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Sustainable Agriculture in the Middle Ages: The English Manor*

By JULES N PRETTY

Abstract

Manorial estates survived many centuries of change and appear to have been highly sustainable agricultural systems. Yet this sustainability was not achieved because of high agricultural productivity – indeed it appears that farmers were trading off low productivity against the more highly valued goals of stability, sustainability and equitability. These were promoted by the integrated nature of farming, the great diversity of produce, including wild resources, the diversity of livelihood strategies, the guaranteed source of labour, and the high degree of cooperation.

THERE can be no doubt that the manorial estates of medieval England were extremely long-lived. They survived centuries of change, adapting only in small ways whilst retaining their major characteristics. It was a system of agriculture that appears to have been highly sustainable. Today, understanding what makes agricultural systems sustainable is a key concern of agricultural development. But there are methodological and practical problems. In particular, it is difficult if not impossible to ascertain whether a system is sustainable until it has stood the test of time.

One approach being currently pursued attempts to identify those key features or components which facilitate the capacity of an agroecosystem to withstand the effects of countless shocks and stresses whilst maintaining the desired level of output. Here an agroecosystem is defined as an ecological system modified by humans to produce food, fibre and other products, and hence contains a wide range of both biophysical and socio-economic components. Each such agroecosystem is maintained by the human beneficiaries, who value the system according to present productivity, future security, and how well the resources are distributed. If these desired objectives are not met, and people starve or natural resources are severely degraded, then the system may not survive.[1]

TABLE 1
Definition of four properties of an agroecosystem

Productivity: the output of valued product of the agroecosystem per unit of resource input
Stability: the constancy of production of the agroecosystem in the face of small disturbing forces arising from the normal fluctuations and cycles in the surrounding environment
Sustainability: the ability of the agroecosystem to maintain production when subject to stress or shock. Stresses and shocks have the potential of causing declining trends in production or even collapse
Equitability: the evenness of distribution of the production of the agroecosystem amongst its inhabitants

Persistent agroecosystems, such as the manorial estate, allow the maintenance or enhancement of the long term productivity of the resource base, together with the generation of adequate stocks and flows of food and income, so as to meet basic needs. But in practice this implies a trade-off between four central agroecosystem properties – productivity, stability, sustainability or equitability (Table 1). Once identified these four properties can be used as the means to classify the valued goals of an agroecosystem.

As a result of the complex interrelationships within a system, these properties are

* I am very grateful to Gordon Conway, Edward Barbier and E J T Collins, together with two anonymous referees, for their valuable comments and suggestions.

[1] *Food 2000. Global Policies for Sustainable Agriculture.* Report to the World Commission on Environment and Development, 1987, pp 3–5. G R Conway, 'The Properties of Agroecosystems', *Agric Systems*, 24, 1987, pp 95–112.

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closely linked. The capacity to withstand shocks and stresses may, for example, necessitate some undesired reduction in productivity, stability or equitability. Alternatively communal access to natural resources may set limits to the total possible level of productivity. Such explicit or implicit trade-offs have continually been made throughout the history of agricultural development.

During the era of the manorial estate agricultural productivity was very poor. Quite clearly farmers must have valued more than just productivity. This paper explores some of the reasons for the low productivity, and argues that sustainability, stability and equity were all encouraged at the expense of productivity. Integrated farming and diversity promoted stability; diversity of the whole system together with varying livelihood strategies enhanced sustainability; and equity was maintained by a high level of cooperation. Finally some of the shocks and stresses which seem likely to have played a role in the eventual collapse of the manorial agroecosystem are described.

I

A fundamental feature of the manorial agroecosystem was the low agricultural productivity. In order to compare cereal productivity and stability, the yield data of fourteen manors belonging to the Bishop of Winchester for the period 1283–1349 were analysed. During this time records exist for a large number of consecutive years where the standard acre is known to have been in constant use (Table 2).[2] Wheat returned the greatest number of seeds per seed sown, but the best productivity per hectare was achieved by barley. Although the gross yields of wheat and oats were approximately equal, once the seed for the next sowing was removed, wheat was more productive by some 85 kg/ha. By contrast, oats were notably more stable for both measures of yield. High productivity, it appears, was associated with low stability.

TABLE 2
Summary of yields of three cereals grown on fourteen manors of the Bishop of Winchester, 1283–1349. (Manors are Alresford, Beauworth, Bentley, Cheriton, Downton, Farnham, Hambledon, Ivinghoe, Rimpton, Sutton, Taunton, Wargrave, West Wycombe, and Wield)*

	Wheat	*Oats*	*Barley*
Productivity			
Gross yield (kg/ha)	515	530	755
Net yield (kg/ha)	385	300	540
Stability			
Coefficient of variation (%)	38.8	31.3	39.9
Productivity			
Seeds/seed sown	4.0	2.3	3.5
Stability			
Coefficient of variation (%)	36.9	33.6	37.3
Number of data (kg/ha)	704	699	637
Number of data (seed ratio)	751	730	681

* *Source: see text, n.3.*

The best gross yields achieved in a single harvest on any of the Winchester estates were 1800, 1200 and 3000 kg/ha for wheat, oats, and barley. However, poor yields were frequent, sometimes falling to as low as 50–100 kg/ha. The individual manor with the best overall yields, Ivinghoe, was also the most variable; yet even here wheat yields

[2] Cereal yields are usually expressed in manorial accounts as the ratio of seeds harvested to seed sown, probably because several different sizes of acre were in common use, A Jones, 'Land Measurement in England, 1150–1350', *Ag Hist Rev*, XXVII, 1979, pp 10–18. But where the standard acre is known to have been in use, it is also possible to calculate yields per hectare. Manorial yield data usually exclude the tithe of between one fifteenth and one ninth (usually one tenth) of cereal, which was removed whilst the crop was still in the field. Until the sixteenth century the standard or Winchester bushel weighed 64 tower pounds. One tower pound equals 349g, thus one bushel is taken to equal 22.39 kg; see R E Zupko, *A Dictionary of English Weights and Measures*, Wisconsin, 1968, pp 25–27, 133–137. R E Zupko, *British Weights and Measures*, Wisconsin, 1977, pp 77–79. R D Connor, *The Weights and Measures of England*, 1987, pp 149–155. The accounting year began and ended at Michaelmas (29 September) and hence manorial accounts can be defined by either year. In this paper all dates of yields refer to the year of harvest; for example all the transactions and events recorded in the account for September 1300–September 1301 are denoted as having occurred in 1301.

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only averaged 700 kg/ha.[3] But compared with other regions of the country these yields were not especially poor. The most productive region may have been north-east Norfolk, where mean gross yields for all these crops were over 1000 kg/ha, but in Sussex, Oxfordshire, Hertfordshire, Kent, Essex, south-east Norfolk, and the Isle of Wight, they rarely exceeded 8–900 kg/ha.[4]

Because manorial records refer to demesne harvests, assessment of tenant cereal yields is almost impossible. But the accounts for two Hertfordshire manors in 1371 recorded both the area of cereal cultivated for each of ten tenants together with the tithes paid: assuming a tithe of one tenth, Stern calculated that tenant wheat and dredge productivity was less than fifty per cent of that of the demesne.[5]

Livestock productivity was also low. Milk production from cattle was just 550–685 litres per year on well managed estates, and pigs, farmed principally for meat, were long-legged, bristly and smaller than wild boars. Sheep were primarily farmed for milk, wool, and manures, ewes yielding between thirty and fifty litres of milk per lactation of 200 days. On average, fleeces weighed about 500 grams in the thirteenth to fourteenth centuries, which contrasts unfavourably with modern long-wools that produce fleeces weighing some three to five kilograms. Ewes were expected annually to produce one lamb, but in practice anything from fifty to ninety were lambed per 100 ewes – this is approximately equal to modern hill sheep grazing on unimproved pastures. The average survival rate of lambs in southern England was between 70 and 80 per cent, though this could fall to less than 20 per cent in a very bad year (Table 3). Moreover, because of the extremely high variability in rate of survival, flock sizes were unlikely to remain stable from year to year.[6]

TABLE 3
Lamb survival rates on three manors, 1283–1349*

	Annual Survival of Lambs (%)	*Minimum Value (%)*	*Coefficient of Variation (%)*
Crawley, Hampshire	74.2	17.1	75.6
Kingsbourne, Hertfordshire	78.4	26.3	90.3
Meopham, Kent	80.4	–	–

* N S B Gras and E C Gras, *The Economic and Social History of an English Village (Crawley, Hampshire) AD 909–1928*, Cambridge, Mass, 1930, pp 410–15. Stern, *op cit*, pp 344–53. Mate, 'Medieval Agrarian Practices', *op cit*, p 25.

II

Crops and Cropping Practice

An important compensation for the low productivity of individual elements of the system was the range of arable, garden and orchard crops cultivated and livestock raised (Table 4). Such variety between sectors of the estate or within sectors of production helped to reduce the risk of complete failure; for example plentiful wild resources in a year when crop harvests are poor, or a poor wheat crop being offset by a good harvest of oats.

[3] J Z Titow, *Winchester Yields*, Cambridge, 1972, pp 40–120. Coefficient of variation equals standard deviation of mean/mean yield × 100. A low coefficient of variation denotes low variability about the mean and thus high stability; high variability equals low stability.

[4] B M S Campbell, 'Arable Productivity in Medieval England: Some Evidence from Norfolk', *J Econ Hist*, XLIII, 1983, pp 388–391. P F Brandon, 'Demesne Arable Farming in Coastal Sussex During the Later Middle Ages', *Ag Hist Rev* XVII, 1971, p 131. D V Stern, 'A Hertfordshire Manor of Westminster Abbey (Profits, Yields and Weather), PhD thesis, Kings College, University of London, 1978, pp 203–4. M Mate, 'Profits and Profitability on the Estates of Isabella de Forz (1260–92)', *Econ Hist Rev*, 2nd ser, XXXIII, 1980, p 332. M Mate, 'Medieval Agrarian Practices: The Determining Factors', *Ag Hist Rev*, XXXIII, 1985, pp 23–27.

[5] Stern, *op cit*, p 149.

[6] R Trow-Smith, *A History of British Livestock Husbandry to 1700*, 1957, p 122, 127. J Wiseman, *A History of the British Pig*, 1986, p 6. M J Stephenson, 'Wool Yields in the Medieval Economy', *Econ Hist Rev*, 2nd ser, XLI, 1988, pp 368–373. E A Atwood and H G Evans, *The Economics of Hill Farming*, Cardiff, 1961, p 99.

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TABLE 4
Produce from a typical manorial estate*

Source	*Produce*	*Source*	*Produce*
Arable Crops		Cattle	Draught power, milk, cheese, butter, curds, some meat, leather, horn
Wheat (spelt, club, bread)	Bread, ale		
Oats (cultivated and wild)	Bread, pottage, livestock feed, ale	Horses	Draught power, leather
Barley (hulled, naked)	Ale, bread, livestock feed	Poultry (chickens, geese, swans, peacocks)	Eggs, meat
Rye	Bread	Pigeons and doves	Meat, manures
Peas, beans, vetches	Whole plant for human and livestock food	Bees	Honey, wax
		Rabbits	Meat, fur
All cereal straw	Livestock feed, thatching		
		Natural Resources	
Orchard and Garden Crops		Deer	Meat, manures
Apples	Fruit, cider	Wild boar	Meat
Pears, cherries, figs, walnuts, damsons, plums	Fruit and nuts	Birds	Meat
		Fish – from fish pond, river, sea	Meat
Vines	Wine	Hares	Meat, fur
Flax	Linen	Oak and beech trees	Acorns and mast for pigs, timber
Hemp	Rope and linen		
Herbs	Seasoning, medicines, dyes	Other trees and shrubs	Nuts, berries, fruits, timber, browse, fuelwood
Leeks, onions, borage, mustard, peas, beans	Vegetable foods	Ferns, bracken, sedges	Thatch, bedding, litter
		Nettles	Linen
		Osiers, reeds	Baskets, fish traps
Livestock		Holly, thorns	Threshing flails
Pigs	Meat	Peat	Fuel
Sheep, goats	Wool, milk, manures, some meat, skin for parchment	Herbs	Medicines, vegetables
		Grass	Hay
		Grass turves	Roofing, fuel

* Lord Ernle, *English Farming. Past and Present*, 6th edn, 1961, pp 6–30. Gras and Gras, *op cit*, pp 33–53. H S Bennett, *Life on the English Manor. A Study of Peasant Conditions, 1150–1400*, Cambridge, 1937, pp 75–96. G W Johnson, *A History of Gardening*, 1829, pp 36–43. J Harvey, *Medieval Gardens*, 1981, pp 163–180; E M Veale, 'The Rabbit in England', *Ag Hist Rev*, V, 1957, pp 85–90.

Several different species and varieties of each cereal were cultivated, each with important agronomic characteristics. Spelt wheat grains, for example, are protected by awns, which confer a high degree of resistance to pests and diseases, and tough glumes that make them more difficult to thresh. But bread wheat became increasingly common, with its looser more easily threshed ear and suitability to clay soils. Oats were preferred on poor acid soils, particularly where summers were both wet and cool. There were at least five cultivated forms, including pillcorn or polscorn with husks which did not adhere to the grain. Spring and winter varieties of both barley and rye were common, though of all the cereals rye remained the least cultivated. Hulled six-row species of barley predominated, namely the lax-eared nodding bere of berecorn and the dense-eared erect type, but an early ripening variety known as haste or haste-bere was also cultivated.[7]

Rotations of these crops and fallowing helped maintain the biological fertility of

[7] M Jones, 'The Development of Crop Husbandry' in M Jones and G Dimbleby, eds, *The Environment of Man: The Iron Age to the Anglo-Saxon Period*, BAR Brit Ser 87, Oxford, 1981, pp 106–108. F J Green, 'Plant Remains' in C M Heighway, A P Garrod and A G Vince, 'Excavations at 1 Westgate St, Gloucester, Appendix 5', *Mediev Archaeol*, 23, 1979, pp 186–190. F J Green, 'Iron Age, Roman and Saxon Crops: The Archaeological Evidence from Wessex' in M Jones and G Dimbleby, *op cit*, pp 132–143. G Beresford, 'Three Deserted Medieval Settlements on Dartmoor: A Report on the Late E Marie Minter's Excavations', *Mediev Archaeol*, 23, 1979, p 143. J E T Rogers, *A History of Agriculture and Prices in England 1259–1793*, Vol II, 1259–1400, Oxford, 1866, pp 173–77. *Middle English Dictionary*, eds, R E Lewis, J Reidy, S M Kuhn and H Kurath, Michigan, 1957–88 (cont), *passim*.

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the soils and enhanced stability. The anonymous author of *Husbandry* recommended cultivation of both autumn and spring crops, because 'it may happen that the winter sowing takes well and the spring sowing fails' or vice versa. The variation in rotation patterns throughout England was great and fallowing regularity varied according to local conditions. In Sussex the best soils were cropped continuously, and in Norfolk arable was fallowed only once every ten years; but marginal land, such as in the Kent marshlands, had to be fallowed for at least two years after each wheat crop. In general, legumes were uncommon until at least the thirteenth century, though again the practice varied according to location. In Sussex and Norfolk, in the first half of the fourteenth century, legumes were sown on 15 to 30 per cent of the arable, whereas on the Winchester manors they had risen to only 8 per cent by 1345.[8]

Although arable crops were usually sown separately, the practice of mixed cropping of two or more crops together in the same field was also common. The most widespread mixtures were barley with oats, wheat with rye, and one of the cereals with a legume (Table 5). The mixtures were probably intended as smother crops, in which strong competition between the two different species helped to outcompete weeds. Examples of regional variations include bulimong in East Anglia and brotcorn in south and mid-England. On some manors many mixtures were used: on the estates of Crowland Abbey only wheat and oats were sown as pure grain after the mid-fourteenth century, the remainder of the land being sown with various mixtures of barley, oats, wheat, rye and legumes.[9]

TABLE 5
Contemporary Middle English, Latin and French terms for mixtures of crops*

Wheat + Rye	*Mancorn, Maslin, Mongcorn, Mestilion, Mastylon, Menglyd*
Barley + Oats	*Drage, Dragium, Dredge, Mixtil, Mixtylium*
Wheat + Vetch	*Frumentum vescosum* or *vessetum*
Oats + Peas and/or Vetches	*Bullimong, Bulimong, Brotcorn*
Wheat + Barley + Rye	*Beremancorn*
Wheat + Barley	*Beremancorn*

* *Middle English Dictionary, op cit, passim.* Lamond, *op cit, passim.* Rogers, *op cit*, Vol I, pp 221–2. Gras and Gras, *op cit*, pp 35, 353–7. *New English Dictionary on Historical Principles*, ed J A H Murray, Vols 1–10, Oxford, 1888–1928, *passim.*

The author of *Husbandry* also defined expected yields of various crop combinations. For example, the yield ratio for monocropped spring barley should have been eight seeds per seed sown, and for monocropped oats four; a mixture of the two in equal parts was expected to yield six. Although these values are rather higher than those documented in the manorial accounts, they imply that the author recognized no productive advantage in cultivating mixtures of crops, suggesting that one of the reasons for using mixed crops was to reduce the risk of complete failure.[10]

Between 1283–1349 several of the other Winchester estates cultivated both mancorn and drage: compared with their individual constituents both mixtures show some interesting differences in productivity and stability (Figure 1). Mancorn productivity is exactly an average of the returns of rye and wheat, but is markedly less stable. Drage however is as stable as monocropped oats and as productive as barley. Sometimes

[8] *Anonymous Husbandry*, in E Lamond, ed, *Walter of Henley's Husbandry, together with Anonymous Husbandry, Seneschaucie and Robert Grosseteste's Rules*, 1890, pp 70–71. Brandon, 'Demesne arable farming', pp 123–126. B M S Campbell, 'The Regional Uniqueness of English Field Systems. Some Evidence from Eastern Norfolk', *Ag Hist Rev*, XXIX, 1981, p 21. Mate, 'Medieval Agrarian Practices', p 30. B M S Campbell, 'Agricultural Progress in Medieval England: Some Evidence from Eastern Norfolk', *Econ Hist Rev*, 2nd ser, XXXVI, 1983, p 33. J Z Titow, *English Rural Society*, 1969, pp 41–2.

[9] Rogers, *op cit*, Vol II, pp 173–7. F M Page, *The Estates of Crowland Abbey. A Study in Manorial Organisation*, Cambridge, 1934, pp 118–119.

[10] *Anonymous Husbandry, op cit*, pp 70–73.

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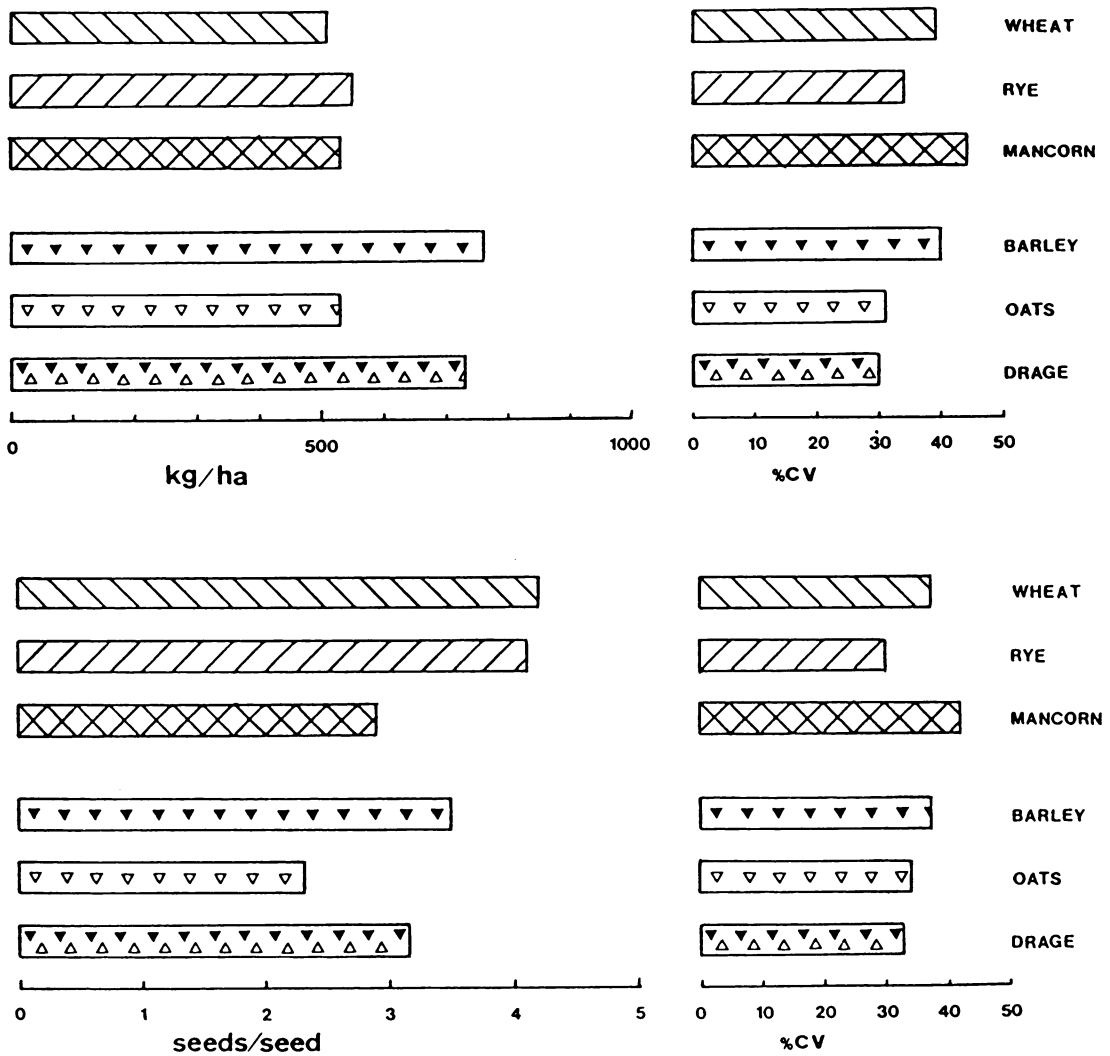

FIGURE I
Productivity and stability of mixed crops compared with their individual constituents, grown on Winchester manors, 1283–1349

the mixtures yielded more than either of the individual constituents: 770 kg/ha for maslin in Norfolk and 1000–1300 kg/ha for drage at Crawley manor. On other occasions mixtures performed poorly – winter barley with wheat produced an average of only 500 kg/ha at Crawley; or on average in Oxfordshire drage returned over 900 kg/ha, about half-way between the individual returns for barley and oats. But none of the harvest records details the relative proportions of each crop in the final yield.[11]

Crop Complementarities

A particularly valuable complementarity between crops was the way that they

[11] Gras and Gras, *op cit*, p 353. Campbell, 'Arable Productivity', p 391.

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responded differently to stresses and shocks. These responses can be followed by analysing yields after a large departure from the average. Those returning to normal quickly after a deviation, whether positive or negative, suggest a high level of resistance, whereas a slow return indicates low resistance. Yield indices, as percentages of long-term mean yields per hectare, have been calculated from data for wheat and oats grown on the fourteen Winchester manors between 1283–1349. Incidence of key years, taken as those when the yield was more than one standard deviation below or above the average, varied between crops and between locations.

The aggregated responses after key years for wheat and oats on five of the manors are illustrated in Figures 2 and 3. After poor harvests, oats returned to normal more rapidly than wheat. Nonetheless six years after the deviation oats were still below average at four of the manors. Following a very good harvest, oats were again advantageous, returning more slowly than wheat, though at two manors the responses are characterized by a ramp with no return. In this case high resistance, represented by yields returning quickly to the average, may not be a valued property of a particular crop.

Unravelling the patterns of year-to-year relationships is complex – there were many constraints to productivity, as described below, and it would appear that no single factor was responsible for high or low yields. However it is possible to envisage some positive feedback mechanisms: a poor wheat grain and straw yield could have resulted in poorer livestock condition, fewer manures, and low future wheat yields. Here it must be assumed that given a limited resource, farmers chose to manure wheat fields rather than oats, and thus loss of manures would have had no impact upon later oat yields. Or a weed smothered crop could increase the likelihood of weed attack the following year; but the feedback is complicated by differences in local farming practice: if the crops were rotated the residual effect in one particular field would impact on a different crop. In a wheat-oat-fallow-wheat rotation, low wheat yields following a universally poor year would have to be explained, at least partly, by a residual negative impact arising from the field that was under fallow.

What is clear, though, is that oats were both more stable and sustainable than wheat, advantages which may have been recognized by the medieval farmers. Oats were commonly cultivated on colonizing manors, particularly where the new land was marginal, and also were the principal crop on the marsh manors in Kent and the Fens.

Crop–Livestock Interactions

The relationship between crops and livestock was a primary feature of the mixed approach to manorial agriculture. Stability was enhanced by the integrated use of resources and great diversity of products, though at the probable expense of productivity. Livestock produced valued manures, which were critical in maintaining soil fertility. The value of manure was recognized in the widespread practice of folding sheep overnight in pens on arable land. But this practice may still have been inadequate, and evidence suggests that probably no more than 30 per cent of arable land was manured by animals. On fifteen Norfolk demesnes in the later fourteenth century an average of 15 per cent of the arable was folded annually, and a further 13 per cent received off-farm manures; and in Kent only 10 and 15 per cent was composted and sheepfolded. Even potential losses through leaching were recognized, Walter of Henley indicating that 'manure wastes in descending' (*fens gastent en descendant*).[12]

[12] Campbell, 'Agricultural Progress', p 36. Mate, 'Medieval Agrarian Practices', p 23. *Walter of Henley, op cit*, pp 20–21.

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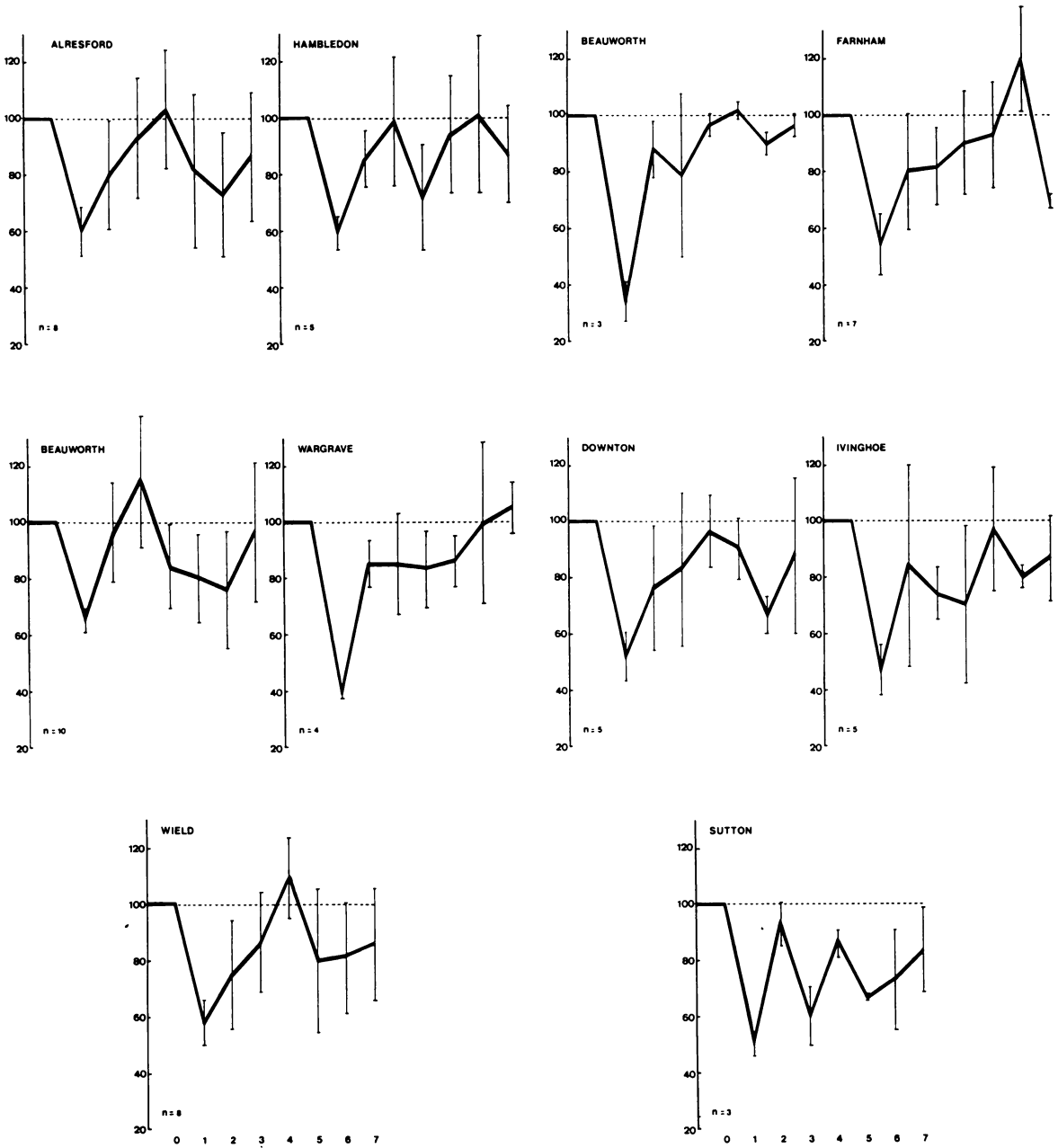

FIGURE 2
Responses of wheat and oats after negative key years

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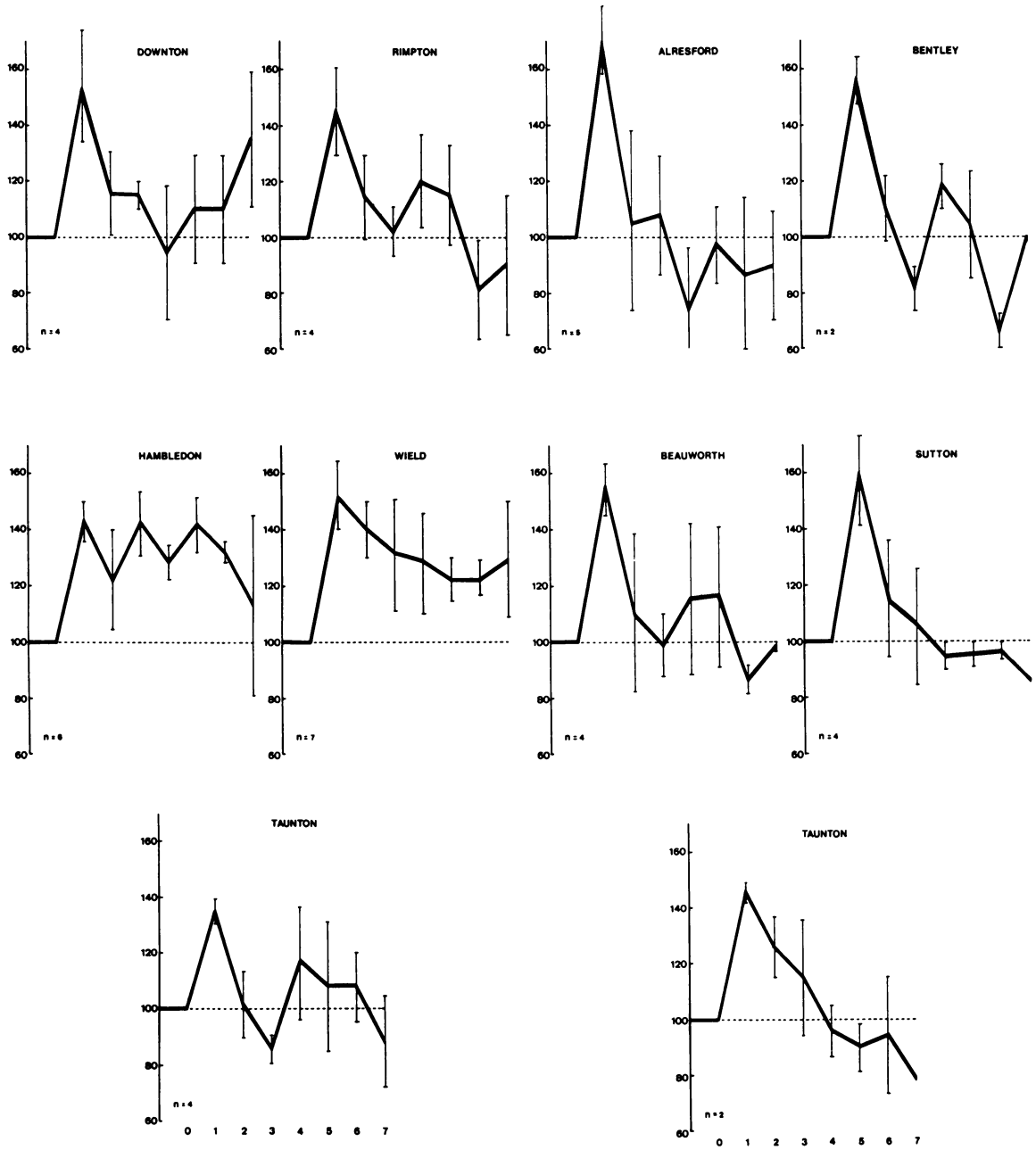

FIGURE 3
Responses of wheat and oats after positive key years

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Apart from livestock manures, other important sources of fertilizer included pigeon manures, dead leaves, deer droppings, chalk and lime (marl), crushed shells and seaweed, ash from burnt turfs of grass, and human wastes. Marling was common practice on clay soils and, even though it required a high labour input to transport the chalk and lime from often distant locations, it could certainly enhance productivity: oats on non-marled land at Ebony manor in Kent yielded 1230 kg/ha, but a dramatic improvement to over 1900 kg/ha was reported following addition of marl.[13]

Livestock productivity in turn was probably limited mainly by the availability of feed, though the further factors of dietary preference plus cost of upkeep appear to explain the enduring dominance of oxen as draught animals over horses. Langdon indicates that an important trade-off was made between productivity per unit of time or area and productivity per unit cost. Thus horses were more costly to keep and required between six and twenty times more oats than oxen, which could be maintained mostly on straw and hay (Table 6). In addition, though oxen had a shorter lifespan and worked more slowly, they were more reliable and less liable to fall sick. In the eleventh century 95 per cent of demesne work animals were oxen; yet by the fourteenth century the numbers of horses had only risen to about 30 per cent of work animals. Even in regions where horses were relatively common, very few demesnes employed only horses for work; and those that did so appear to have cut the size of plough teams from eight or nine to five or six animals, thus saving on costs rather than capitalizing on potential speed of work.[14]

The high demand for hay also brought about higher rents for meadows compared with arable land, and during times of arable expansion and pressure upon natural resources even poor pasture commanded high prices. In addition, money paid by farmers for the cutting of fodder from trees and the feeding of pigs upon acorns and beechmast was always an important source of income for owners of woodlands.[15]

TABLE 6
Productivity and costs of upkeep of oxen and horses on 77 manors, 1250–1350*

	Oxen	*Cart Horses*	*Plough Horses*
Speed of ploughing (ha/day)	0.1–0.4	–	0.3–0.5
Speed of harrowing (ha/day)	0.4	–	0.8
Speed of hauling small cart loads†	x	2x	–
Average demesne life (years)	5.1	7.0	5.5
Costs‡ (shillings/animal/year)	7.2	23.7	10.2
Consumption of oats (kg/year)	61	1190	362

* J Langdon, 'The Economics of Horses and Oxen in Medieval England', *Ag Hist Rev*, XXX, 1982, pp 31–40. J Langdon, *Horses, Oxen and Technological Innovation. The Use of Draught Animals in English Farming from 1066 to 1500*, Cambridge, 1986, pp 158–165.

† x is nominal value for speed

‡ Costs include feed, maintenance and depreciation.

Key Constraints to Productivity

Although diversity and integrated use of resources helped to offset the apparent disadvantage of low productivity, several key constraints to productivity also boosted one or more of the other three system properties.

On many manorial estates individual holdings of arable land were not consolidated into one portion, but split into several small strips widely dispersed across the

[13] Ernle, *op cit*, p 10. D Roden, 'Demesne Farming in the Chilterns', *Ag Hist Rev*, XVII, 1969, p 16. Campbell, 'Agricultural Progress', pp 33–36. Mate, 'Medieval Agrarian Practices', p 23.

[14] From Langdon, *ibid*, pp 27–46, 86–96, 124–127 and 'Economics of Horses and Oxen', pp 32–45. Ernle, *op cit*, pp 13.

[15] M M Postan, *The Medieval Economy and Society*, Pelican Economic History of Britain 1, Harmondsworth, 1972, pp 66–67. W O Ault, *Open Field Farming in Medieval England*, 1972, pp 35–37. C R Young, *The Royal Forests of Medieval England*, Leicester, 1979, pp 114–117.

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TABLE 7
Productivity of open and enclosed fields in 116 parishes in England, 1801*

	Open parishes (kg/ha)	*Enclosed parishes (kg/ha)*	*Yields from open as a % of enclosed*
Wheat	1300	1650	78.8
Oats	1990	2500	79.6
Barley	1800	2190	82.2

* From M Turner, 'Agricultural Productivity in England in the Eighteenth Century: Evidence from Crop Yields', *Econ Hist Rev*, 2nd ser, XXXV, 1982, p 500.

open fields. The reason for this apparently inefficient system of the scattering of strips may have rested on a trade-off between productivity and stability. Although farmers incurred greater costs in time spent travelling from one strip to another, the risk of complete crop failure in a given year was reduced by both the spatial separation and the mixture of land with varying fertility.[16] Turner has shown that cereals cultivated in open fields were some 20 per cent less productive compared with those grown in enclosed fields at the beginning of the nineteenth century (Table 7). Although agricultural technology had advanced greatly by this time, this productivity loss must represent a measure of the value accorded to both a stable and equitable system of property rights. For enclosed and open fields to have coexisted for so many centuries, farmers must have valued more than just productivity.

Most agricultural activities were highly labour intensive, largely because there existed few opportunities for significant substitution. One hectare of cereal, for example, probably took two-and-a-half man-days to plough and five man-days to reap and bind, and one of meadow two-and-a-half man-days to mow.[17] In order to insure against labour scarcity, all tenants, whether free or not, were under varying obligations to work on the demesne at certain set times of the year, mainly for ploughing, weeding, reaping, mowing, threshing and carrying manures. However, the lord could choose either to accept payments in lieu of services or to oblige their completion, depending upon the number of tenants and how much of the demesne was being directly farmed. In addition some innovations adopted during the manorial period increased labour productivity rather than yields. For example, as soon as water-mills were established, despite the requirement for greater capital investment compared with labour intensive hand querns, they rapidly spread across the country and, together with windmills, released labour for other farming activities.[18]

Pests, diseases and weeds must have had a major impact on productivity. Although pest control was rudimentary, the records reveal some practices that may have restricted losses. The anonymous author of *Seneschaucie* recommended that sheep be kept away from snails, which could infect them with parasitic liver flukes. Sometimes payments were made by the lord or village council for the capture of rats and moles; arsenic was used to control invertebrates; and some livestock disease, particularly sheep scab, was controlled by the application of mercury, sulphur, copper, tar or bitumen compounds.[19]

However it is impossible to assess quantitatively the degree of infestation and the effect on yields. Archaeological evidence does indicate a prevalence of some weeds: mayweed, a typical associate of cereals, was commonly found in medieval deposits, appearing to increase in prevalence from the Roman period onwards. Several times during the fourteenth century low wheat yields in Surrey were attributed to attacks

[16] D McCloskey, 'The Persistence of English Common Fields', in W N Parker and E L Jones (eds), *European Peasants and Their Markets*, Princeton, New Jersey, 1976, pp 113–119.

[17] B A S van Bath, *The Agrarian History of Western Europe AD 500–1850*, 1976, pp 183–184. Bennett, *op cit*, pp 104–6.

[18] van Bath, *ibid*, p 71.

[19] Rogers, *op cit*, Vol I, p 33, 461, Vol II, p 429. *Seneschaucie. op cit*, pp 96–97.

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of mildew: bread wheat was susceptible to attack by birds and fungi. Documents also recorded poor harvests due to abundant poppies and thistles. Losses of livestock to diseases could be substantial, often rising to several hundred cattle and several thousand sheep in a bad year. Annual sheep losses were on average 30 per cent, whereas today they range typically from 2 to 5 per cent. Foxes and wolves were also economically significant pests. A consequence of reductions in livestock numbers was depletion in manure supply, which would clearly have had an important impact upon crop performance.[20]

Climate, though, was one factor beyond the control of farmers. During the manorial era the climate was characterized by the medieval warm epoch, which lasted from about AD 950–1000 to AD 1300. Lamb has used a wide variety of evidence to describe the changes in temperature and rainfall during the whole year and certain key seasons. From the late seventh century the year-round wet and cold conditions began to give way to drier and warmer summers and markedly colder winters; building up to a period of remarkable warmth, when summer temperatures during 1250–1300 were almost 1°C warmer than in 800–1000. Total rainfall declined and also shifted from summer to the rest of the year, so that summers during 1250–1300 were some ten per cent drier than during the late Anglo-Saxon era. Temperature declined after 1300 until the coldest phase since the last ice-age was reached during 1500–1700.[21]

These long-term changes in climate influenced the distribution and type of crops grown and their potential productivity. Vineyards were relatively common in the south and east of England, with more than seventy known to have existed between AD 1000–1300. The limit of cultivation was increased by at least 100 metres in altitude compared with before AD 800. The probability of crop failure on marginal land was also lower: when summer temperatures are low the chance of failure is very high, yet higher temperatures result in a disproportionate decline in the probability of failure. But this summer warmth may have also caused a small decline in productivity. Temperate cereals yield more in cooler summers; coefficients calculated for the relationship between wheat productivity and combinations of temperature and rainfall suggest that yields may have been 1 to 7 per cent lower during the medieval warm epoch.[22]

Although many manorial accounts contain references to weather conditions, correlations between patterns of weather and crop yields are poor. But there are several possible biases in the data: the impact of weather is highly heterogeneous, the Winchester manors geographically widespread, and references in accounts were often made to excuse items of high expense or years of low income. For instance, dry summer weather was apparently used to explain greater than usual costs of repairs to ploughs.[23]

In general, though, extremes of wet weather were usually associated with low wheat yields, with 1315 and 1316 probably

[20] Jones, 'Development of Crop Husbandry', p 111. M Mate, 'Agrarian Economy after the Black Death: the Manor of Canterbury Cathedral Prior, 1348–91', *Econ Hist Rev*, 2nd ser, XXXVII, 1984, p 349. Mate, 'Medieval Agrarian Practices', p 25. W H Long, 'The Low Yields of Corn in Medieval England', *Econ Hist Rev*, 2nd ser, XXXII, 1979, pp 465–469. M L Ryder, *Sheep and Man*, 1983, p 448.

[21] H H Lamb, 'The Early Medieval Warm Epoch and its Sequel', *Palaeogeog, Palaeoclim, Palaeoecol*, 1, 1965, pp 13–37. H H Lamb, 'Britain's Changing Climate', *Geog J*, 133, 1967, pp 448, 456–458. H H Lamb, 'Climate from 1000 BC to AD 1000', in Jones and Dimbleby, *op cit*, pp 56–60.

[22] M L Parry and T R Carter, 'The Effect of Climatic Variations on Agricultural Risk', *Climatic Change*, 7, 1985, pp 100–109. Beresford, *op cit*, p 144. L M Thompson, 'Weather Variability, Climatic Change, and Grain Production', *Science*, 188, 1979, pp 535–541. J L Monteith, 'Climatic Variation and the Growth of Crops', *Quart J R Met Soc*, 107, 1981, pp 761–769.

[23] J N Pretty, 'The Stability of the Common-Field System: A Study of Thirteenth and Fourteenth Century Yields and Prices', MSc Thesis, Imperial College of Science and Technology, University of London, 1981, pp 37–44. J Z Titow, 'Evidence of Weather in the Account Rolls of the Bishopric of Winchester 1209–1350', *Econ Hist Rev*, 2nd ser, XII, 1959, pp 360–408.

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TABLE 8
Some selected weather conditions and yields of wheat, oats and barley (kg/ha) recorded on the Winchester manors*

Year	*Weather Conditions*	*Wheat*	*Oats*	*Barley*
1315	Wet all year	320	510	690
1316	Wet all year	330	460	630
1292	Wet all year	500	530	620
1339	Wet autumn, dry summer	290	410	910
1346	Wet autumn, dry summer	390	460	750
1325	Wet autumn, dry summer	630	510	820
1344	Wet winter, dry summer	690	550	1000
1331	Wet winter, dry summer	440	470	600
1327	Summer drought	580	620	770

* Titow, 'Evidence of Weather', *passim*. Titow, *Winchester Yields*, pp 40–120.

the clearest examples (Table 8). Wet weather at the time of sowing could lead to poor yields, even if the following summer was dry, as in 1339 and 1346. By contrast the spring sown oats were less affected by poor weather, and even the conditions of 1315–16 had little effect on oat yields in the Winchester region. In Sussex excessive rains or drought at the time of sowing were also more likely to cause a failure of wheat than of oats, barley or rye.[24] However, there are anomalies: in both 1334 and 1344 dry summers followed wet winters, yet in the former yields were high and in the latter low; and in the drought year of 1327, when wells and marshlands dried out, yields were above average.

However fewer cold summers may have indirectly contributed to the economic importance of pigs. Acorns and beech mast were a valuable source of food for pigs and it appears likely that both oak and beech were more productive during the medieval warm epoch. The key to successful fruit production appears to be a long warm growing season, which favours the laying down of flower buds and tends to be followed by abundant seed in the next year. But during cold summers most acorns fail to mature or remain small. In the warmer parts of Europe heavy crops occur at three- to four-year intervals, yet in the colder regions this period more than doubles. The difference between success and failure is substantial: beech mast years may be up to ten times as productive as poor ones, producing up to 1500 kg/ha, and abundant oak years can result in 2000–5000 kg/ha of acorn production.[25]

[24] Brandon, 'Demesne Arable Farming', p 134.

III

Given these constraints on productivity, people on manorial estates were less concerned with maximizing agricultural productivity than with securing an adequate livelihood through stable food production, income-earning activities and ownership of, or access to, resources to offset risk and meet contingencies. The pursuit of these sustainable livelihood strategies meant in turn that the family household valued more than just the productivity of the agroecosystem.

Food and Income Sources

For a family to achieve at least the basic needs of subsistence the size of landholding was of primary importance. But it seems likely that few peasant families survived entirely upon the produce grown on their land. Postan has calculated that some 50 per cent of the peasant population had holdings too small to maintain even a bare minimum of subsistence during the twelfth to thirteenth centuries. On single estates the

[25] E W Jones, '*Quercus* L. Biological Flora of the British Isles', *J Ecol*, 47, 1959, pp 187–199. M W Shaw, 'The Reproductive Characteristics of Oak', in M G Morris and F J Perring (eds), *The British Oak*, Berkshire, 1974, pp 162–181. B O Nielson, 'Beech Seeds as an Ecosystem Component', *Oikos*, 29, 1977, pp 268–271.

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proportion could be much greater: more than 85 cent of tenants each farmed less than four hectares on a Winchester manor in the mid-thirteenth century; and, further north, between 30 and 40 per cent of tenants in Lancashire, Yorkshire and Northumberland at the same time had less than two hectares each.[26]

Thus although crop and livestock production formed the basis of this highly persistent agroecosystem, numerous smallholders must have supplemented their diet or income from other sources, or faced starvation. Two critical sources of supplementary food were wild resources and crops cultivated in the kitchen garden. These gardens could be very diverse, and by the thirteenth and fourteenth centuries royal and monastery gardens were known to cultivate 200–250 species of food, herb, and ornamental plants. Those with multiple uses were especially favoured, such as the sweet bay with ornamental flowers, medicinal berries, and leaves for flavouring.[27]

Income generation was an important strategy exploited by the rural poor. Many smallholders were also skilled craftsmen, practising their trade as blacksmiths, turners, and carpenters during the slacker winter months. Some peasants were employed full-time on the manor, and others were communally employed on a regular part-time basis as mole-catcher, cow-herd, barber, stock-brander, shepherd, or swineherd. Cottage craft industry, often dependent on natural resources, was also common: nettles were made into linen; osiers and reeds into baskets; wood was cut and carved for household items or made into tools; wool was spun, woven and dyed; leather tanned; and ale brewed from malted cereal grain. Peasants living near forests probably had greater opportunities for supplementing income: many were employed in the charcoal industry, the mining of iron and coal, glassmaking, pottery, rope-making from tree bark and wood cutting. These activities were also easy to leave temporarily when agriculture demanded immediate attention.[28]

Natural Resource Management

The economic use of wild resources was sustained by management practices and penalties designed to prevent serious long term degradation. Recognition of such potential economic benefit is highlighted first in the Codes of Ine of the late seventh century, which demanded that a fine of sixty shillings be imposed upon anyone cutting down a tree large enough to shelter thirty pigs, and later when the Normans carried out the Domesday survey. In this survey woodland size to the south-east of a line stretching from the western borders of Norfolk to Hampshire was recorded in terms of the number of pigs it could support: *silva ad x porcos*, *silva de x porcis* or just *silva x porcos*, in other words 'there is wood for x swine'. Some entries were very detailed, suggesting a precision in the measure of quality of woodland resource. Thus from the values recorded it is impossible to calculate size of woodland. The survey also distinguished between exploitable and non-exploitable resources within the same woodland, using the terms *silva infructosa*, 'infertile woodland', and *fertilis per loca*, 'fit for pig feeding in a few places'.[29]

Woodlands were also used for generating income during hard times. At one manor

[26] Postan, *op cit*, pp 145–7. Titow, *English Rural Society*, pp 76–7. E Miller and M J Hatcher, *Medieval England: Rural Society and Economic Change 1086–1348*, 1978, pp 54–5.

[27] Johnson, *op cit*, pp 36–43. Harvey, *op cit*, pp 28–29, 168–180.

[28] Postan, *op cit*, pp 147–50. J Birrell, 'Peasant Craftsmen in the Medieval Forest', *Ag Hist Rev*, XVII, 1969, pp 91–107. Ernle, *op cit*, pp 28–30.

[29] B W Clapp, H E S Fisher and A R J Jurica (eds), *Documents in English Economic History*, 1977, p 76. H C Darby, *Domesday Geography of Eastern England*, Cambridge, 1952, pp 179–182, 362–4. H C Darby and I B Terrett, *Midland England*, 1954, p 434. Darby and E M J Campbell, *South East England*, 1962, p 699. Darby and I S Maxwell, *Northern England*, 1962, p 438. Darby and R W Finn, *South West England*, 1967, p 377. Trow-Smith, *op cit*, p 83.

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in Hertfordshire the largest sales of wood coincided with years of poor agricultural performance. Before 1303 wood sales were limited to controlled lopping and wind-blown trees, but misuse of the capital resource then led to a serious depletion of oak and beech trees. Pig numbers also fell from 1300, and completely disappeared from the estate by 1363. The Duchy of Cornwall carefully conserved its woodlands, using them principally as a source of building materials on the manors. Nonetheless woodland was cleared to raise capital during times of financial crisis, as in 1359 when some ten to forty-five hectares were felled at Liskeard manor in order to service the Black Prince's costly preparations for war.[30]

Apart from the Norman laws designating many forests as exclusively royal hunting grounds, from which peasants were prohibited, most regulations corresponding to use of resources were formulated locally. Manorial courts produced by-laws: fine-tuned regulations capable of taking account both of the quantity and quality of resources available, and the demand for their use. These regulations, or by-laws, covered a wide range of activities and potential resource uses, almost all of which required the purchase of a licence (Table 9). Hunting and fishing supplied valuable supplementary sources of meat, though fishing was often permitted only during daylight, so that the total catch could be checked by other members of the village. Wild birds were an important part of the diet: those consumed at medieval feasts might include species of bustard, crane, curlew, finch, gull, heron, lark, mallard, partridge, pheasant, pigeon, plover, quail, snipe, swan, teal, thrush, and woodcock.[31] Nonetheless there were many references to the activities of poachers, and punishments for illegal use were usually strictly enforced.

[30] Stern, *op cit*, pp 196–201. J Hatcher, *Rural Economy and Society in the Duchy of Cornwall 1300–1500*, Cambridge, 1970, pp 184–186.
[31] W E Mead, *The English Medieval Feast*, 1931, pp 32–39.

TABLE 9
By-laws and management measures designed to prevent long-term damage to village resources*

Activity	*Management Measure*
All hunting, gathering and collecting activities	Licences required
Pig feeding	Nose-rings to discourage deep-rooting Fines for owners of destructive pigs Pannage season limited to protect tree saplings Elected swineherd responsible for any damage
Cattle grazing	Stocking rates limited
Trees	Regulation of cutting and selling All villagers permitted to carry own firewood only Heavy fines for possession of woodcutting tools without licence Lopping of oak, beech, apple prohibited Replacement trees should be planted every year
Hedges	Require regular repairs
Fencing and gates	Compulsory around gardens to prevent livestock escaping and causing damage
Reeds and rushes	Mowing controlled Gathering permitted for own use only, not for sale off manor
Manures	Not to be sold off manor Should remain on meadows
Fishing	Permitted only during daylight
Hunting and bird-snaring	With licence only
Watercourses	Should be regularly cleaned Pollution by human wastes, animal offal and hemp or flax residues prohibited

* From W O Ault, 'Open Field Husbandry and the Village Community – A Study of Agrarian By-Laws in Medieval England', *Trans Amer Philos Soc*, 55, 1965, *passim*. *Walter of Henley*, *Anonymous Husbandry*, *Seneschaucie*, in Lamond, *op cit*, *passim*. Wiseman, *op cit*, pp 1–6.

As economic resources trees represented long-term investments that received special protection to ensure sustained productive returns. Wood collection was carefully controlled: Walter of Henley stated that

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wood should only be sold 'without loss or destruction' and the phrase 'by hook or by crook' derived from the way that wood could be collected from trees – only by knocking off or pulling down. Sometimes the lopping of trees producing food for livestock and humans, such as oak, beech, and apple, was completely prohibited. Such control is critical because there is considerable delay from germination to the productive stage: acorn yields are negligible for at least twenty years and will not be abundant until the tree reaches at least forty years of age. Even then year to year production is very variable: in this century good yields occur every six to ten years, moderate ones at intervals of three to four years and complete failure during the remainder. But even in a district experiencing widespread failure of seed, abundant production over limited areas still occurs, allowing a certain amount of exploitation whilst limiting the resource degradation elsewhere.[32]

Feudalism and Cooperation

Some of the manorial agroecosystem's success was achieved as a result of the guaranteed source of agricultural labour. Two groups of tenants predominated, the unfree villeins bonded to the lord for life and required to perform work on the demesne and serve in manorial offices, and the freemen with fewer labour obligations. The freedom of villeins was restricted in marriage, migration, education, buying and selling property, brewing, milling, and baking; and perhaps most importantly in the eyes of many commentators, they had no rights under common law against their lords. The lord could lawfully evict at will and take all a villein's possessions upon death. Thus the unfree have usually been represented as both highly oppressed and dependent upon their lord's whim and favour.

However Hatcher's re-examination of lordship and villeinage at many manors suggests that customary local practices were sufficiently powerful to take precedence over common law. Evictions were actually rare, and a tenant defaulting on services or rent received several warnings and small fines before the landholding was removed. Tenancies and goods usually passed to heirs, and lords were commonly satisfied with a small fine or tax set by custom. Furthermore these customary payments were often inelastic over long periods of time, and not subject to market forces.[33]

The security and rights of villeins did change as a result of fluctuations in the availability of labour and land. When labour was scarce or land abundant peasants were under greater oppression; but when labour was abundant, or land scarce personal freedom increased. If poverty rather than freedom were to be taken as a measure of well-being, then landless freemen probably suffered the worst economic hardship, and of course customary practice, in granting security to the villeins, denied the landless access to land. Moreover freemen were frequently willing to trade personal freedom for a measure of economic security by taking up unfree tenancies.

Thus a relationship appears to have existed between access to land and freedom. When increasing population coupled with shortage of land forced up arable rents, this resulted in villeins paying far less for their land than free tenants. Landlords sought to change unfree tenancies to free, and thus receive greater economic returns. Lords then used this money to hire the landless to work on the demesne. But when the population declined during the fourteenth century,

[32] *Walter of Henley, op cit,* pp 6–7. Bennett, *op cit,* pp 231. Young, *op cit,* p 125. P D Goodrum, V H Reid and C E Boyd, 'Acorn Yields, Characteristics and Management Criteria of Oaks for Wildlife', *J Wildl Manage,* 35, 1971, pp 523–527. Jones, '*Quercus*', pp 187–199. Shaw, *op cit,* pp 162–181.

[33] J Hatcher, 'English Serfdom and Villeinage: Towards a Reassessment', *Past & Pres,* 90, 1981, pp 6–10.

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lords attempted to reinstate feudal practices to safeguard labour supply. To the peasants the cost of freedom was higher rents; the benefit of serfdom was security.

Nonetheless all peasant livelihoods were characterized by continual economic stress: notably in the form of rents, entry fines for new tenancies, marriage fees, death duties, payments for use of the lord's pastures and woodlands, tithes to the church, occasional royal taxes, licences and fines for transgressions against by-laws. The total paid in fees by a peasant household was probably 25 to 50 per cent of gross income.[34] Yet under conditions of severe hardship this flow of goods from peasant farmer to lord was reversed. Lords often granted allowances of grain to the poor and sick, provided free shelter and remitted fines. Food relief was distributed to the poor of Hampshire manors, taxes reduced in failed harvest years at Dry Drayton, housing repaired and tenants excused rents on the estates of John of Gaunt, and a proportion of the tithes sent to the almoner for relief of the poor on the Westminster manors. On many manors entitlement to glean cereal grains from the arable fields after the harvest was restricted only to those with no source of income, including the very young and old. Usually about a week was allocated for this activity before the livestock could be released to graze the stubble.[35]

There was also significant cooperation between peasants on each manor. In his introduction, Walter of Henley reflected the tone of medieval farming by quoting the French proverb, 'who has a good neighbour has a good morrow'. Such cooperation is clearly illustrated by life on the manors of Halesowen in the West Midlands. From 1271–1349 the transactions between villagers fell into three categories. First villagers traded ale, cereals, hay, livestock, and wood, and hired out livestock, ploughs, harrows, and carts. Secondly, they provided support and mutual help for each other, particularly through crop and plough-team sharing arrangements. Peasants lent grain, livestock, tools and household utensils to needy neighbours, though these arrangements were more common between small and middle landowners. Thirdly, communal decisions were taken against individuals who had attempted to overconsume or underinvest in the communal resources – in particular those who had encroached onto the common wastes, had over-used the commons, over-gleaned the fields, or had neglected their obligations to maintain roads, ditches, hedges and gates.[36]

Despite the social hierarchy of the manorial system it can be seen that there was a relatively high degree of equitability amongst the landholding farmers. Scattering of individually-owned strips of land in the large open fields ensured a share of both good and bad land. In most regions costs and benefits were proportional to landholding: in consequence the larger landowners paid more towards the wages of village herdsmen, upkeep of fencing and general repair, but were also able to graze more animals on the commons than the smallholder, and received a greater share of the hay from the meadows.

Cooperation in the form of common consent was also a principal feature of the manorial courts. These assemblies were convened so that decisions on farming practice could be made, by-laws framed and enforced, manorial officers appointed, and civil actions heard. All tenants, regardless of size of landholding or status, were obliged to attend the manorial court. The landless, though, could not attend and consequently had little voice in village affairs. The court's authority was enforced by a committee or jury of freeholders and villeins, and presided

[34] Titow, *English Rural Society*, pp 80–93. Postan, *op cit*, pp 139–141.

[35] Titow, *English Rural Society*, p 96. M McKisack, *The Fourteenth Century 1307–1399*, Oxford History of England V, 1959, pp 343–4. Ault, *Open Field Farming*, pp 29–31.

[36] *Walter of Henley, op cit*, pp 4–5. Z Razi, 'Family, Land and the Village Community in Later Medieval England', *Past & Pres*, 93, 1981, pp 10–16.

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TABLE 10

Portraits of shocks and stresses and their role in the decline of the manorial agroecosystem*

Stresses and Shocks	*Impacts or Responses*	*Stresses and Shocks*	*Impacts or Responses*
Population growth (to approximately 1300)	Increasing demand for food, especially from urban areas Declining rural labour wages Increasing demand for tenancies Declining average landholding size Increasing specialization in wheat at expense of oats and barley	severe rains; pests and disease; drought (1315–21)	Severe famine Human mortality 10–15% above normal
		Agricultural recession plus Black Plague (1348 onwards)	Population decline
		Population decline	Desertion of villages, especially solely agrarian Arable land abandoned
Arable expansion (to approximately 1300)	Increasing gross agricultural production Declining woodland, pasture and marshland responses Growing scarcity of meadows Growing conflicts between agriculture and forest sectors Loss of system components that acted as buffers for rural poor	Shortage rural labour	Increasing wages for landless labourers Falling land values Increasing legislation to strengthen feudal labour system Increasing incentives to tempt tenants to stay, including granting permanent tenancies and permitting enclosure
Greater competition for fewer wild resources, plus	Agricultural recession 1315–21 (crop failure, livestock deaths)	Increasing opportunity for employment	Move from generalist to specialist livelihoods, notably bands of harvesters, artisans

* These responses have been compiled from many sources. Those that are recognizable for advocating or analysing one particular stress, impact or response include G Ohlin, 'No Safety in Numbers: Some Pitfalls of Historical Statistics' in R Floud (ed), *Essays in Quantitative Economic History*, Cambridge, 1974, pp 73–75; H S Lucus, 'The Great European Famine of 1315–17', *Speculum*, 5, 1930, pp 7; C Dyer, 'Deserted Medieval Villages in the West Midlands', *Econ Hist Rev*, 2nd ser, XXXV, 1982, p 33; I Kershaw, 'The Great Famine and Agrarian Crisis in England, 1315–1322', *Past & Pres*, 59, 1973, pp 3–50; C R Young, *op cit*, pp 142–8; Ernle, *op cit*, pp 11–12.

over by the lord's steward. The meeting elected the jury, who judged civil disputes, and manorial officers such as bailiffs, constables, overseers, ale-tasters, and woodwards. These posts were mostly filled by richer tenants. The principal duty of the officers was to ensure that the standards of farming were maintained in accordance with decisions made at the assembly; all tenants contributed, therefore, to the choice of crop rotations, the setting of dates for ploughing, sowing, reaping and the post-harvest release of livestock onto the arable fields.[37]

[37] Ault, *Open Field Farming*, pp 58–9. Miller and Hatcher, *op cit*, pp 94–106. Z Razi, 'The Toronto School's Reconstitution of Medieval Peasant Society: A Critical View', *Past & Pres*, 85, 1979, p 147.

IV

Sustainability, stability and equitability in the manorial system thus appear to have been promoted at the expense of productivity. But despite its persistence, the manorial agroecosystem did decline and eventually disappear. What then were the key stresses and shocks that promoted decline?

There are many plausible theories explaining the decline in direct farming, which began during the late thirteenth and early fourteenth centuries. They include, for example, rapid population growth; severe reduction in population due to outbreaks of the plague; the decline of cereal yields due to soil exhaustion; an increase in peasant

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resistance to feudalism; the advent of a commercial spirit in landlords; the rise of a money economy; the increasing non-agricultural population in the towns; the increasing profitability of sheep farming due to the elevated demand for wool in Flanders; and finally the consequences of conflict with France during the Hundred Years War.

Taking two of the most likely of these stresses, population growth and agricultural expansion, it is possible to construct the generalized system responses (Table 10). Some of these responses became in turn other stresses and, combined with the serious shocks of the agricultural crisis of 1315–1321, may have set in motion the series of economic and social responses which so completely changed rural conditions that a return to large scale direct farming of demesnes by lords could no longer be envisaged. Not only was the system no longer sustainable, but in the long run productivity increased and equitability declined as open fields were enclosed and communal sharing arrangements discontinued.

But this portrait describes a generalized picture, and does not take account of regional variations and exceptions. Some of the most interesting questions that now arise concern the special buffers and their critical interrelationships that enabled the manorial agroecosystem to survive the cumulative impact of stresses and shocks at some locations, whilst at others it fell into decline.

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