present Barnhorne Manor Farm (G.R. 699078). An earlier site of the manor house and farm buildings lay further to the east at the site named Old Town field. The move to a new site, which had taken place before 1305 when *Oldeton* is first mentioned<sup>2</sup> probably followed the successful reclamation and cultivation of such important marshes as Stottismarsh and Lose marsh (Fig. 1) which would have been inconveniently reached from the original settlement. In 1433 only one cottage (and that un-let) existed at Old Town<sup>3</sup> compared with a cluster of tenants' dwellings at the new site.

The very varied soil and drainage conditions which obtained on this estate are clearly distinguished in an extent of 1305.<sup>4</sup> Meadow was valued at 18d. an acre. Accounted the best arable land was the reclaimed salt-marsh (*terra maritima*) rated at 12d. an acre. The best of the upland fields (*terra susana et campestris*) was valued at 6d. an acre and the remainder at only 3d. The brookland (*terra brocal*), land liable to be seasonally inundated but generally capable of spring sowings or fit for mowing, was valued at 4d. an acre but "potentially worth 10d. an acre if competently drained." Additionally, there was a little heathland and wood<sup>5</sup>. The Abbey's tenants had rights of common pasture in *Codyngdune* (Cooden

<sup>1</sup> The nucleus of the estate can be identified with the three hides granted by Offa to Bishop Oswald in Barnhorne in the eighth century. (Anglo-Saxon Charter BCS 208, printed by E. Barker, "Sussex Anglo-Saxon Charters," in *Sussex Archaeological Collections* (S.A.C.), vol. 86 (1947), pp. 92, 94). The estate, like all ecclesiastical estates, was augmented by gifts and corrodies (Fuller Papers, University of London) and a further 90 acres of the demesne was held of the Bishop of Chichester (P.R.O. E. 315/57).

<sup>2</sup> P.R.O. E.315/57.

<sup>3</sup> P.R.O. E.315/56. Mr. A. J. F. Dulley tells me, in a private communication, that the grass-covered remains of buildings have been observed at Old Town. Sandhurst Road was the main road to Battle from the old site (E.S.R.O. Dunn MS 507).

<sup>4</sup> P.R.O. E.315/57.

<sup>5</sup> The heath was probably at *Pigglinde Dune* (Pickhill). Huntington Library, Barnhorne Charter IIII (C.1210-28).

Down) and on an adjoining common called the Slyder<sup>1</sup>. A territorial reconstruction of the demesne lands has been made with the aid of references to the bounds of the medieval fields in the account rolls and in the 1433 rental. The approximate site of other fields has been ascertained by means of field-names preserved on manuscript estate plans<sup>2</sup>. The likely location of the fields is indicated on Fig. 1.

#### *Arable husbandry at Barnhorne*

The cultivation of this land will now be considered. The soils of the Sussex High Weald, in which region Barnhorne lies, have never been valued very highly and except on specially treated fields cultivated ground quickly becomes foul and exhausted and requires periods of rest. The upland soils at Barnhorne are derived from the clays and sands of the Hastings Beds and tend to form heavy land since the sandier formations are exceedingly fine-grained and thus behave from a farming point of view more like a clay. They are naturally deficient in plant nutrients and in the past, even more than now, their cultivation was extremely dependent on weather conditions at the times of ploughing and sowing<sup>3</sup>. From the sixteenth and seventeenth centuries, when the character of the regional farming can be discerned in outline by means of inventories of personal estate and contemporary descriptions of agricultural writers, convertible husbandry has been practised<sup>4</sup>, the length of a ley in a particular field being determined by such physical factors as the nature of the soil and drainage and by other considerations such as the amount of field dressing applied. At certain times, notably under the stress of war, the amount and frequency of tillage has increased with detrimental results<sup>5</sup>, and Wealden farmers in East Sussex are still advised that "many years of continuous arable cropping bring about a serious deterioration in soil structure and a marked lessening of response to fertiliser. Frequent spells of long ley are the only answer."<sup>6</sup>

That this system of farming is not likely to have been an innovation of the sixteenth and seventeenth centuries is suggested by the

<sup>1</sup> Huntington Library, Barnhorne Charter C.135r.m. 48; P.R.O. E.315/56.

<sup>2</sup> E.S.R.O. Battle Abbey estates manuscripts; Barnhorne estate maps, 1724, 1788, 1811 (uncalendared).

<sup>3</sup> W. Topley, *The Geology of the Weald* (1875), p. 249; A. D. Hall and E. J. Russell, *A report on the agriculture and soils of Kent, Surrey and Sussex* (1911), pp. 131, 135-137; S. W. Wooldridge and F. Goldring, *The Weald* (1953), pp. 114, 116.

<sup>4</sup> Gervase Markham, *The enrichment of the Weald of Kent* (1636 edition). (Markham's work was also intended to relate to the Weald of Sussex). He noted that the soil of the Weald was generally "a fleet and shallow mould . . . (which) will faint and give over after a crop or two; for which reason also it cannot yield any sweet or deep grass" (p.6).

<sup>5</sup> W. Marshall, *Rural economy of the Southern Counties* (1792), vol. 2, p.102. The Rev. Arthur Young, *A general view of the agriculture of Sussex* (1808 edition), p. 461.

<sup>6</sup> W. J. Dalton, in *Agriculture*, vol. 60 (1954), p. 493.

TABLE 1 CROPPING AT BARHORNE 138

	1382	83	84	85	86	87	88	1397	98	99	1400	01	02
Wellonde	15 W 17 B	39 B	24 B 3 P	14 W 15 B	16 W 11 B	W B	W			W	Be P O	W	Be O
Punden		30 W		14 W	6 O 6 B 5 Be		W	W		O	W	Be P O	W
Furneys	14 O	25 W	12 Be				Be					W	
Berkham			30 W 10 Be	40 O	37 O			W		Be		W Be	Be O
Plyme	10 O	15 W	6 Be 8 O										
Oldtown	20 O		30 O										
Fletmarsh	54 W	80 O	60 O										2 P
Stottismarsh											Be O	W O	Be 1400
Losemarsh	3 P		30 O	22 Be 6 P	25 O					W			
Caldecot	O		6 R	6 R	8 O		B						
Pavyland			14 W				O			O			
Pavymarsh			30 W	} 38 O	} 33 W		20 Be W O	B		Be P			
Mellefeld	} 25 O						7 R						
Rede							20 O						
Pondelond	12 O †												
Hofeld											O		
Whitdenne				50 O			O						
New Marling													
Densex Marsh	5 W			5 W	5 Be						W	Be	W
Pondfeld Marsh								11 Be					
Robtes Marsh							Be						
Bylhamsgotiemarsh													
Squyersmarsh													
Hoo Brooks	} 30 O										W O	O	
Bremsley													
In Divers Fields		27 O											
In Marshes													
Saltlonde*	2 Be												
Marchaleslond*	30 Be	27 Be											Be

\* In Pevensey parish  
† Including Caldecot

W—Wheat; B—Barley; O—  
L—Wet.

1388 and 1397-1420

04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
		Be	W		W O			W	O	W Be O	W Be	Be		W	O	
	Be O	W			O					O	W	O	W	O	W	O
					W		W						O	W	O	
					W		W O	O	W Be O	O						
Be	W				W		O	Be	O	W				O	O	
	O												O	O	O	
Be O	W	O	W						O	W O	Be O	44 W	Be	W	10 Be O	
	Be	Be	Be 20													
		W			O			W	O		W		W	O	W	
		W	O		O				W		O	O	WBe	W	O	O
		} O	O													} O
W	W O	L	L		L		L	L	L	L	L	L	L	L	L	L
W					O		Be			W			W			
					12 Be		Be									
								Be								
O	O	O	O													
																50 W Be
							W O	W O		Be		Be	O	O		

s; R—Rye; Be—Beans; P—Peas and Vetch.

Figures refer to acreage sown.

growing evidence of medieval practice in the Sussex Weald which is essentially similar in its basic principles to later husbandry. At Alciston the intermittently cultivated fields on the Upper Greensand and Gault formations and their very flexible rotations have already been discussed by the present author<sup>1</sup>. At Chalvington, on the Lower Greensand and Weald Clay formations, convertible husbandry is documented from 1295 and prevailed throughout the fourteenth and fifteenth centuries<sup>2</sup>. Information as to farming practice in the High Weald in the late Middle Ages is scanty and obscure<sup>3</sup> and the Barnhorne evidence is the most illuminating.

The details of farming provided by the account rolls of Barnhorne manor are not so meticulously detailed as in the Westerham series<sup>4</sup>; nor are field names recorded over so long a period as in those accounts. Nevertheless, during the period between 1382-1388 and 1397-1420 when the sequence of accounts extant is almost complete, the sowing of twenty-six fields are carefully recorded on the grange exits and these particulars afford valuable information as to rotations. In the use of these sources by the present writer the omission of a reference to a field in a particular account, either as a sown field in the grange exit or as a letting on the obverse of the roll, is taken as an indication that the field was in a state of bare fallow or remaining in ley.

In the rotations of crops disclosed by the account rolls, the basic principle of modern ley farming—the movement of the plough round the farm—is clearly apparent (Table 1). A field was sown for several years “until it ran out” and the land was allowed to tumble down to grass so as to recover and be capable of again bearing corn whilst a similar breach was made into the pasture elsewhere. Some details of the cropping deserve special comment. The three-course system of husbandry so wide-spread in medieval England, and practised on the main arable fields at Westerham, was not a feature of the husbandry at Barnhorne during the period under review. There was, however, a fundamental distinction made between land

<sup>1</sup> P. F. Brandon, “Arable farming in a Sussex scarp-foot parish during the late middle ages,” in *S.A.C.* 100 (1961), pp.67-69. See also P. F. Brandon, *The Commonlands and Wastes of Sussex*, unpublished Ph.D. thesis, University of London, 1963, pp. 253-4.

<sup>2</sup> E.S.R.O. CH.247. See also P. F. Brandon, thesis cited, pp. 250-254.

<sup>3</sup> A similar form of convertible husbandry to that under discussion, with frequent recuperative breaks, seems to have been practised at Ticehurst in the fifteenth century. A lease dated 10th October, 1483 (the eve of Old Michaelmas) includes restrictive husbandry covenants of a remarkably modern style designed to prevent a tenant “skinning” the land. These included provision against the sowing of oats on any field more than two years successively and, in the last two years of the seven-year lease, the ploughing of meadows was prohibited, wheat was not to be sown and a specified maximum acreage of oats was prescribed. One field was to be enriched with marl. E.S.R.O. Dunn MS 246.

<sup>4</sup> T. A. M. Bishop, “The rotation of crops at Westerham, 1297-1350”, in *Economic History Review*, 2nd ser. vol. 9 (1938), pp. 38-44.

near the *curia* and the barns which was in receipt of the main manure dressings and under frequent tillage and the other fields, which in varying degrees, were irregularly cropped. The first group of fields, which Bishop styled *infields*, is represented at Barnhorne by the Wellonde and Punden fields cropped 22 and 19 years respectively out of the 28 years covered by the detailed accounts. The cropping arrangements of Wellonde were obviously extremely flexible, a large part, for example, must have been under three successive barley crops between 1382-1386. On Punden the custom was to rest the land for wheat throughout the period by means of the wheat-fallow-wheat or wheat-oats-wheat rotation so much despised in the Weald by eighteenth century writers<sup>1</sup>, the sowing of oats to alternate with wheat in the decade 1410-20, instead of fallowing as in the 1380's, being probably a response to rainier summers and the sharply deteriorating condition of the marsh<sup>2</sup>. The remaining fields fell into two groups. One set of fields comprised the upland and marsh-land valued as high quality arable land in 1305. These fields were typically cropped for three to five years in succession and left to recuperate for a similar period. A further group of fields formed only occasional tillage ground, being under pasture for more than eight years in ten and usually ploughed for an oat crop only when it was necessary to restore the sward. On remoter fields, such as Whitdenne and Gotham, this happened only once or twice in a generation. Farming on such land thus took the form of "temporary cultivation snatched at intervals from the waste and pasture" and is strikingly similar to that of wet and hilly districts such as Pembrokeshire, Cornwall and Devon in the sixteenth and seventeenth centuries.

Although the husbandry at Barnhorne is distinguished by a marked empiricism it was far from being haphazard or devoid of a coherent practical basis. On the contrary, the standard farming techniques of the Barnhorne bailiffs in the late middle ages anticipate by more than two centuries the accepted farming principles of Wealden farmers in the seventeenth century. Such practices as the sowing of oats or beans on freshly broken ground; the sowing of oats, beans or peas as a preparation for wheat; the sowing of beans after wheat and a final crop of oats, in Fitzherbert's phrase, "a great breeder of grass," all extolled as sound husbandry by sixteenth century and later writers were normal practices at Barnhorne in the late middle ages. Furthermore, some of the crop rotations were identical to those adopted in the Weald in the seventeenth century. Thus land then brought under cultivation on the cold clays near Ashford in Kent was sown with oats (or beans) and the rotation followed the course of fallow, wheat, oats (or beans), fallow and wheat after which crop the land was exhausted and it was laid down

<sup>1</sup> The Rev. Arthur Young, *op. cit.*, p. 70.

<sup>2</sup> This aspect is considered further below.

for ten or twelve years before being converted again to tillage<sup>1</sup>. Gervase Markham, the best known of the seventeenth century writers on the Weald, advocated rotations for different soils. That recommended for a "reasonable good sandy mould" was: oats, wheat, beans, wheat (or fallow if the preceding summer was dry) followed by a rest of five to six years; alternatively freshly broken ground could be marled for wheat and then followed by pulses and wheat to be rested as before. Another of Markham's suggested rotations, that suitable for poorer land, was: wheat, fallow, wheat followed by a rest of five or six years<sup>2</sup>. Similar rotations can be identified on Berkham, Caldecote, Fletmarsh, Furneys and Wellonde between 1382 and 1420 and it thus seems likely that Markham was consolidating the accumulated experience of generations of Wealden farmers rather than publicising any major innovations or experiments in techniques.

A trend in arable farming at Barnhorne was the elimination of several crops in the late fourteenth and fifteenth centuries which had been normally sowed at an earlier period<sup>3</sup>. The solitary account roll which gives full particulars of sowings before the Black Death enumerates no less than eight different crops. Wheat and oats occupied 60 per cent of the sown acreage, the acreage under wheat being slightly the larger; pulses and legumes (beans, peas and vetch) covered 21 per cent of the sown land; and, in addition, there were small crops of barley and rye and a considerable acreage of dredge corn. It was also normal to make a small sowing of winter oats (*avena hyemal*),<sup>4</sup> as distinct from the main spring oat sowing, in the mid-fourteenth century.

This polyculture was severely curtailed on the demesne during the late fourteenth and early fifteenth century. The dredge corn and rye, about two-thirds of the pulses and one-third of the oats were being consumed as livery in the second half of the fourteenth century by the Barnhorne servants working the demesne. Further sowings of winter and spring oats and pulses were necessary to fulfil obligations to corrodians. These renders of produce in kind were steadily reduced in favour of increased money payments and the reduction in the farm servants in consequence of the increasing pastoral bias also

<sup>1</sup> R. Lennard, 'English agriculture under Charles II: the evidence of the Royal Society's "enquiries"', in *Economic History Review*, vol. 4, (1932), p. 44.

<sup>2</sup> Gervase Markham, *op. cit.*, pp. 9, 19.

<sup>3</sup> This reduction in the variety of crops sown in the fifteenth century has also been noted by F. M. Page on the estates of Crowland Abbey. F. M. Page, *The estates of Crowland Abbey* (1934), p. 118.

<sup>4</sup> In thirteenth century charters reference is made to the rendering of winter sown oats to corrodians from the feast of John the Baptist 24th June. (Fuller MSS. 19). This suggests that the harvest was considerably earlier than at present for which the more sustained warmth of the thirteenth century may be partly responsible. H. H. Lamb, "Britain's changing climate," in *Geographical Journal*, vol. 133 (1967), p. 453.



contributed to the reduction of crops used for livery. This gradual abandonment of livery renders can be charted from the account rolls: period dredge corn was not sown after 1346; winter oats not after 1354; vetch was not regularly sown after 1369 when the crop was lost to floods; the last extant record of rye is in 1388; peas were a very exceptional and minor crop after 1402. The beans livery, mainly responsible for a considerable acreage of very precarious marshland arable with fluctuating and often derisory yields, was abolished altogether in 1444. The fate of the legume sowings at Barnhorne is especially significant. These declined in the fifteenth century to become merely minor sowings and disappeared altogether in the last thirty years of the Abbey's direct management of the estate thus suggesting that the legumes were not valued primarily for their nitrifying properties. Indeed, although small sowings of legumes were made in the main arable fields, and formed part of a rotation, the bulk of such crops were taken off the marshes until the deteriorating nature of the arable there made this an impossibility. The very substantial savings in labour resulting from this policy of curtailing liveries can be instanced from the situation in 1368/69, a typical year, when it can be calculated that about one quarter of the arable acreage at Barnhorne was used for liveries to the eleven servants in receipt of them. Even in 1400-01, by which time the arable was being reduced, nine farm staff were being supplied with weekly liveries of oats and beans which required a sowing of about 50 acres of land (21 per cent of the total sown acreage).

Several methods of artificially increasing fertility were practised at Barnhorne but none of them were in frequent and regular use in the late fourteenth and the fifteenth centuries. This lack of improvements, which is fully consistent with similar neglect in the Weald at this period,<sup>1</sup> contrasts strongly with the generous and hence expensive applications of marl and lime on Sussex estates in the thirteenth and early fourteenth centuries, when the pressure on land was so much greater<sup>2</sup>. Marling, which is only occasionally mentioned in the account rolls after the Black Death was of very local provenance and this suggests that the Wadhurst Clay, a local subsoil which contains a high proportion of calcium carbonate, was applied to some of the lighter lands. Reference is also occasionally made to the use of chalk or lime (*calciata*) but it is clear that most of the upland was not in receipt of any dressing for several decades at a time, a policy which was not unprecedented in Kent in the seven-teenth century<sup>3</sup>. The form of soil improvement of most interest, because of its regional distinctiveness, was that of laying oozy ditch sludge on pasture to be freshly broken for tillage. This practice,

<sup>1</sup> J. Norden, *The surveyor's dialogue* (1607), p. 226; G. Markham, *op. cit.* (1625 edition), p. 4.

<sup>2</sup> E.S.R.O. CH. 248 and 250 (Chalvington manor, 1337/8 and 1346/7).

<sup>3</sup> R. Lennard, *op. cit.*, p. 35.

known as sleeching in East Sussex, was a common seventeenth century custom in the Pevensey Levels and similar marshlands<sup>1</sup> by which time the custom was of ancient origin since "slychyng" is recorded at Barnhorne from 1401.

*The ravages of the sea*

The great value of Barnhorne to the Abbey lay not only in its proximity to Battle but also in the possibilities it afforded for the reclamation of the sea marshes in the fast silting bay of Pevensey. Abbot Ralph (1107-1124) was quick off the mark as a reclamer and improved a parcel of marsh "at much labour and expense with houses, cultivation and a mill"<sup>2</sup> but the subsequent stages of reclamation are almost unrecorded but evidently still incomplete in the mid-thirteenth century as is indicated by the grant to the Abbey of a wall and ditch "together with whatever can be acquired from the sea adjacent"<sup>3</sup>. By this time, however, the sea-marshes of the estate had largely been reclaimed<sup>4</sup> but salt-works still survived to the early thirteenth century at the head of the Waterlot Stream (*Fletum de Hooe*). The grant to the Abbey of "land called Denne and two salt-works in the marsh" (ante 1212) can probably be identified with *Denysmarsh* (Dennetts marsh) at *Tonlegh* (Stone) Bridge near low mounds in a field called Salts in the Hooe Tithe Apportionment which are thus likely to be the remains of the salt-works<sup>5</sup>.

The ten charters extant which relate to the drainage of these newly reclaimed lands between c.1210 and 1310 testify to the acute difficulty the Abbey encountered in maintaining adequate water control in the face of the rising sea level and increased storminess in the thirteenth century. Two tidal channels existed into which water from inland parts could be discharged. One was Pevensey Haven into which debouched most of the natural drainage of the Pevensey Levels<sup>6</sup>. The other was the *Meneflete*, a shallow, tortuous creek, at the head of which was the minor port of Northey<sup>7</sup>, a limb of Hastings. The present East Stream is probably the precursor of this medieval channel.

The earliest charter relating to drainage extant (c.1210-1224) provided for the drainage of the Abbey's lands by a waterlode sixteen

<sup>1</sup> E. Kerridge, *The agricultural revolution* (1967), p. 134. E.S.R.O. Dunn MSS. 960. (Etchingham).

<sup>2</sup> M. A. Lower (ed.), *Chronicon de Bello* (1851), p. 116-122.

<sup>3</sup> Huntington Library, Barnhorne charter 1147.

<sup>4</sup> This can be inferred from the early thirteenth century drainage agreements discussed below.

<sup>5</sup> Huntington Library, Barnhorne charter 1503. The grantor, Stephen de Esburneham, died c.1212. (*Victoria County History, Sussex*, vol. 9, p. 127). A. J. F. Dulley has drawn attention to the mounds. See 'The level and port of Pevensey in the Middle Ages,' in *S.A.C.* vol. 104 (1966), pp. 28-9 and map.

<sup>6</sup> L. F. Salzman, 'The inning of the Pevensey Levels,' in *S.A.C.* vol. 53 (1910), p. 37.

<sup>7</sup> Huntington Library, Barnhorne charter 873.

feet wide through the marshes of the manor of Hooe, then administered by the Priory of Ogbourne, a chief cell of the Abbey of Bec, "as far as the sea"<sup>1</sup>. Since the lands of the manor of Hooe lay to the north and west of Barnhorne and Northey the waterlode concerned must be the stream now called the Waterlot which was then probably taking the main drainage from Barnhorne Pond and flowing out at Pevensey. The remaining drainage charters deal with the evacuation of water by means of *Meneflete* and by drains in Cooden to the east of it. The earliest agreements (c. 1235-c. 1248) provided for the drainage of the sea marshes by means to two exits: one by "the old drain of *Codynge*,"<sup>2</sup> probably to be identified with the Crooked Ditch which was to be widened and scoured and to debouch into the sea at a new outfall; the other was by means of a new sluice and drain near Chapel Bridge at Northey into *Meneflete*.<sup>3</sup>

These drainage arrangements seem to have worked satisfactorily until the great storms in the latter part of the thirteenth century. Thereafter new developments are discernible, the most notable being that the Pevensey outfall lost its former importance as an outlet for the Abbey's lands. This can be inferred from agreements of 1305 and 1310 which permitted the Abbey to "drain all their sea-marshes and brooklands" to the *Meneflete* which was to be newly scoured.<sup>4</sup> This preference for a more direct and a more easterly route to the sea is fully in keeping with the silting which is known to have arisen at the Pevensey outfall<sup>5</sup> a circumstance which can probably be explained by the inning of the tidal lands and the general eastward movement of shingle along the Channel coast. These physical problems seem to have been exacerbated by the building of a new dam and sluice at Pevensey which the Abbot of Battle maintained would cause frequent inundations of fresh water on neighbouring lands<sup>6</sup>. Although a Commission was appointed to make an investigation of these new works, with powers to remove them, this does not appear to have been done<sup>7</sup>, and the Abbot's negotiations which led to the use of the *Meneflete* as the main drain for the Barnhorne estate were probably his response to what he considered to be ill conceived attempts to improve the Pevensey outfall. That the *Meneflete* entrance was similarly choked by the early fourteenth century is suggested by the provision in 1305 for a new sluice and

<sup>1</sup> Huntington Library, Barnhorne charter 1130.

<sup>2</sup> Huntington Library, Barnhorne charter 720.

<sup>3</sup> Huntington Library, Barnhorne charter 873.

<sup>4</sup> Huntington Library, Barnhorne charters 695 (dated 1305) and 710 (dated 1310).

<sup>5</sup> Pevensey Haven was suffering from silting as early as 1207. A. J. F. Dulley, *op. cit.*, p. 40.

<sup>6</sup> Calendar of Patent Rolls, Edward I, 1281-1292, p. 404.

<sup>7</sup> A. J. F. Dulley, *op. cit.*, p. 32.

drain to take water through the marshes of *Estwrenham* to a more direct outfall<sup>1</sup>.

It is now well known that the Saxo-Norman marine regression which had encouraged the colonisation and cultivation of marshes in the North Sea Basin and the English Channel was followed by a fall in the relative level of land to sea which led to a submergence, particularly marked in the fourteenth and early fifteenth centuries when it was associated with increased storm-tide frequency<sup>2</sup>. This necessitated the embanking of rivers, the heightening of sea walls and the cutting of new dykes, tasks which proved beyond the capacity of a medieval society devastated by recurrent pestilences and famines and in consequence many settlements and much marshland was abandoned to the sea and valuable turbaries such as those of the Norfolk Broads were flooded. Along the coast of Sussex early "forerunner" floods such as the "great flood" at Appledram in 1274-5<sup>3</sup> were manifestations of a rapid submergence leading to the great storm of 1287 which destroyed Old Winchelsea, was responsible for severe flooding in the Pevensy Levels and along the coast of Kent<sup>4</sup>, and required special measures to protect winter corn at Bosham<sup>5</sup>. Thereafter the coast was never free of flooding for long but at the turn of the fourteenth century there seems to have been an interlude free of severe inundations which permitted the restoration of marshland. This interlude was rudely ended by the severe flooding still recent along the whole length of Sussex and Kent in 1331-2<sup>6</sup> and the coasts of eastern England and the lower reaches of rivers emptying into the Wash and Humber were overwhelmed at the same time. This great flood ushered in recurrent inundations during the 1330's and 1340's and for Sussex the damage resulting at this period is clearly recorded in the Nonae Rolls of 1341<sup>7</sup>.

The Battle Abbey marshes and brooklands at Barnhorne and Hooe seem to have survived these early fourteenth century calamities remarkably well. The earliest ministers' accounts extant give evidence of minor damage resulting from the "great gale" of 1333-1334 and the floods of 1345-6 but the general well-being of the

<sup>1</sup> Huntington Library, Barnhorne charters 710, 695. *Estwrenham* lay west of the present course of the East Stream.

<sup>2</sup> G. Green, 'East Anglian coastline levels since Roman times,' in *Antiquity*, vol. 35, pp. 21-8. J. M. Lambert, *et. al.* *The making of the Broads*, Royal Geographical Society research series, vol. 3 (1960), pp. 99-102, 139-144.

<sup>3</sup> P.R.O. SC 6/1019/22.

<sup>4</sup> L. F. Salzman, *op. cit.*, p. 45. P.R.O. Calendar of Patent Rolls, 1281-1292, pp. 320, 390.

<sup>5</sup> The item "... pro sulcris aquarum mundand ad salvandum semen yemale . . ." is of regular occurrence from 1287. (P.R.O. SC. 6/1020/16-23).

<sup>6</sup> Cal. Pat. R. Edward III (1330-1334), pp. 71, 198, 202, 253, 288-9.

<sup>7</sup> A. R. H. Baker, 'Some evidence of a reduction in the acreage of cultivated lands in Sussex during the early fourteenth century,' in *S.A.C.* vol. 104 (1966), p. 4. It is uncertain to what extent the flooding resulted in a *permanent* loss of agricultural land.

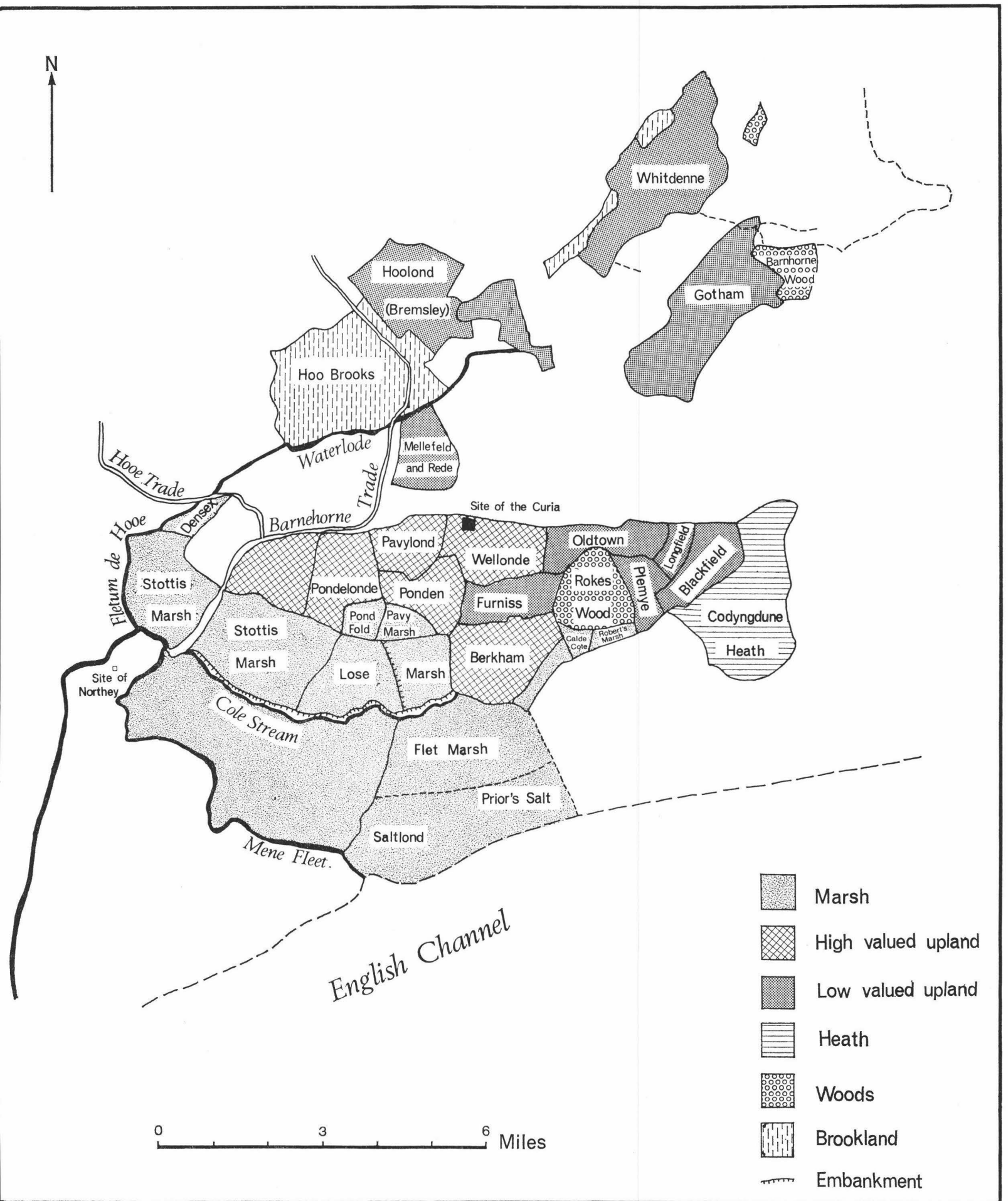


Fig. 1. The location of the fields of Barnhorne



marshes in the early fourteenth century is confirmed by such circumstantial evidence as the high value placed on marshland arable in the 1305 extent, the remarkably high arable acreage recorded in the account rolls for both Barnhorne and *Marechalls* (in the extreme north east of Pevensey parish up against the Mark Dyke) in 1332-3 and the immunity from flooded land in Bexhill in 1341. It thus seems likely that the Abbey's bailiffs still strongly held the initiative in matters of sea defence.

From 1345 the account rolls of the manor of Barnhorne exist in sufficient quantity to be important evidence of floods. The limitations of account rolls as evidence of weather have been discussed by Titow<sup>1</sup> and references to floods in these documents are subject to similar limitations. Floods went unmentioned unless they provided an adequate explanation for certain items of expenditure or income or for low yields of seed. Thus summer floods destroying crops or preventing agistment and letting are mentioned whereas it is likely that many minor winter floods escaped recording because little land was then being used for crops or pasture. Another difficulty concerns the expenditure on drainage and defences. This is a crude guide to the severity of a recent flood but the expenditure recorded on the account rolls is unlikely to represent the full expense to the Abbey since work carried out by the *famuli* as part of their duties was expressly excluded<sup>2</sup>. Some of the references to floods in the accounts are also often insufficiently precise to permit the identification of the actual season or sometimes even the year of inundation.

The evidence of the account rolls of Barnhorne will now be examined, bearing in mind the limitations discussed. From the mid-fourteenth century records of sea floods repeatedly occur in the rolls and damage reached severe proportions.<sup>3</sup> Nineteen account rolls are extant for the period 1352-1388. Three of these account rolls record summer floods which destroyed spring sown crops: in 1356-57 when new defences were built for "the protection of the corn, yet the sea overflowed it"; in 1371 when a crop of vetch

<sup>1</sup> J. Titow, 'Evidence of weather in the account rolls of the Bishopric of Winchester, 1209-1350' in *Economic History Review*, 2nd series, vol. 12 (1959-60), pp. 360-1.

<sup>2</sup> Barnhorne account roll for 1385/6.

<sup>3</sup> Several other parts of the Sussex coast were similarly damaged. At Apuldram, for example, 'a great tempest' on Ash Wednesday 1348 caused flooding and the same storm presumably caused the floods reported in the Ouse valley at Itford in the same year. (P.R.O. SC. 6/1016/9 and E.S.R.O. G. 44/3). Further floods at Itford are mentioned in 1351 (E.S.R.O. G. 44/5). At Dengemarsh in Kent severe flooding is reported in 1363 and 1368. (P.R.O. SC. 6/889/18, 20). Marine inundations in the mid-fourteenth century were also reported at Birling, Bourne (Eastbourne), Bulsham (in Yapton), Herstmonceux, Pulborough, Rustington, Sidlesham, Udimore and West Dean. (P.R.O. C 135/97/2; 56/37; 151/4; 32/28; 210/11; 137/6; E.S.R.O. M. 673; B.M. Add MSS. 6165, f. 216).

was "inundated during growth by an immense sea"; and in 1386 when the bean crop was submerged. This persistent sea attack galvanised the Barnhorne bailiffs into great activity. New drainage works were needed in 1353 and 1354 "on account of the floods"; a new wall was provided in 1374 and repairs to a wall in 1375-6 while the height of one of the main sea embankments was raised in 1385-6. Meanwhile the security of the brookland was given attention. Its drainage appears to have temporarily lapsed (a recurrent feature of the land to this day) but major works to the main drain in the 1380's controlled the water level sufficiently to again permit regular cropping. This activity temporarily repelled the sea at Barnhorne and helped to stave off the severe disasters which were to reach their climax in the 1420's. Yet the drainage of the Battle Abbey lands was but a part of the Hooe Level and some of the credit for the improved water control belongs to the commissioners for the Level who carried out major works at the Pevensy Haven outlet in 1396 and 1402<sup>1</sup>.

These improvements between 1380 and 1402 permitted substantial acreages of the sea marshes and brookland to be regularly under the plough. The bulk of the spring sown crops, notably beans and oats, were produced on this land and about one-third of the wheat. During the seven year period from 1382 (a stormy era) about forty per cent. of the arable was in the sea marshes and the proportion rose to as high as sixty per cent. between 1396 and 1404 and was still averaging 55 per cent. during the period 1406-16, by which time the drainage was sharply deteriorating. In all over 2,200 acres of crops were taken off the marshes and brooks during the 21 year period covered by the ministers' accounts recording field names.

#### *The abandonment of the marshes.*

The strengthened sea defences were to bring merely a short respite and in the face of worsening attacks of the sea in the first quarter of the fifteenth century a gradual abandonment of the marshes was necessitated. Evidence of the increasing severity and frequency of flooding is to be obtained from almost every account roll. The great floods which covered large expanses of the Hooe Level in 1401 and 1402<sup>2</sup> evidently still left the Battle Abbey marshes largely unscathed, as they had been in the 1340's, because large sowings of spring crops continued to be made on the marsh fields. The onset of serious trouble began in 1407, when a wheat field was inundated and in the winter of 1408-9 major floods put the entire marsh out of action for the season and during the following summer gales and inclement

<sup>1</sup> L. F. Salzman, *op. cit.*, pp. 46-50.

<sup>2</sup> L. F. Salzman, *op. cit.*, p. 48 and Sussex Record Society, pp. 37, 182. Severe floods obliged the Priory of Hastings to vacate its site at Hastings in 1407 for one at Warbleton in the High Weald. (Cal. Pat. R. 8 Hen. IV, membranc 17). I am indebted to Mr. J. Manwaring-Baines for this reference.



weather added to the difficulties.<sup>1</sup> The Barnhorne bailiffs again responded to this calamity with vigour; extra workmen were hired to scour the sluices and water channels, to repair the walls and to replace gates and a bridge washed away by the floods with new ones strengthened with iron. This permitted sowings, but on a substantially reduced scale, in the following year, 1409-10. In the following years drainage expenses rose steeply and it is clear that cropping the marshland had become extremely hazardous. The final *coup de grace* came with the devastating floods of the 1420's which effectively terminated the old farming economy altogether. The outstanding disaster was the flood of 1421-2<sup>2</sup> which proved to be the greatest ever experienced. The bailiffs had to obtain special funds (*forinsec*) from the Abbey for repairs to walls, buildings and roads, for ditching and draining, and for heavy purchases of livestock which began the transition of farming at Barnhorne from an essentially arable economy to something approaching a cattle ranch. This disaster was followed by successive floods which must have made the 1420's the most trying decade in the manor's history. Summer floods in 1422, destroyed oats: summer flooding in 1423, for which there is not extant account, is also likely because crops were lost that year at Appledram; and in 1429 the pea crop was lost to floods. Meanwhile the marked deterioration in drainage is also indicated by the letting of parcels of meadow in the former arable marshes, by the frequent mention of drowned land (*terra aquatica*), the marked rise in agistment receipts and the presence of rushes (*sperta*) in marshland fields formerly under the plough.

Yet another sign of badly drained land was the re-orientation of farming towards cattle rearing. The run-down of cereal farming and the trend towards pastoral activities which is observable on many manors during the later middle ages was very pronounced at Barnhorne. Certain features of the trend are identical to those at Alciston, another manor of Battle Abbey which was also under direct management at the time, notably the timing of the onset of

<sup>1</sup> This corroborates the severe flooding in September, 1408 reported by monastic compilers; the summer of 1409 is also described as having been wet generally, no authority being cited. C. E. Britton, *A meteorological chronology to A.D. 1450* (1937), p. 155.

<sup>2</sup> This great flood is well known for the damage it caused in the Netherlands. The only notice of its unusual severity in England appears to be in *Nature*, vol. 126 (1930), p. 792. It was presumably responsible for the destruction of 'the greater part' of Rottingdean and New Shoreham reported in 1421/2 (*Rotuli Parliamentorum* . . . vol. 4, p. 160) and for the appointment of Commissions of Sewers to restore the banks and drainage of most of the Sussex coast in the spring of 1422 (P.R.O. C. 66/404, m. 13d.). At Eastbourne arable was reported inundated in 1430 (E.S.R.O. CP 151) and in the same year tenements at Bexhill in the lord's hands and 'devasted by the sea' were formerly rented for 32/4½d. (Lambeth Palace Cr. 248). The decasus for Pagham manor in 1426 remits rents for tenements destroyed by the sea amounting to 50/0d. per annum at Wittering, 30/0d. at Charlton and 20/0d. at Bognor (Lambeth Palace CR. 881).

the arable decline in the decade 1400-09, the gradual but continuous running down of arable and the slight but short-lived recovery in 1460-9<sup>1</sup>. Thus it would seem that economic conditions and manorial policy are reflected in both trends. Yet the abrupt drop in arable at Barnhorne in the first decade of the fifteenth century is largely attributable to the low sowings of 1408-9 and 1409-10 and is almost certainly the consequence of the sea flooding already discussed and the much more spectacular decline in cultivation at Barnhorne as compared with that at Alciston draws attention to the retreat of the plough from the marshland generally. Also implicit in the very low sowings at the end of the fifteenth century is the virtual abandonment of many of the upland fields as well. We can doubtless envisage a retreat of arable farming to the two main arable fields nearest the barns which had been quasi-permanently arable in the 1380's, whilst the remainder of the estate of some 800 acres lapsed into ever deteriorating pasture, heath and scrub disturbed by only an occasional breach.

The impossibility of working land which always lay comparatively wet and the growing coarseness of the pastures resulting from the deteriorating drainage and infrequency of ploughing out must be important factors which explain the emphasis on cattle to provide meat for the Abbey, a trend which represented a complete break with tradition<sup>2</sup>. During the 1360's and 70's, when sowings were relatively high, the stock of cattle, other than working oxen, was small and the pastoral activities, which were subordinate to arable farming, centred largely on the sheep flock which although of modest proportions compared with that maintained at Alciston, comprised up to 500-600 adult sheep. The running down of this flock and its minor importance after 1420 coincided with the strengthening of the cattle stocks and a notable stocking-up between 1421-5<sup>3</sup>. This inaugurated the era of cattle farming on the Hooe Level which has continued to this day.

The clearest sign of the dwindling arable in the marshes during the first half of the fifteenth century is, however, to be found in the entries in the accounts relating to ploughing. Two types of plough were in regular use at Barnhorne, in the later middle ages; one for the upland (*caruca terra susanna*) and one for the marsh (*caruca maritima*). The upland plough had a pair of wheels and its own special sharebeam and ground-wrest. The general use of the term "reste" in the accounts probably indicates that this plough was essentially similar to the Kentish turn-wrest plough described by Walter Blith in 1653<sup>4</sup>. The marsh-plough, which was a swing, or

<sup>1</sup> P. F. Brandon, *S.A.C.* vol. 100 (1961), pp. 67-72.

<sup>2</sup> Sheep murrain, of little consequence during 1382-1388 was severe between 1400-1430.

<sup>3</sup> Sheep continued to be agisted on the marshes in summer.

<sup>4</sup> W. Blith, *The English improver improved* (1653).

foot plough, was presumably of much lighter construction than the "upland" plough, thus making it much more manageable on heavier and wet land. In the mid-fourteenth century as many as five upland and five marsh ploughs were being regularly maintained on the estate. Gradually the entries relating to the purchase and repair of marsh ploughs became less frequent and finally, in 1458/9 the last recorded purchase or a marsh plough is made, nearly forty years before the estate was leased out in its entirety.

The Barnhorne accounts not only relate to lands in the Hooe Level but also contain a limited information concerning another Battle Abbey marshland, that of *Marchaleslond* or *Mareschall*, located in the extreme north east of Pevensy parish up against the Mark Dyke. The relationship of this property to Barnhorne itself is obscure. It probably functioned at times as an "outfarm" of an upland estate but just before the Black Death it was accounting direct to Battle as a separate estate with some 60-70 sown acres whilst exchanging seed with Barnhorne and producing corn for the Barnhorne servants' liveries. After 1345 *Marchaleslond* slips silently out of notice and it can probably be safely inferred that it was in a badly drained state. An occasional sowing of spring crops there is accounted for in the Barnhorne account rolls (notably in the 1380's) but thereafter long intervals elapse between recorded sowings and the land was probably overwhelmed by the great floods of 1402.

The steadily deteriorating drainage of the Hooe Level went largely unchecked until 1455. The ministers' accounts of Barnhorne, so full of references to drainage activity in earlier decades, have very little to report after the 1420's. All the evidence points to the marshland and brooks being little more than summer pasture at that time. In 1455 a major attempt to improve the drainage of the Hooe Level was made with the diversion of the main drainage from Pevensy Haven, which was choked, to a new sluice at Northey<sup>1</sup>. The immediate effect on husbandry at Barnhorne appears to have been slight although some improvement in drainage had evidently occurred because occasional small sowings were made at Northey and at *Marchaleslond*. By the late 1460's when flooding is again reported in the Pevensy Levels, this arable farming had ceased, and renewed flooding in the 1480's makes it clear that no effective remedy had been discovered.

#### *Floods, Weather and Harvests*

It is now proposed to examine the effects of floods and weather at Barnhorne on the quality of the harvests. To this end yields of grain have been calculated from the particulars recorded on the grange exits for 80 years spanning the period 1369-1494<sup>2</sup>. The figures relate to gross yield *per seed*. Until 1399 wheat was measured

<sup>1</sup> L. F. Salzman, *op. cit.*, pp. 50-62.

<sup>2</sup> The reference to years are those in which the harvest was taken. The accounts relate to a year commencing at Michaelmas.

at Barnhorne by heaped measure (*quolibet bussello cumulato*), an *incrementum* being added at the rate of 2 bus. 2 pecks a quarter, reduced to two bushels from 1369. After 1399 wheat was measured *rasa mensura* (i.e. lightly filled to the brim) with every eighth bushel heaped (4 heaps=1 rased bushel), thus increasing the volume by  $\frac{1}{32}$ . This was the system practised at Cuxham from 1353<sup>1</sup>. Oats were measured throughout by heaped measure with the increment of one quarter the volume. The *superonus*, an additional charge added by the auditors to make the yield up to a certain ratio, first appears in 1406-7 and was normal thereafter, the amount usually being small. It is assumed that the tithe was taken straight from the fields after harvest and that the yield ratios should therefore be increased by one ninth. This does not apply to grain harvested from the marshes from 1408 for which the tithe was commuted to a money payment, received by the Almoner.

The average yield ratio for wheat harvested at Barnhorne during the period 1369-1494 is 3.33; for barley 3.36 and for oats 3.51. For the purpose of comparison the average wheat yield on the manors of the bishopric of Winchester between 1209-1350 was 3.83<sup>2</sup> and at Appledram (for which the yields have been calculated by the present author from 51 accounts extending over a similar period to the Barnhorne records), the yield of wheat was 3.95; that of barley 3.24; and of oats 3.45. Soil differences are probably sufficient to explain the lower quality of the Barnhorne harvests compared with those of Appledram; the deep loams of the latter being much superior for wheat growing than the less inherently fertile land at Barnhorne which, by the possession of so much marsh and brookland (*brocale* or *mor*) with a high water table was particularly well suited to oats. A direct comparison of the barley yields at the two Battle Abbey manors is not possible since at Barnhorne it was never more than a minor crop and could well have been given special attention.

The harvests, following the classification adopted by Titow and van Bath<sup>3</sup>, are distinguished by quality as follows: "good" harvests are those which deviated from the average gross yield over the period of thirty years in which they lie commencing in 1369 by between +15 and +29% "very good" by between +30 and +49%; and "excellent" by more than +50%. "Poor" harvests deviate from the average by between -15 and -29%; "very poor" by between -30 and -49%; and "dearths" by more than -50%. On this basis there were 10 "poor" wheat harvests during the period reviewed, 8 "very poor" and 4 "dearths" out of 74 recorded harvests (29.9%) for which particulars of yield can be

<sup>1</sup> P. D. A. Harvey, *A medieval Oxfordshire village* (1965), p. 54.

<sup>2</sup> J. Titow, *op. cit.*, p. 361.

<sup>3</sup> J. Titow, *op. cit.*, p. 363; B. H. Slicher van Bath, *Acta Historiae Neerlandica*, vol. 2 (1967), p. 71.

ascertained. For barley there were seven "poor" harvests, 11 "very poor" and 2 "dearths" out of 59 recorded harvests (33.9% of the whole). For oats the harvests divide as follows: 15 "poor" 7 "very poor" and 2 "dearths" out of 79 recorded harvests (30.4%). Thus about one in three cereal harvests were poor or worse. Conversely, only 20 wheat harvests (27%) were "good" or better; 40.7% of the barley harvests were in this category and 35.4% of the oat harvests. The proportion of bad harvests appears to have been substantially worse than in the mid-sixteenth century when it was popular belief that a bad harvest came once every seven years<sup>1</sup>, and it rather exceeds that calculated by B. H. Slicher van Bath from the very limited information published as to medieval yields in Europe<sup>2</sup>.

This general classification of the Barnhorne harvests, conceals, however, a marked difference between the harvest quality in the earlier part of the period under review compared with the latter. Confining attention to the periods 1382-1388 and 1400-1440 there are wheat yields available for 32 of the 48 seasons. Of these harvests three were "poor," seven were "very poor" and three "dearths" occurred during these periods, the tally of harvests "good" or better being only six. The trend in oat harvests was even more adverse, there being 18 "poor" or worse harvests and only 4 "good" or better harvests out of 36 recorded yields. For barley there were 8 "poor" or worse harvests and 6 "good" or better harvests out of 18 recorded yields. The high proportion of bad seasons implies that farming at Barnhorne during these periods was exceptionally difficult and unrewarding, of particular interest being years when bad harvests occurred in cycles of successive years. Notable runs of bad seasons were: 1386-1388; 1400-1404; and 1412-1416. W. G. Hoskins has noted a similar tendency for bad seasons to occur in runs of successive years during the period 1480-1619 and he is probably correct in suggesting that since a large proportion of the gross yield has to be kept for the next season's seed "a bad harvest almost automatically ensured another bad harvest from a sheer deficiency of seed"<sup>3</sup>. Another factor in perpetuating harvests below normal would be the poor quality of corn used for seed in the season following a bad harvest. Nevertheless, the possibility that adverse weather and floods may have been factors underlying the series of recurrent cycles of bad harvests needs examination and it is first desirable to consider the weather conditions which most commonly produce harvests considerably below average.

<sup>1</sup> W. G. Hoskins, 'Harvest fluctuations and English Economic History, 1480-1619,' in *Agricultural History Review*, vol. 12 (1964), p. 30.

<sup>2</sup> B. H. Slicher van Bath, op. cit., p. 71; *idem*, *Yield-ratios, 810-1820*. A. A. G. Bijdragen 10, Wageningen, 1963).

<sup>3</sup> W. G. Hoskins, op. cit., pp. 32-3.

TABLE 2 POOR HARVESTS AT BARNHORNE: 1369-1493

Year	Crop	Deviation Index	Wheat	(a) Barnhorne	Weather references	
			Price		(b) other Sussex Manors	(c) other Manors
			in year following harvest (ave-100)			
1369	Wheat	-54.7	154 M		Inclement summer (Bosham). Winter barley sowings reduced by rain in autumn 1368 (Dengemarsh). Summer floods destroy crops at Beddingham.	Worst harvest since 1316. Severe floods and pestilence. ( <i>Schole</i> , 234).
1378	Oats	-27.8		Low wheat sowing suggests a wet autumn.	Severe storms cause flooding (Dengemarsh).	Floods at Christmas (147).
1382	Barley	-39.7			Floods at sowing time reduce wheat crop (Funtington) and floods destroy crops at Beddingham.	Inundation of Fens. ( <i>Creighton</i> , 218)
1384	Wheat Barley Oats	-47.2 -53.9 -29.5	92		A dry winter and summer (Bosham).	Dry summer (149).
1386	Barley Oats	-51.2 -41.6		Crops submerged; sea defences raised.	Excessive rain at sowing destroys winter wheat (Wiston). Tempestuous weather at Beddingham destroys vetch. Winter floods at Bosham.	
1378	Barley Oats	-52.7 -37.6	M			
1388	Barley Oats	-51.2 -26.3		Heavy drainage expenses; new sluices.	Severe autumn floods (West Dean) and winter and summer flooding at Beddingham.	Wet harvests. ( <i>Thorold Rogers</i> , 608)
1389-1399	No information					
1400	Wheat Oats	-55.6 -47.3	M 123	Low wheat sowing suggests a wet autumn.		Inundations in Humber, 153; wet hay harvest. ( <i>Rogers</i> , 608)
1401	No Barley sown. Wheat	-46.5	123 M	Floods in winter (hall-moot roll).	Mildew reduces wheat (Wiston). Great floods in Hooe Level (S.R.S. Vol. 37, p. 179).	
1402	Wheat Oats	-39.4 -33.9	92 M		Great floods in Hooe Level continue (S.R.S. Vol. 37, p.182).	

1403	Wheat	—39.9	82	Winter floods (hall-moot roll).		
1409	Oats	Very poor yield	M		Gales and floods destroyed oats at Appledram.	
1412	Wheat Oats	—49.2 —41.9	92			
1413	Wheat Oats	—40.5 —31.6	92		Wet spring at Chalvington (seed failed).	Wet winter and spring (156) wet spring and summer at Broomham (Wiltshire).
1414	Wheat Oats	—33.4 —26.2	92			
1415	Oats	—26.3			Torrents of rain in spring (Alciston).	
1416	Wheat	—27.6	164 M			Heavy rain in spring (156).
1421	Wheat Oats	—77.1 —43.3	None sold M			
1422	Wheat Oats	—54.1 —53.2	123 M	Devastating floods destroy oats.		
1425	Barley Oats	—29.2 —58.8			Floods destroy crops at Appledram and Alciston.	
1429	Barley	—38.3		Summer floods destroy crops.	Very wet autumn (Alciston)	Wet Autumn (158)
1442	Wheat Barley	—40.5 —40.5	82			
1443	Barley	—39.6		Summer floods.		
1454	Barley	—34.1				
1465	Barley Oats	—48.5 —74.9			Floods in Pevensey Levels ( <i>Salzman</i> , S.A.C. 53, p. 53).	

The year in each case is the harvest year commencing at the previous Michaelmas. Only the worst harvests are mentioned in this table. The Deviation Index expresses the deviation as a percentage of the average yield of the grain harvests for the period 1369-1494. M=years in which sheep murrain was particularly severe.

Page references, except when otherwise stated, are to C. E. Britton, *A Meteorological Chronology to A.D. 1450* (1937). Weather references relating to Sussex manors are from ministers' account rolls in the custody of the Public Record Office, Sussex Archaeological Trust and the West Sussex Record Office. Other references used in this table are: D. J. Schove, *Climatic Fluctuations in Europe in the late Historical Period*, unpublished M.Sc. thesis, University of London (1953), p. 234; C. C. Creighton, *A History of Epidemics in Britain* (1965 edition), p. 218; Thorold Rogers, *A History of Agriculture and Prices*, vol. ii, p. 608.

Medieval farming was much more dependent on favourable weather than the highly technical husbandry of the present day and none more so than that on the heavy lands such as the Barnhorne upland or the precariously drained and extremely exposed marshes. The most bountiful wheat harvests on such land to-day are preceded by above average temperatures in winter, a low winter and spring rainfall and slightly less than average summer rain. In a wet winter nitrates are washed out of the soil and the plant's root system is restricted by deficient aeration; sowings were reduced in such weather in the past and after exceptionally inclement weather the land would be "porridge" and crops a total loss. A wet season is also the most common cause of a reduction in the yield of barley and oats tend to develop straw rather than grain in excessive rain and growth is retarded on land which has not consolidated after flooding. Livestock in medieval times were also much influenced by weather, summers which were wet and warm constituting the greatest hazard to sheep and other cattle grazing low-lying grounds by providing the necessary pre-conditions for rot which carried off great numbers<sup>1</sup>.

To evaluate the influence of weather and floods on the quality of the Barnhorne harvests evidence has been gathered from account rolls and other sources. References to weather in the ministers' accounts and hall moot rolls for Barnhorne manor are listed in Table 2. These are much less frequent than in the thirteenth and early fourteenth century rolls of the bishopric of Winchester and when possible have been supplemented by weather references in account rolls of other Sussex manors. These local references to weather, in the main, substantiate the accounts of weather in monastic compilations and therefore it has been considered justifiable to include some such references where gaps in local information exist.

The correlation between the bad harvests at Barnhorne and periods of excessive rain, wind and floods, is very close. The 1369 harvest, nationally a disaster, was also one of the worst at Barnhorne which also suffered from the flooding which was widespread in England generally<sup>2</sup>. The period 1386-1388 was a notable stormy

<sup>1</sup> J. A. S. Watson and J. A. More, *Agriculture: the science and practice of farming* (eleventh edition, 1962), pp. 206, 222, 234; A. D. Hall, *The book of the Rothamsted experiments* (1917), pp. 61-2; E. J. Jones, *Seasons and prices: the role of the weather in English agricultural history* (1964), pp. 55-6, 81.

<sup>2</sup> D. J. Schove, *op. cit.*, p. 234. Bad wheat harvests in the year are also recorded for the polder district near Bruges in the accounts of St. John's Hospital for May 1369-May, 1370. (J. A. Mertens and A. E. Verhulst, 'Yield-ratios in Flanders in the fourteenth century,' in *Economic History Review*, 2nd series, vol. 19 (1966), pp. 178-9). It is noteworthy that these authors' published yield-ratios, although very restricted, yield two other examples of bad harvests which were below normal on both sides of the Channel: 1385 and 1386 (poor at both Barnhorne and Apuldram). At the English manors flooding is the most likely cause. At Alciston, an inland Sussex manor, yields remained high throughout the 1380's, thus synchronising with the national trend in this decade observed by Schove, *op. cit.*, p. 234).



era in winter and also suffering from summer floods. The years 1400-1404, 1413, 1415 and 1422-1428 were also notable for inclement weather and floods<sup>1</sup>.

Added light is thrown on these bad harvests by the grain prices recorded on the Barnhorne rolls in the year following the poor season. The bulk of the wheat harvest was consumed by the monks but it can be reasonably assumed that the prices recorded for grain deliveries to the monastic granary were realistically related to local prices since they fluctuate with the same abruptness and amplitude as prices for commercial transactions. Using this line of evidence, 10 of the 17 bad harvests at Barnhorne for which data is available are associated with prices in the following year above the average for the period 1368-1590 (84 recorded entries) and this suggests that for those years the Sussex harvest was also generally below normal. (Table 2). Two other harvests at Barnhorne were so deplorable that no wheat delivery was made to Battle (1386 and 1421); that these were also years of bad harvests at coastal manors generally is indicated by the low yields recorded in these years at Appledram. Thus 12 of the 17 bad harvests being considered are likely to have been bad in Sussex as a whole. In some years, however, the quality of the Barnhorne harvests was considerably inferior to that of the county generally. This seems to be true of the years 1384, 1402-1404, and the three successive years 1412-1414 for which years the wheat prices recorded on the Barnhorne rolls are below, or only slightly above average. No explanation is offered in the Barnhorne accounts for the bad harvests of the early 1400's but this period, as previously discussed, was one of severe marine inundations and it is thus likely that crop losses from this cause at Barnhorne were severe. Three other years when Sussex harvests generally would seem to have been better than at Barnhorne, those for 1412-1414, are years of excessive rain (Table 2) in which circumstances the harvests would be expected to have been especially disastrous at Barnhorne considering that the heavy upland soils and low lying land would naturally suffer more.

At this point it is necessary to consider the crop yields in the latter part of the period falling under review, that is from 1440-1490. The decennial average yield ratios (Table 3) for wheat and oats show that a regression in wheat yields during the early fifteenth century and the very modest oat yields of the same period were followed by a substantial improvement in wheat yields and by a marked rise in the yield of oats. The retrenchment in arable farming and the retreat from the more marginal lands which began in the 1410s would be expected by itself to have had a beneficial effect on yields. This was probably the main factor in the improvement of the wheat yields at

<sup>1</sup> D. J. Schove, op. cit., B. H. Slicher van Bath, *Acta Historiae Neerlandica*, vol. 2 (1967), p. 62.

TABLE 3

*Decennial yield averages*

	WHEAT			OATS		
	No. of harvests recorded	Average yield ratio	sowing rate (bushels per acre)	No. of harvests recorded	Average yield ratio	Sowing rate (bushels per acre)
1370-9	3	4.90	3.0	4	3.55	6.00
1380-9	5	2.83	3.0	7	2.65	6.00
1390-9		—			—	
1400-9	8	2.56	3.0	8	3.04	4.5
1410-19	7	2.51	3.1	8	2.71	5.00
1420-9	8	3.11	3.0	8	2.90	5.25
1430-9	5	3.43	3.0	5	3.70	5.00
1440-9	8	3.26	3.0	8	4.48	5.00
1450-9	8	3.53	3.0	8	3.86	4.00
1460-9	9	3.33	3.0	9	2.97	4.00
1470-9	5	3.35	3.0	5	4.95	4.00
1480-9	5	4.32	3.0	5	3.81	5.00
1490-9	3	4.16	3.00	3	4.32	5.00

Barnhorne. Oats continued to be much more influenced by weather conditions because although a higher proportion of oats was sown on the upland fields than formerly, and this would form part of the ordinary sequence of rotation of crops, harvests were still being snatched from the marshland. The temporary declines in oat yields during the decades 1460-1469 and 1480-1489 coincides with stormy phases at Barnhorne with accompanying floods and conversely the 1440s and 1450s seem to have been on the whole much more favourable for farming. The decade 1440-9 had oat harvests which included 1 "good", 4 "very good" and 2 "excellent" and the 1450s ran it very close with 1 "good," 2 "very good" and 1 "excellent" harvests. Such a sequence of harvests of above average quality betoken a marked amelioration in weather and there is supporting evidence of this in the low grain prices prevailing in Sussex and similar high yields recorded at Appledram during the same decades.

*Conclusions*

It is now possible to attempt some conclusions as to the agriculture at Barnhorne and the role of the weather. Arable farming at Barnhorne was only moderately fruitful even by medieval standards. Its convertible husbandry in the late middle ages was of a primitive kind but it anticipated later practice which is followed to this day. The marshland suffered severely from the marine transgression of the later middle ages and the frequency of floods, gales and excessive rain appears to have been abnormally high at several periods in the late fourteenth and early fifteenth century with disastrous effects on crop production and livestock, particularly sheep. The extreme difficulty under which the arable/sheep husbandry was conducted must have been a potent factor in the decision to lease out parts of

the demesne and concentrate on cattle rearing. As a coastal manor with much low-lying land Barnhorne bore the brunt of adverse weather conditions but inland areas are also likely to have suffered. The meteorological factor needs further investigation on a broader basis before its relative importance can be more adequately assessed. For this reason it is desirable to widen the inquiry by utilising the late medieval account rolls of other Sussex manors, notably Alciston, Appledram, Bosham, Chalvington, Lullington and Wiston and the present author hopes to have the findings published shortly<sup>1</sup>.

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<sup>1</sup> P. F. Brandon, 'Late medieval weather in Sussex and its agricultural significance,' *Trans. Inst. Brit. Geogr.* (forthcoming).