

The Development of Pastures and Meadows during the Sixteenth and Seventeenth Centuries

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AGRICULTURAL historians have given scant attention to livestock feeding in the early modern period,¹ though an examination of the patterns in England from 1500 to 1700 shows that dramatic changes took place. Two developments were the cultivation of the grazing unit, and the introduction of clovers, as both a ground cover for grazing and as a fodder for the overwintering of livestock. A third change, the evolution of ideas of livestock nutrition, will not be discussed in this paper.

At the beginning of the sixteenth century livestock were essentially scavengers upon the bits and pieces of land that were allocated for their provision. Very little fodder was deliberately cultivated for winter feeding, and most farmers made no conscious effort to expend energy for the production of food for livestock. In those areas of England where there was both arable and livestock rearing, livestock feeding was merely an adjunct to the arable, so that stock was fed upon the stubble of arable crops and whatever land could be grazed. Rearing in the early sixteenth century was extensive in nature — large tracts of land were necessary to provide food for the livestock. The ratio of land to stock was high, and land was the limiting factor in the number of livestock that could be raised. This, however, was no longer the case by the end of the seventeenth century. A second feature of sixteenth-century livestock raising was that the types of ground cover available for grazing were those which grew naturally in the particular environment. Generally farmers did not use special seeds for their grazing areas at the beginning of the sixteenth

century, except for an occasional use of vetches.

The major purpose of this paper is to examine as biological entities the several types of land used for the rearing of livestock, and to survey the sixteenth- and seventeenth-century literature about pasture management in order to document the changes in livestock feeding. The object is to show that increases in the amount of ground cover in these cultivated units took place, which in turn changed the ratio of land to animals. More animals could thus be reared on natural pasturage. These changes were not uniform all over England, but where they did occur the changes in the management of grazing can be documented and perhaps extrapolated. The changes probably took place on land which was either enclosed or held in severalty; land which was managed in common was not generally given the extra energy input because the management of the commons had to receive the consent of the community.

I *The Ecology of Pastures and Meadows*

During the sixteenth century land used for grazing and mowing was not cultivated for that purpose. In terms of habitats, either natural or man-made, six kinds of land provided feed for livestock. These included wastes which bordered the edges of villages and parishes; the ground cover on the fallows, which may have had a catch crop of vetches; the stubble left on arable lands after the harvest; woodlands which were browsed and/or grazed for fruits and herbaceous plants; meadows, which are lands which border running water and are liable to floods; and pastures which are drier, and may or may not form part of the commons. Biologically, two distinct types of pastures and meadows can be

¹ Livestock is used throughout to include cattle, horses and sheep, acknowledging that regional differences existed in the proportions of these various animals.

discerned: those which were solely grazed, and those which were mowed and grazed. The species of plants and their densities depended on patterns of grazing and mowing as well as the environmental conditions of the particular area. Farmers made essentially no energy input into these seemingly unproductive lands: thus the edaphic factors were probably the major determinants of the species which grew there. At the beginning of the sixteenth century these six classes of land provided the major part of the food for livestock for most of central and eastern England. In some areas of the north and western region of England soil, climatic and topographic considerations allowed only the extensive type of livestock rearing on large tracts of natural grasslands.

The changes brought about in the units cultivated for more food became apparent after an examination of these natural grazing lands from an ecological viewpoint. Three major ecological niches exist with respect to moisture, with all possible gradation within them: they are xeric — dry (deserts); hydric — wet (marshes and the edges of ponds); and mesic — an intermediate stage (woodlands). Arable land is essentially in a xeric condition, because the land has been cleared of all growth and an extensive ground cover no longer helps conserve moisture. Ecologically, several climaxes or steady states or equilibriums occur naturally. The amount of physical disturbance which occurs in an area is a major factor in succession, succession being the natural evolution of plants and animals as dictated by type of soil, climatic factors of light and water, and the species which are present. Any area not disturbed by man by widespread grazing, or by natural catastrophic events undergoes several stages of succession and eventually reaches the climax steady state for that particular environment. Some of these climax areas are grasslands, characterized by low annual rainfall; deciduous forests, areas of medium amounts of rainfall and temperate climate; coniferous forests, which have higher rainfall and are in cooler temperate regions; and

deserts, hot or cold areas with very little rainfall. The life forms in the climax conditions have reached an equilibrium. Any widespread interruption of an environment alters the natural succession pattern. The common rapid succession pattern which occurs when a deciduous forest is cut down has an initial phase in which grasses and herbs invade the area. This leads to a shrub phase, in which a wide variety of herbs, shrubs, and tree seedlings occur, and from this stage the area eventually returns to the deciduous phase. An important point about succession is that the plants and animals alter the habitat themselves, and thereby create conditions which allow for the next wave of succession.²

Although natural succession is prevented from reaching a steady state by the agricultural practices of ploughing, grazing or planting seeds, succession patterns can still be described. Continual disturbance of the habitat by agricultural practices favours those plants which can invade and colonize disturbed areas and become successful. These are predominantly the annual, biennial, and perennial herbs, some mosses, and ferns, plant species which become the ground cover upon which the livestock feed. An important feature of the sixteenth-century environment is that the plant species which grew without requiring man to supply the seed were predominantly native to the British Isles. The plant population of the British Isles in the early sixteenth century was relatively stable, though the changes in agricultural practices from 1500 to 1700 brought about an increase in the number of species which grew naturally because some of these new species colonized successfully and became naturalized, that is, they no longer required man's cultivation. Another factor which influenced early pasturage is that farmers in the sixteenth century rarely added many nutrients to the soil, for the only fertilizers available were marl, lime, manure, and vegetable wastes. These two factors meant that the actions of

² Henry J Oosting, *The Study of Plant Communities*, 2nd edn, San Francisco, 1956, pp 240–8.

man, as compared to his livestock, had very little influence on plant succession in sixteenth-century pastures and meadows.

Two studies have been carried out from which we can make reasonable deductions about English grasslands before cultivation and sowing of seeds became established for livestock feeding lands. The first by H Baker examined the meadow and hay fields in Oxfordshire, while the second by Winifred Brenchley is a long-term descriptive study of the plants growing in the Park Grass Plots at the Rothamsted Experiment Station, Hertfordshire. The data from these two studies illustrate the species present and their relative abundance, and can be extrapolated to much of the grass/grazing lands in the midland area of England. Three habitats have been examined in these studies, an area adjacent to a river which was only grazed, an area adjacent to a river which was mown for hay and then grazed, and a dry field which was mowed for hay. In any grazed or hayed habitat one of the major factors which determines succession is the time of the year when the land is grazed or mowed. Grazing early in the growing season inhibits the perennial species from becoming fully established or dominant, and thereby increases the number of short-lived, annual species during the summer months. Continual mowing without any input of nutrients depletes the soil, and numerous species will invade, some of which will even flourish, although their density will be lessened. Over-grazing of an area also results in an increase of species and decrease of density.

On the Thames above Oxford two types of meadows exist which have been used as common land for several centuries. The largest plot of land is the Commons, Port Meadow, which has been used solely for the grazing of livestock. This 400-acre tract can be further divided into three parts whose species are determined by the amount of flooding of the river and the length of time the water stands upon the land. Pixey, Oxei and Yarnton Mead are three smaller parcels of

land which are used as hay meads and then grazed from autumn until March. The floristic data include some 95 species which occur on these contiguous parcels; however, only 56 species occur in Port Meadow, of which 30 species also occur on the hay meads. The total number of species on the hay meads is 69, of which 39 are unique to the hay meads. The species distribution is further divided into those species which predominate on the wetter parts of the land, and those which were found only on the drier parts. In the smaller area of the hay meads, 270 acres, a greater number of species occurred than on the grazed lands. One of the conclusions that the author reached was that grazing had considerable effect upon the species which would be present and on those life forms which are rosette or creeping predominate. Baker states that on the wetter edge of Port Meadow, 'Were the grazing factor removed it appears likely that the vegetation of this section would develop as a typical marshland community in seral succession. . . .'³

The Park Grass plots at Rothamsted were set aside in 1856, and have no records of deliberate sowing of seeds. This study of a natural grassland has used various types of nutrients as variables to demonstrate the difference in the numbers and types of plant species present and their densities. Each year the several plots are mowed, and the weight of the clippings and number of species present have been recorded. Two of the plots, 2 and 3, have had no manures or nutrients added, although one-half of each plot has had some applications of lime. The other twenty-one plots have had various types and amounts of nutrients added. Comparison between these different programmes demonstrates the wide variety of differences between active pasture management and leaving the land to the mechanical effects of grazing or mowing.

The average number of species in plots 2 and 3 was 35 from 1903 until 1949. Plot 3 had

³H Baker, 'Alluvial Meadows: A Comparative Study of Grazed and Mown Meadows', *Journal of Ecology*, XXV, 1937, pp 408-20.

the greatest fluctuations, from 27 species recorded in 1919 to 43 species recorded in 1903. The variations in plot 2 were from 31 species to 35 species.⁴ Brenchley described plot 3 as 'Herbage of a characteristic poverty-stricken type, yielding a very small crop, and consisting of a large number of species, of which few are strikingly in evidence in most seasons. The plants are nearly all low growing, and tend to form leaves close to the ground rather than much top growth. . . . Starts into growth late in spring. Yield very low . . . species subject to considerable seasonal fluctuations.'⁵ She also made an observation which is critical to my argument: 'N.B. — A species may almost disappear in one season only to reappear in relatively large amount in later years.'⁶ By contrast the average number of plants in plot 11, in which high amounts of nitrogen, superphosphate, potash, soda, and magnesia were added, was only 8.5, with fluctuations from 7 to 10 species.

Although the number of species was much smaller than on the control plots, the yields were consistently considerably higher. The average number of hundredweights that were cut from these twenty plots from 1920 to 1963 was 30.1. The average number from plot 2 was 14.4, and for plot 3 12.5. In contrast the averages for the two sections of plot 11 for the forty-four years were 46.2 and 52.7. The predominate species in the high-yielding plot 11 were the grasses because the legumes had lost their competitive advantage through the heavy concentrations of nitrogen. These data emphasize that in contrast with the fertilized plots more varieties of plants occur within these unseeded plots, although the over-all yields are less.⁷

Direct comparisons between the Rotham-

sted data and the Yarnton commons are not possible because the Oxford study reported only the frequency of species and not percentages of the whole. We can compare the variety of species recorded in the two studies. Forty-three species were found in plots 2 and 3 at Rothamsted. Of these 20 are common to the Hay meads, in which 69 different species were recorded. The greater variety of species in the meads is most likely caused by its location beside a river and the topographic features that allow standing water.

From these data we can assume that sixteenth-century unmanaged pastures and meadows had a large variety of plant species present, few of which were in evidence all year round. The volume, mass, and thus caloric value that these many varieties produced, were low. The factors which affect the species distribution were the edaphic ones, the location, and the mechanical effects of grazing and mowing. These two studies give us a reasonable profile of what most of the pastures and meadows of central England must have resembled during the sixteenth and early seventeenth centuries.

II Sixteenth- and Seventeenth-century Agricultural Writing

A survey of the agricultural literature from Sir Anthony Fitzherbert in 1523 to John Worlidge of the late seventeenth century reveals a striking change in the way livestock feeding, meadows, pastures, fodder, and plants for livestock care were perceived. The most important occurrence is that during this period the concern for calories for livestock feeding became an active rather than a passive concern. In England previous to the sixteenth century pastures and meadows were not consciously managed, and livestock were fed from plants which were available as a concomitant to other farming activities. By the end of the seventeenth century methods of pasture management had evolved which included enclosure, use of leys, the leaving of land for grazing as either a part of a rotation

⁴ Winifred E Brenchley, *The Park Grass Plots at Rothamsted, 1856-1949*, rev Katherine Warington, Harpenden, Rothamsted Experimental Station, 1958.

⁵ Winifred E Brenchley, *Manuring of Grassland for Hay*, 1924, pp 9-10.

⁶ *Ibid*, p 11.

⁷ 'Hay, The Park Grass Plot, 1856 onwards', in Rothamsted Experimental Station, *Details of the Classical and Long Term Experiments up to 1967*, Harpenden, 1970, pp 34-43.

system or for longer terms, and ploughing and sowing of seeds for grazing or fodder.

The late thirteenth-century treatise of Walter of Henley and its variations mentioned livestock feeding only in pointing out that three gradations of pastures existed: very good, good and very bad. It mentioned the number of livestock that could be kept upon the different types of land, but not the number per acre. No comments or suggestions were made on how to improve feeding lands or prevent their natural deterioration. Fitzherbert, in both his *Boke of Surueyng* and *Boke of Husbandry*, mentioned the feeding of livestock, but like Walter of Henley he showed only very passive concern. Fitzherbert suggested that hay be mown at the end of June because 'it is not convenyent to have hay and corne bothe in occupacion at one tyme'.⁸

Barnaby Googe's translation of Conrad Heresbach's *Foure Bookes of Husbandrie* represents a further confirmation of the passive interest in the over-all feeding of livestock. His comments on the rearing of horses are typical:

He that hath a fancy too breede horses, must first prouide himselfe of a good race, then of a good ground, and plenty of pasture, which in other Cattell, ought not be so greatly obserued.⁹

Then follow several pages about the characteristics a horse should have, but no specific instructions are given on the feeding of the horses, other than by good ground and good pasture. Leonard Mascall, in his *The First Booke of Cattell* in 1587, was also cursory in his instructions for the feeding of livestock:

The keeper and gouernour of cattel must always be diligent to forsee that his cattel have meate in due season, and that his stalls be cleanly kept. . . .¹⁰

Mascall further advised that a good man should be sought who will 'feed or see that they have sufficient meat and water dayly at couenient times . . . and . . . to help him with medicine.' He did state that 'the best and most frankest grasse is that which groweth

amongest errable groundes and furrowes, rather than medowe which are wette or moyst'.¹¹ Yet when he came to the diseases and cures for livestock, Mascall gave very specific details for the types of apothecary's drugs which should be used for their care.

The prevalent attitude towards the management of pastures and meadows was taken from the classical authors. As Cono, the landowner, states in Barnaby Googe's 1577 translation of Heresbach:

yet other olde wryters doo most of all preferre Pastures, as the grounde that requireth least a doo about it: and therefore they were called as Varro sayth, *Prata*, because they were *parata*, always in redinesse, and needed neither great charge nor labour. . . .¹²

Fitzherbert's work on surveying has two chapters dealing with pasture and meadow management. In the chapter 'To amende and make better, dyuers maners of pastures' he listed the types of land, and stated that some pastures were previously used as arable, but he did not indicate how to improve such pasture lands. 'Bushy ground which has been arable' may have been land which was browsed by livestock, which does not wholly prevent succession. The pastures did not have constant care and management. The following chapter was entitled 'Howe to amende ley ground, the which hath ben errable land of late.' In this section Fitzherbert suggested that if the terms of the lease were favourable, the husband should drain and plough in the spring to let the mosses rot, and if by winter moss was still there he should plough again and sow 'with dyuers cornes'. The methods which Fitzherbert presented are slightly contradictory. He recognized that grasslands often needed improvements but he did not detail a specific regimen. Quiche grass was the only plan Fitzherbert mentioned as a good hay.¹³

Fitzherbert's usage of the word ley is

¹¹ Ibid, p 213.

¹² Heresbach, op cit, p 44.

⁸ Master Fitzherbert, *The Boke of Husbandry*, 1523, p xiv.

⁹ Conrad Heresbach, *Foure Bookes of Husbandry*, trans Barnaby Googe, 1577, p 112.

¹⁰ Leonard Mascall, *The First Booke of Cattle*, 1587, p 51.

¹³ More than likely this is *Agropyron repens*, now considered to be 'a noxious and persistent weed': A R Clapham, T G Tutin and E F Warburg, *Flora of the British Isles*, 2nd edn, Cambridge, 1962, p 1157.

worth exploring, because leys became an important part of pasture management during the seventeenth century.¹⁴ He used the term ley to identify land which had been set aside to regain heart:

Nowe euery husbände hath sixe seuerall closes, whereof thre be for corne, the fourth for his leyse, the fyfte for his comen pastures, and the sixte for his hay: and in wynter tyme there is but one occupied with corne. . . .¹⁵

Thus the husband could use the other five closes for his different livestock after the hay was mown and the corn harvested. Fitzherbert's advocacy of the use of leys implied that land was relatively abundant. The tenant often had an excess of land, or made extensive use of land because rents had not yet begun to climb. He noted that if any of the three closes used for corn were worn then the farmer could plough up the ley and

lette the other lye for a tyme, and so shal he haue always rest grounde, the which will beare moche corne with lytell dong . . . and also he shall haue great profite of the wode in the hedges when it is growen.¹⁶

John Norden's *The Surueyor's Dialogue* contained what was apparently the first suggestion that the care of pastures and meadows should be a part of a systematic agrarian activity. Around 1593 Norden began a projected series of county histories, and travelled extensively throughout England collecting information. He was also one of the surveyors of the crown woods during the first decade of the seventeenth century. Norden had the opportunity to observe different farm-

ing practices and to make pronouncements about preferred techniques from his travel observations. Like Fitzherbert, Norden felt that the role of surveyor was to assess the amount and value of holdings, and also to suggest improvements for both tenant and landowner. Improving one's land was stressed throughout the *Surueyor's Dialogue*. In it the Bayly stated that he did not like interference with the natural course of good meadow grounds, to which the Surveyor replied:

You need not feare it, for experience hath found, that it hurteth no kinde of ground . . . (and) Euery thing hath his time and course, a growing, a perfection, and decay. . . . And therefore he that hath best meadow grounds, if he be a good husband, will obserue how they stand in force, or weaknes, and accordingly indeuor to help the defects. . . .¹⁷

Norden classified as pastures all tillable land, and thus included upland meadows as pasture. He distinguished between naturally wet meadows, 'meadowes, the cause of whose goodness is the soyle, and ouerflowing, with the most muddy water', and man-made water meadows. He concluded that meadows 'may be made excellent by charge: but they will decay, unless they be always relieued'. He observed that wet meadows yield by far the greater profit but his instructions for water meadows were vague at best. The management of pasture was in two forms: the rejuvenating of meadow land, including letting it become grazing ground, and ploughing it up and sowing seed. If a meadow had been weakened by too much cutting of hay it should be pasture for several years, or the farmer should carry fat soil and dung to the area and 'cast it abroad upon the meadows, not too thick'. Then the area should be sown with hay dust. His instructions for tilling and sowing meadow/pasture land were to plough it up and leave it fallow for the summer, then plough in the fall and

sow it with pease or fetches, next with wheat, and lastly with fetches and hay dust, laying it as plaine and

¹⁴ Walter W Skeat in his *The Book of Husbandry by Master Fitzherbert*, 1534 edn, London; English Dialect Society, 1882, p 157, defines leys as pasture ground. Perhaps a better definition for leys for the first half of the sixteenth century would be long-term fallow which may have been used for livestock. In Fitzherbert's *Surveying* the word ley does not connote a livestock usage but land in longer fallow. The 1587 will of Richard Collins, Wolvercote, included 'the herbage of Meades leys and closes': M A Havinden, ed, *Household and Farm Inventories in Oxfordshire, 1550-1590*, HMSO, 1965, p 225. This may be an example of a transition towards leys being used for livestock in a rotation with arable. I do not recall seeing the term ley in the seventeenth-century agricultural literature used for this paper.

¹⁵ Master Fitzherbert, *The Boke of Surueyeng*, 1523, p liiii.

¹⁶ Ibid, p liiii.

¹⁷ John Norden, *The Surueryor's dialogue*, 1610, p 164. I would like to thank Dr Thirsk for collating Book Five of John Norden, *The Surueryors Dialogue* of 1607 with Norden's 1610 edition. Book Five of the two editions varies only in typesetting.

leuel as you can. Then seede it the next summer, and after that, hayn it and mowe it, and with in a year or two, the grasse will be fat sweet and good.¹⁸

The Bayly related that if one ploughs pastures on some types of soil:

they will hardly graze againe in 6 or 7 years: yet haue I seen as rich wheat and barley on it, as may well approve the ground to be very fruitful.¹⁹

This is true, for if one only ploughs and leaves the land to fallow, beginning a succession phase, those plants which are in the environs will set seed and invade the fallow. If the farmer did as Norden advised, sowing the area with either hay dust or seeds, 'especially the seed of the clauer grasse, the grasse hony-suckle, and other seeds that fall out of the finest and purest hay', then he had begun to control the species that would be major ground covers in his pastures.²⁰

During the 1650s a flurry of literature on the improvement of agrarian practices was published. Samuel Hartlib was perhaps the pivotal figure of this exchange, and his role in the improvement of agricultural practices in England during the seventeenth century should be examined in greater detail. In 1650 Hartlib published the letter of Sir Richard Weston to his sons, describing the intensive agricultural practices of the Low Countries. The Dutch use of land seemed to have been a turning point for land management:

about April following you may sow the same Land with Oats; and upon them *Clover-grass* seed onely harrowing it with bushes, which will com up after the Oats are mowed, and that year yield you a very great Pasture till Christmas; and the next year following you may cut that grass three times . . . and will continue (as pasture) good four or five years together without sowing it.²¹

The other editions of Hartlib included letters from the vast correspondence which he received. These letters presented empirical observations of the writers, their questions, observations, trials and errors as they tried to improve their agricultural practices. In 1651

one of the correspondents recommended the following regimen for the improvement of pastures:

A *Meadow* yields 6 times more *Hay*, when it is turned up with a plough, and sown thick with ashes burnt out of the substance thereof, but the rain must fall first. Afterwards sow your *Meadow* with the seed of *Trefoil*, and plough and harrow them in.²²

The correspondent then recommended the 'Trefoile' going to seed and seeding itself before mowing.

Clovers

Robert Plot, in his *Natural History of Oxfordshire*, 1677, discussed the flora found in Oxfordshire. One of his headings was 'Of unusual Plants now cultivated in the *Fields*':

for *Grasses*, the usual name for any *Herbage* sown for Cattle, especially if *perennial* (to pass by the *trifolium purpureum majus sive sativum*, *Clover-grass*; and *Onobrychis spicata flore purpureo, semine echinato*, commonly called *Saint-foin*, or *Everlasting-grass* . . . now every where known, and therefore nothing concerning the qualities and advantages of it). They have lately sown *Ray-grass*, or the *Gramen Loliaceum*, by which they improve a cold, sour, clay-weeping ground, for which it is best, but good also for dryer up-land grounds, especially light stony, or sandy Land, which is unfit for *Saint-foin* . . . *trifolium agrarium Dodonaei*, called *Melilot-trefoil*, and sometimes *Non-such* . . . *Trefoil* . . . *saenum Burgundiacum caeruleum L'Obelii* . . . commonly called *Lucern*. . . .²³

Eight years later Edward Fuller, a seed merchant at the May-Pole in the Strand, London, offered, 'Clover-grass, Hop-Clover, Saine-foin, La Lucern, Rye-grass, French Furz, Dantzick-Flax' under the heading 'Seeds to improve Land'.²⁴ These several 'grasses' were among the major plants which were a part of the innovation of improving pastures and meadows.

The major grass (member of the *Gramineae*) in these two lists was rye grass, 'Ray-grasse' (*Lolium perenne*), an indigenous plant of the

¹⁸ Ibid, pp 155, 157.

¹⁹ Ibid, pp 158, 164.

²⁰ Ibid, pp 163, 194.

²¹ Richard Weston, *A Discours of Husbandrie Used in Brabant and Flanders*, 2nd edn, 1652, p 7.

²² Samuel Hartlib, *Samuel Hartlib his Legacy of Husbandry*, 3rd edn, 1655, p 128.

²³ Robert Plot, *The Natural History of Oxfordshire*, Oxford, 1677, pp 150, 155.

²⁴ 'A catalogue of seeds, plants, etc.' sold by Edward Fuller, c 1685. I wish to thank Malcolm Thick for this reference and for supplying a photocopy of the plant list.

British Isles which was not systematically sown or grown for pastures until the middle of the seventeenth century. John Gerard's *Herball*, revised in 1633 by Thomas Johnson, included two *Loliums*, called white darnel and red darnel. The two plants are described thus: Among the hurtfull weeds Darnell is the first. . . . Red Darnel is likewise an unprofitable corne or grasse. . . . They grow in the fields among wheat and barley, of the currupt and bad seed . . . especially in a moist and dankish soile. . . . The Names . . . in English, Darnel: of some Iuray and Raye.²⁵

John Parkinson's herbal of 1640 described the darnels as growing 'either in the fields of corne, or in the borders and path-ways of other fields that are fallow'.²⁶ The transition of rye grass from a weed to a mainstay of British pastures is remarkable and should be explored.²⁷

During the seventeenth century the sowing of 'clovers' became part of the systematic care of pastures and meadows. Historically a discontinuity occurred in their use as a cultivated plant. Evidence exists that some clovers or lupines were used as a green manure, a fodder, and a grazing ground cover for several centuries BC. G W Hendry has suggested that the domestication of lucerne, alfalfa (*Medicago sativa*), follows closely the domestication of the horse.²⁸ Rediscovery of the previously domesticated clovers, and domestication of other clovers, began in western Europe during the late fifteenth century. The introduction and adoption of the clovers in England during the seventeenth century was partially documented by a variety of contemporary writers.

Any discussion of the 'clovers' of the seventeenth century and earlier is beset with numerous taxonomic problems, because the

four important fodder and grazing genera (*Medicago*, *Melilotus*, *Onobrychis*, and *Trifolium*) contain over thirty-one cultivated species, and other leguminous plants were also sown in the seventeenth century.²⁹ A quote from Parkinson regarding the common names of 'Trifolia pratensis, Medow Trefoiles' (?*Trifolium pratense*) shows the extent of the taxonomic problem.

The Names . . . in English, Claver or Clover grasse, and Medow Trefoile or Three leafed grasse, and of many also Hony suckles, because Bees feed much on the flowers. . . .³⁰

For lucerne, alfalfa (*Medicago sativa*), Parkinson included under the heading 'The Names', 'we call it Medick, Fodder and Snaile Claver, or Trefoile'. The terms 'Trefoile' and 'Clover' seem to have specific meanings to their respective authors, but it may be difficult to generalize these meanings for all the seventeenth-century English agricultural literature.³¹ Given the lack of sufficient taxonomic data to make firm pronouncements, this section will try to present a reasonable modern approximation of the taxonomic species used for improving seventeenth-century pastures and meadows.

A few general points about the biology of the clovers are important. These leguminous plants have nodules containing nitrogen fixing bacteria in association with their roots which enable the plants to fix nitrogen and improve the nitrogen content of the soil. Some forms of clover are prostrate and suitable only for grazing, whilst others are erect and thus are suitable for both grazing and producing hay. Clovers include annuals,

²⁵ John Gerard, *The Herball or Generall Historie of Plants*, rev Thomas Johnson, 1633, pp 78-9.

²⁶ John Parkinson, *Theatrum Botanicum: The Theater of Plants*, 1640, pp 1144-6.

²⁷ Rye grass (*Lolium perenne*) was in the original unseeded plots 2 and 3 at Rothamsted in 1856. The largest percentage of rye grass was 1.2 per cent in 1926, and generally was less than 1 per cent in those years in which it has appeared in those plots. Brenchley, op cit.

²⁸ K Lesins, 'Alfalfa, lucerne' in N W Simmonds, ed, *Evolution of Crop Plants*, 1976, p 166.

²⁹ To emphasize the complexity of this problem *Flora Europaea*, ed T G Tutin et al, Cambridge, 1968, II, has 37 species under *Medicago*, 99 species under *Trifolium* and 16 species under *Melilotus*.

³⁰ Parkinson, op cit, pp 1110, 1112.

³¹ The standardization of plant characteristics and specific epithets was introduced by Carl von Linne in his *Species plantarum* published in 1753. The synonymy before 1753 is often difficult to follow as the flower parts were not used uniformly for plant descriptions. Thus Rembert Dodens may have one name, Mathias de L'Obel another, and Charles L'Ecluse yet another name for the same species; and each may have used a different part of the plant as its identifying characteristic.

TABLE 1

Selected characteristics of certain clovers grown in England in the seventeenth century

Clover name	Life-span	Height	Use	Soil
Lucerne <i>Medicago sativa</i>	perennial to 30 years	30–90 cm	Hay and grazing	Sandy loams and heavy clays
Hopclover, Black Medic <i>Medicago lupulina</i>	annual to biennial	5–60 cm	Grazing	Poor soils drained
Sweetclover <i>Melilotus alba</i>	biennial	30–120 cm	Poor hay and grazing	Almost any soil
Yellow sweetclover <i>Melilotus officinalis</i>	biennial	60–120 cm	Grazing	
Sainfoin <i>Onobrychis viciifolia</i>	perennial to 20 years	30–60 cm	Hay and grazing	Drained loams limed, some clays
Crimson clover <i>Trifolium incarnatum</i>	annual	20–50 cm	Hay and grazing	Sands, clay, poor soils
Red clover <i>Trifolium pratense</i>	biennial to perennial	50–60 cm	Hay and grazing	Good soil, well- drained and limed
White clover <i>Trifolium repens</i>	perennial, short-lived	5–50 cm	Grazing, some hay	Sands, loams, clays, drained
Hop trefoil <i>Trifolium campestre</i>	annual to biennial	35–50 cm	Grazing, some hay	
Bird's foot trefoil <i>Lotus corniculatus</i>	perennial	10–40 cm	Grazing	

biennials or perennials, which may affect which species was selected for a particular rotation. Some species have a strong tap root, and are unsuited for heavy clays, whilst other with shallower roots can be used on heavier soils. Some are more aggressive on poorer soils than others. The seed pods are either indehiscent, with seed pods that do not open regularly, or dehiscent, with pods which open easily. Some of these biological constraints undoubtedly had an effect on the adoption of the 'clovers' during the seventeenth century. Table 1 summarizes the main botanical characteristics of those which were probably grown.

William Turner, an English botanist who travelled extensively throughout Europe during the sixteenth century, observed one of the 'medics' growing in Germany, and commented on sowing 'clovers' in a prepared field.³² This was the first recorded English

observation of the practice of sowing 'clovers' which was adopted in the seventeenth century. Googe (Heresbach) and Estienne (Surfleet) translated European comments on 'clovers' as fodder and as plants to be sown for pastures. The botanical literature also contained comments. Gerard's 1633 edition, for example, had fourteen clovers under the heading '*Trifolium*'.³³ Parkinson's *Theatrum Botanicum* described thirty-five kinds of 'clovers'. But Gerard and Parkinson do not include the kinds of comments about their growing which appeared in Turner's herbal, nor were all the 'clovers' they listed suitable for livestock feeding.

³² William Turner, *The First and Second Partes of the Herbal of William Turner*, Collen, 1568, II, p 52.

³³ John Gerard published in 1596 and 1599 lists of the plants which were growing in his garden in Holborn. The plants in these lists were given modern species epithets by Benjamin Daydon Jackson, *A Catalogue of Plants Cultivated in the Garden of John Gerard*, London, privately printed, 1876. Gerard was growing 'Dutch Cocks Head' (*Onobrychis viciifolia*), 'Burgundie hay' (*Medicago sativa*), 'Purplewort' (*Trifolium repens*), 'German Clover' (*Melilotus officinalis*), and 'Great Haresfoot' (*Trifolium incarnatum*).

George Owen travelled through Pembroke-shire in 1603 and observed the natural occurrence of one of the 'clovers':

. . . if the lande bare either furse, fearne, heath, broome, or any other kinde of shrubb the Marle vtterlie destroyeth it, and causeth the grounde, (be it neuer so ill conditioned and barren before) to bringe forth fine grasse full of the herbe called *Trifolium* or three leaved grasse, and of the countrie people honie suckles' both white and red. . . .³⁴

Credit for introduction of 'clovers' for improvement of pasture and feeding livestock has largely been given to Sir Richard Weston, who travelled extensively in the Low Countries as an exile during the 1640s. Upon returning to England he wrote a tract which described the agricultural practices of the Low Countries, including intensive use of land for food, fodder, industrial plant products, and the sowing of 'clovers' for pastures. Weston's 'clover-grasse' has been assumed to be *Trifolium repens* but may have been *Trifolium pratense*. Indeed it was probably a mixture of several clovers, (*Trifolium* and/or *Melilotus*), which may account partially for the varied experiences Weston reported with 'clover-grasse'. His directions may be condensed as follows:

Clover-grasse Seed thrives best when you sow it in the worst and barrenest ground. Such as our worst heath ground is in England. The ground is thus to be prepared for the Seed . . . plough and sow . . . harrow afterwards, and with bushes under your harrows. . . . An acre of ground will take about ten pounds of your Clover grasse-seed . . . cheif season of sowing it are April or . . . Marsh. About the first of June it will be ready to cut. It yeelds most excellent hay . . . at least five bushels of Seed from every Acre. . . . One Acre of it will feed you as many Cows, as six ordinary Acres. . . . Being once sowed, it will last five years, and then being ploughed it will yeeld three or four years together, rich crops of wheat, and after that a crop of Oats.³⁵

Weston used this method on his land in Surrey, and recommended it to his sons. In one instance he offered his advice to others.³⁶

Andrew Yarranton, in his work on clover in 1663, pointed out that sowing 'clover' 'brings the ground into a fresh capacity of tillage', which could not otherwise occur unless the land was left fallow for a number of years.

I can make it appear, six acres of land in *Clover* will keep as many cattle, as Thirty acres of natural grass; and besides your Land need not now lie out of tillage, so long as it was wont to do; but once in four five years you may break it up, and it shall be as fit for tillage, as though it had lain 20 years with natural grass.³⁷

Yarranton experimented with the optimal time for sowing 'clover seed'. Initially he recommended that it be sown from 10 March until the end of April. Yet after experimenting, he felt that sowing clover in August was best, 'because I find one great enemy to Clover is natural grass'. Yarranton felt that the start which the seedlings would have over winter would shade out competing weeds. He recommended sowing 12 lb of seed per acre on 'gravely dry land' or 'clayland where it drains', and liming the field.³⁸

While Weston and Yarranton dealt solely with the vague heading of 'clovers', other writers were recommending other genera. Blith recommended the use of three 'clovers', 'Trefoyle or great Claver Grass' (*Trifolium pratense*), 'St Foyne' (*Onobrychis viciifolia*) and 'La-Lucerne' (*Medicago sativa*). The species mentioned in the Plot quotation were 'Clover-grass' (?*Trifolium pratense*), 'Saint Foin' (*Onobrychis viciifolia*), 'Ray Grass' (*Lolium preenne*), 'Mililot-trefoil' (*Melilotus officinalis*), 'Trefoil' (?*Trifolium repens*/*Trifolium incarnatum*), and 'Lucern' (*Medicago sativa*).

In 1671 appeared *St Foin Improved*, 'written by a person of honor lately deceased'. This work extolled the virtues of sainfoin (*Onobrychis viciifolia*) as 'that delight in Husbandry'. The soils proper for St. Foin, as those most of dry grounds, and though they be very barren, trial having been made plentifully on Stony and Chalky Grounds. . . .

³⁴ Henry Owen, ed, *The Description of Pembroke-shire by George Owen of Henllys*, 1892, pt 1, p 72.

³⁵ Hartlib, op cit, pp 242-3.

³⁶ A R Michell, 'Sir Richard Weston and the Spread of Clover Cultivation', *Ag Hist Rev*, XXII, 1974, p 160.

³⁷ Andrew Yarranton, *The Improvement Improved by a Second Edition of The Great Improvement of Lands by Clover*, 1663, p 12.

³⁸ Ibid, pp 21, 23.

Sands . . . the Red and Brown, bear it singularly well; all Clays and other cold and wet Grounds bear it not.³⁹

Since sainfoin is a perennial, the author did not recommend that cattle graze upon it during the first year. But after the second year both mowing and grazing were expected. If sainfoin was sown in the spring it was acceptable to oversow with either oats or barley, but if it was sown in the autumn 'it must ever be sowed alone without corne'. The rate of sowing was four bushels per acre. The author suggested that before the farmer lay down sainfoin for a time he make a 'trial whether any Ground will bear it', on a small plot 'about four yards square', to ascertain if the plant would be successful on his land.⁴⁰

The major part of *Hartlib His Legacie* was comprised of correspondence to Hartlib from persons who were experimenting with new agricultural improvements, and the discussions on 'clovers' were an integral part. Unfortunately, most of the correspondents and their locations are not identified. The majority of the comments on 'clovers' affirmed the technique that they should be a part of a several-year rotation, for they both provided livestock food and improved the soil. Robert Child's letter exhorted that England had abounding pastures but neglected the 'great Clover-grass', 'Sainte Foine', 'Lucerne', 'Trefoils', and 'Hop-Trefoil' (?*Medicago lupulina* or ?*Trifolium campestre*). During the seventeenth century 'Saint Foine' and 'La Lucern', although dissimilar legumes, were often confused because both could do well on the poorer soils. If growing sainfoin, farmers were told 'not to expect above 7 years profit by it, for in that time it will decay'. After seven years the field should be ploughed and sown again either with sainfoin or with grains. It was noted about lucerne 'that of once sowing it will continue ten or twelve years'.⁴¹ Both were mown for hay and grazed during the

autumn and winter. From the discussion in Worlidge's 1675 work it seems difficult to decide which to grow, and he states:

St. Foyn . . . hath in several places of England obtained the preference above *Clover-grass*. . . . If it be sown on the poorest and barrenest Land . . . it will thrive . . . *La Lucern* is commended for an excellent Fodder, and by some preferred before *St. Foyn*, as being very advantageous to dry and barren Grounds.⁴²

The improving farmer may well have tried a small plot of each before deciding which would be to his greatest advantage.

One of the problems surrounding the introduction of clovers was the difficulty in obtaining a supply of seed. Contemporary recommendations, such as Yarranton's, suggested that the farmer should send a man to the Low Countries to purchase clover seed; if he obtained extra seed it could be easily sold to one's neighbours. Blith noted that obtaining seed was hazardous:

the transporting of it by sea is no considerable prejudice unto it, but much that is sold in the Seed-mens shops in London was either corrupted by the Dutch . . . or else parched by over-drying. . . .⁴³

Most of the clovers have indehiscent seed pods, which can take years before naturally releasing the seed within the pod. In order to obtain the seed more easily the pods were often dried in a kiln before threshing.

Weston, in a letter of 1650-51, noted that his men could not get clover seed out 'til March' for 'I thinke that it must first be laid abroud a drying in the sun some 3 or 4 hours before it is thresht . . .'.⁴⁴ He wanted to try and thresh the seed in the field during the summer but the weather had been inclement. Lady Ranelagh was said to have used a mill in order to remove the husks from 'clover seeds'.⁴⁵ In 1672 Richard Haynes of Sussex was awarded a patent for 'an invencion or way of severing, divideing, and makeing cleane the said seed called nonsuch trefoye or

³⁹ *St. Foine Improved, a discourse shewing the utility and benefit which England, 1671*, p 17.

⁴⁰ *Ibid*, p 18.

⁴¹ Hartlib, *op cit*, pp 3, 102.

⁴² John Worlidge, *Systema Agriculturae*, 1675, pp 28-9.

⁴³ Walter Blith, *The English Improver Improved*, 2nd edn, 1652, p 179.

⁴⁴ Michell, *op cit*, p 161.

⁴⁵ University of Sheffield, Samuel Hartlib, *Ephemeridis 1652*, BB-BB8. I wish to thank Dr Thirsk for this reference.

hop clover, from it husk, & also from the mixture of course grasse or weed'. The obtaining of clover seed remained a problem.⁴⁶

Some of the letters of the Hartlib correspondence answered the various complaints that clovers took 'the Heart of the Ground, and leave it barren and unfruitful', for not all found the innovation satisfactory.⁴⁷ Part of the problem could have been the different conditions and the types of clovers sown (see Table 1). Another writer felt that 'clover-grass had so poisoned the ground that I had not half a crop this last harvest'.⁴⁸ The establishment of clovers was indeed not always very successful during the seventeenth century. Possibly the necessary *Rhizobium* bacteria were not present in the soil: although clovers have nitrogen-fixing bacteria in their root nodules, these bacteria are not a part of the plants themselves. The bacteria must be present in the soil to establish a symbiotic relationship.⁴⁹ The complaint of John Wood of Dedham, Essex, c 1678 could possibly be explained by a lack of the necessary bacteria. He stated that the clover that he had sown had not been productive, and that the yield was no better than the grasses that were there before. 'That sometimes it is an advantage to the occupier to sow his lands with clover and sometimes not.'⁵⁰

III Conclusion

The comparison of biological features of pastures and meadows in the early sixteenth century versus those of the late seventeenth century has shown that significant ecological developments took place during this period. At the beginning of the sixteenth century

pastures and meadows were generally left in a natural biological state, and the plants which grew were natural concomitants of the soil type, with mechanical interference by either livestock or mowing. By the end of the seventeenth century pastures were systematically cultivated, fertilized and sown with seeds. These changes increased the number of calories per acre available for feeding livestock. The evolution of ley farming or convertible husbandry, in which tillable land was rotated between arable and pasture, was a significant feature of the change. The changes in pasture management combined technical innovations with a change in farming systems: the technical innovations were the ploughing of pasture land and sowing of seeds; the change in farming systems was intensification of land use by elimination of the fallow.

A possible model for the changes in pasture management in the counties north of London as far as Derbyshire can be described. At the beginning of the sixteenth century land which was used for livestock was extensive in nature, and the tenant was not utilizing all of his land; it was still a tenant's market for land. By the 1540s pressures were exerted upon the land, and so leys, which before had simply been excess land which was allowed a longer time to regain heart, were used as grazing lands. During the sixteenth century, apparently, leys began to be used as ancillary pastures, depending upon the location and the ownership of the land, and whether land was in severalty or common fields. About the 1570s these leys became systematically used, and were ploughed up and either left to regain a sward or were used for growing grains and other crops. By the 1590s enough observations had been made to show that a single method could not be applied to all lands, and that the length of time for a good sward to form also varied. Following these observations it appears that farmers began regular sowing of hay dust and seeds of the plants desired in the sward. Thus, by the end of the sixteenth century ploughing up of land and

⁴⁶ Great Britain. British Patent, 1672, No 166, 'A way to Sever, Divide, & Make Cleane the Seed called Nonsuch Trefoyle or Hopclover from itt Huske . . .', issued to Richard Haynes, 1857.

⁴⁷ Hartlib, op cit, p 245.

⁴⁸ Univ of Sheffield, Hartlib MSS, 26/67/1-2, 34/4/21.

⁴⁹ George H Clark and M Oscar Malte, *Fodder and Pasture Plants*, Ottawa, 1923, p 18. When clovers are introduced into new areas inoculum of the specific *Rhizobium* is purchased with the seed for sowing.

⁵⁰ PRO: E 134 33 Char II, East 3.

sowing of seeds for swards was undertaken in some parts of England, and by the middle of the seventeenth century became more common. After 1650 clovers were commonly used. The major results of this systematic care of pastures and meadows were that the farmer had begun to control the species which inhabited his pastures and meadow land, and that the over-all yields of these ploughed-up and seeded lands increased as the competition of natural succession was controlled.

Several factors probably influenced this systematic change in pasture and meadow management: first, the price of livestock products increased throughout the two centuries; second, the population rise of the sixteenth century brought an increased demand for land; third, empirical methods were applied to agriculture as part of the intellectual movement of the seventeenth century, and fourth, the acreage held in

severalty or under the management of enterprising tenants increased. Improving farmers could experiment with new crops by taking small parcels of land and experimenting with them. The observations of one of these farmers engaged in improving farming techniques makes a fitting conclusion to this paper. Andrew Yarranton, writing in 1662, noted 'that knowledge in all arts, especially in Husbandry is attained by industry, observation, often practice, and patience'.⁵¹ This attitude, adopted by many of the improving farmers of the seventeenth century, led to changes in farm management which increased the over-all productivity of English farm lands. By the end of the seventeenth century farmers were using and controlling the natural succession of grasslands to their advantage, and the location of their land was no longer of primary significance.

⁵¹ Yarranton, *op cit*, p 3.

NOTES AND COMMENTS

(continued from page 17)

WILHELM ABEL: AGRARKRISEN UND AGRAR-KONJUNKTUR

Mrs Olive Ordish's translation of Wilhelm Abel's *Agrarkrisen und Agrarkonjunktur* is to be published by Methuen & Co this spring. The Society commissioned the translation many years ago and is pleased at last to see its appearance. The translation incorporates changes made in the recent third edition, and includes an introduction and a select bibliography by Dr Joan Thirsk. The Society has arranged for ordinary members (UK) to purchase copies at a considerable reduction on published price, and a form for this purpose is inserted into the present issue of the *Review*. It should be noted that the offer is restricted to members, and is available only for a limited period. Any enquiries on this matter should be addressed to the Treasurer.

PRINTING OF THE REVIEW

The present issue of the *Review* marks our departure from the previous letterpress printers, Popper & Co, to the lithographic printing unit of the University of Leeds. It is hoped that the change will enable some economies to be made in the future production of the journal, and may make for greater flexibility in the presentation of its contents. No change in format is envisaged, but members may note some differences in its general appearance and in the 'house style' employed. Any comments on these changes should be sent to the Editor.