

The Invention of Sustainability

Nature and Destiny, c. 1500–1870

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**For my mother, Brenda Warde,
and in memory of my father, Noel Warde**

as evidence of betrayal, simple-mindedness or hypocrisy: but instead as a reason to *make our case*, through listening, research and persuasion, for what we regard as desirable and sustainable ways of life in this world. And – this is not a small caveat – to work towards a world where we have *equal chances* to make our case, rather than just the theoretical, legal right to do so. It may help, too, to appreciate that when we argue, self-evidence barely passes muster as evidence at all, that knowledge is a vast, shifting and collective endeavour; that the question of sustainability may not actually have an answer, but that there may be nevertheless good reasons for asking it, over and over.

1 Living from the Land, c. 1500–1620

Bread

‘Man doth not live by bread only.’¹ It is true, and repeated twice more in the Bible to underline the point.² But when it came to that uttermost necessity of sustaining life, the people of early modern Europe did indeed largely live on bread.³ This had been true of much of Europe and the Middle East for many, many centuries. Bread might fall in line behind the Word, and arrived on the scene after the expulsion from Eden, but when prophets and scribes sought some metaphor that could convey a notion as being indisputably essential, it was to bread they reached. In the Catholic tradition, God embodied himself in the transformation of bread: the ‘bread of life’. The fact that the King James Bible contains 330 uses of the word ‘bread’ and only 280 of the word

¹ Deuteronomy 8:3, King James version.

² ‘Man shall not live by bread alone, but by every word that proceedeth out of the mouth of God.’ Matthew 4:3; also Luke 4:4.

³ The literature on bread consumption is enormous and cannot be glossed here. Indeed, as bread or grains (which might also be consumed as beer) constituted the largest share in the diet of the great majority of Europeans, nearly all histories of agriculture and material life must deal with it. There is no doubt too that access to grain and bread was the overwhelming preoccupation of authorities concerned with dearth, even if in some parts of the continent ‘its predominance was not nearly so great as many modern assumptions suggest’. Craig Muldrew, *Food, energy and the creation of industriousness. Work and material culture in agrarian England, 1550–1780* (Cambridge: Cambridge University Press, 2011), p. 58. For an authoritative study of the politics of bread in *ancien régime* France, see Stephen L. Kaplan, *Bread, politics and political economy in the reign of Louis XV* (The Hague: Martinus Nijhoff, 1976).

'love' does not perhaps bear witness to the core tenets of Christianity, but might be an indicative of what most graced the tongues of peasants, preachers and politicians, both literally and metaphorically. Bread was everywhere: in dreams, sermons, speeches, banter and bellies; all the places and processes that collectively somehow, mysteriously, made a life.⁴

So when the bread failed it was not just bodies that quailed and suffered, but the whole community, the order of things. Everyone watched the skies and the earth for portents of the harvest and the progress of the crop. There were, no doubt, a thousand different ways how peasants could judge whether God might make a year bounteous. Those hidebound to their books could consult the advice of the ancients who listed the signs to be read in the celestial heavens, in the nether weathery skies, or the behaviour of bird and beast as to how their fortunes might go. Translated by the learned men of the Renaissance, some of these did not perhaps surpass peasant wisdom, if they could make any claim to particular knowledge at all: 'he shall foretell great Abundance of Raine, if the Clouds be darke, deepe and thicke'.⁵ At times, it seems that the whole of floral and faunal creation knew more of the coming temper of the airs than did those placed to rule over them:

Hee shall know before hand that It will be Rain by these and other such like signs... if little birds, haunting the Fens, be continually washing themselves in the water, if the Crow doe wet her head at the brinke of the water, or wade into it, and crie verie much toward evening; if the raven sound out her song from the hollow of her throat, and boast herself of her wings; if the geese crie and flye more than they have been accustomed; if the Bees will not flye farre from their hives; if the Heron wander and and whirle about to and fro in the midst of the Fields all sad and lowring; if Oxen eat more than ordinarie, lye downe upon the right side, looke toward the South, licke their hooves all about: if the Kine looke up into the ayre, and draw in the same: if the Asses bray: if Cockes crow at all hours, and chiefly at evening,

⁴ Piero Camporesi, *Bread of dreams. Food and fantasy in early modern Europe* (Cambridge: Polity, 2005).

⁵ Charles Estienne, *Maison rustique, or The countrey ferme*, trans. Richard Surfleet, and further edited by Gervase Markham (London: John Bill, 1616), p. 25.

when they are upon their pearches... if spiders fall downe, not being blown downe of the wind: if Dogs tumble and wallow on the earth: if Pigeons come home late to their house: if Flies, Wasps and Hornets, Fleas and Gnats, bite more keenly than ordinarily they are wont.⁶

Did any one ever rush to mow their hay to see the beasts through the long winter ahead at the prompt of a gnat-bite? We cannot know. But it made perfect sense that the whole of Creation might be aquiver for what the tenor of the atmosphere might be. When tempests raged, hail battered ears of corn and soft grapes into oblivion, or deluges saturated the shallow tilth and rotted crops where they stood, things appeared awry with the whole order of the world. We know that in certain parts of Europe the clamour might be raised against storm-raising witches, especially in the exceptional years of 1587-8 and the 1620s when snows fell in summer across an already war-battered southern Germany.⁷ More often, the message from the pulpit was that more prosaic bad behaviour had incited God's wrath: drunkenness, licentiousness, the lack of charity in men's hearts.⁸

People were not resigned to this seasonal wheel of fortune. Whether bad behaviour triggered the calamities or not, clear-minded officials knew perfectly well that good governance could ameliorate the worst. Equally, sharp-eyed merchants saw their main chance. In the dearth-stricken 1590s, the ships of the Baltic swarmed west and south laden with grains from the breadbasket of Poland for the bare warehouses of the Mediterranean and Atlantic coasts. In the popular imagination the men who stocked up in anticipation of the bad times,

⁶ Estienne, *Maison rustique*, p. 25.

⁷ Wolfgang Behringer, *Witchcraft persecutions in Bavaria. Popular magic, religious zealotry and reason of state in early modern Europe* (Cambridge: Cambridge University Press, 1997); also Christian Pfister, 'Climatic extremes, recurrent crises and witch hunts. Strategies of European societies in coping with exogenous shocks in the late sixteenth and early seventeenth centuries', *The Medieval History Journal* 10 (2007), pp. 1-41; Christian Pfister and Rudolf Brázdil, 'Climatic variability in sixteenth century Europe and its social dimension. A synthesis', *Climatic Change* 43 (1999), pp. 5-53.

⁸ See the essays collected in Wolfgang Behringer, Hartmut Lehmann and Christian Pfister (eds), *Kulturelle Konsequenzen der "Kleinen Eiszeit" / Cultural consequences of the "Little Ice Age"* (Göttingen: Vandenhoeck & Ruprecht, 2005); Wolfgang Behringer, *Kulturgeschichte des Klimas. Von der Eiszeit bis zur globalen Erwärmung* (Munich: Beck, 2007), chs 3-4.

awaiting the greatest spike in prices and the moment of greatest need for advancing credit, were the cause of the shortages themselves. Oft-times public officials agreed, condemning these ‘Caterpillars and Locusts’, who ‘make a private gain out of a public detriment’. Sometimes, those local magistrates and the profiteering middlemen were one and the same.⁹ But in many regions statute ordered that grain was to be offered for sale in public places to locals first and foremost. Forestalling and re-grating (stockpiling and speculating through sales to middlemen, not for direct use) were banned. Rioters seized cartloads of grain and redistributed it at what they considered a fair price. Whether the blow was considered providential or from the heartless behaviour of rich individuals, there had to be some culpable, human ‘covertness’ involved.¹⁰

But hunger was endemic, and not just a condition of ‘bad years’. The fear of dearth raised basic issues of equity, distribution and responsibility. The misfortunes of vagabonds and beggars, the mob of the *matta-panes* (‘bread-crazy’) might easily be attributed to their own moral failings; but often the question was not clear-cut. Even small towns in Germany might have a beadle stationed at the town gate to hand out coins to the itinerant poor before barring them entry: a curious combination of beneficence to the stranger with the abdication of responsibility and ejection once this small bounty was extended.¹¹ In any case the cash dried up when times became hard within the

⁹ Charles Fitz-Geffrie’s sermon, *The curse of corne-holders*, cited in Steve Hindle, ‘Dearth and the English revolution. The harvest crisis of 1647–50’, *EcHR* 61 (S1) (2008), p. 70.

¹⁰ R.B. Outhwaite, *Dearth, public policy and social disturbance in England, 1550–1800* (Basingstoke: Macmillan, 1991); Hindle, ‘Harvest crisis’, pp. 74–8; Wilhelm Abel, *Massenarmut und Hungerkrisen in vorindustriellen Europa. Versuch einer Synopsis* (Berlin: Parey, 1974), passim; Robert Jütte, ‘Klimabedingte Teuerungen und Hungersnöte. Bettelverbote und Armenfürsorge als Krisenmanagement’, in Behringer et al., *Kulturelle Konsequenzen*, pp. 225–37; Robert Jütte, *Obrigkeitliche Armenfürsorge in deutschen Reichsstädten der frühen neuzeit. Städtischen Armenwesen in Frankfurt am Main und Köln* (Köln: Böhlau, 1984); Paul Slack, *Poverty and policy in Tudor and Stuart England* (London: Longman, 1988); William John Wright, *Capitalism, the state, and the Lutheran Reformation. Sixteenth-century Hesse* (Athens, OH: Ohio University Press, 1988).

¹¹ Paul Warde, ‘The origins and development of institutional welfare support in early modern Württemberg, c. 1500–1700’, *Continuity and Change* 22 (2007), pp. 459–87; on the ambiguities of attitudes to and explanations of dearth, see Ayesha Mukherjee, *Penury into plenty. Dearth and the making of knowledge in early modern England* (London: Routledge, 2015), pp. 21–34.

walls. The Elizabethan government in England exhorted the peers and gentry to ‘hospitality’, a traditional delivery of alms in hard years at the mansion door (more likely the back door).¹² Poor boxes rattled round the pews and even alehouse benches of an evening to raise funds for the indigent and infirm considered ‘deserving’, most commonly the old. In towns and increasingly rural parishes in a few parts of the continent overseers and beadles distributed bread, cash and fuel to the poor, sometimes collected through forms of property taxation. Hospitals and religious institutions dominated welfare provision in Catholic countries. More often one fell back on kin, while the cold shoulders of neighbours in very many communities pushed unfortunates on to the road, never to return.¹³

Attitudes to the poor were unquestionably harsh, on many occasion un pityingly so. But welfare was nevertheless understood as a responsibility of government. And this is why this story of sustainability begins here. Long before many people concerned themselves in any detail with the capacity of the land to deliver its benefits over the long run, European rulers were presented with an obligation to ensure the products of the land reached those who needed them. At least officials should do everything in their power to ensure that the honest man could labour to make his own shift. Where people had completely lost the capacity to do so, public officials might step in. Of course, this obligation was rather differently felt, and the experience of welfare was highly varied, in part because of the highly varied politics of Europe and the fact that communities and lordships, even in the greater and more centralised states, retained a high degree of autonomy. But policy (or *police* or *polizei*, that range of measures designed to maintain order, published in *Polizeiordnungen* throughout the period) was not only reactive. Markets sales were regulated, maximum prices sometimes fixed. By the late sixteenth century headmen and magistrates could be found searching through

¹² Steve Hindle, ‘Dearth, fasting and alms. The campaign for general hospitality in late Elizabethan England’, *Past & Present* 172 (2001), pp. 44–86.

¹³ For general surveys, see Jütte, *Obrigkeitliche Armenfürsorge*; Slack, *Poverty and policy*; Steve Hindle, *On the parish? The micro-politics of poor relief in rural England, c. 1550–1750* (Oxford: Oxford University Press, 2004); Bas van Bavel and Auke Rijpma, ‘How important were formalized charity and social spending before the rise of the welfare state? A long-run analysis of selected Western European cases, 1400–1850’, *EcHR* 69 (2016), pp. 159–87.

the barns of their charges for sacks of grain secreted away, compiling lengthy despatches on the needs and food stocks of their communities so bureaucrats and rulers could assess the balance of supply and demand. Heads of households lined up to swear oaths on how much they generally consumed, what they needed for seed, and what might be spared for distribution. Outside of the major port cities, those places and people whose credit was always good, little enough of this effort had great effect. And rules to obviate scarcity brought confusion in their wake. If grain should be sold to the near locality, how could one get it to great urban centres when the country was hungry? Did the demands of the potentially restive crowds of the capital trump those of the peasantry? Could one trust the reports of public officials who themselves were farmers, grain merchants, shippers? By and large, policy implementation was by necessity local, but it also posed questions about the distribution of resources in the polity as a whole, or at least within the hinterlands of major cities and strategic military regions.¹⁴

There was another kind of answer to all these quandaries, and to the basic question: how do we get bread? Bread was baked of grains, and since the sin of Adam and Eve grains were coaxed through toil from the tilled earth. Indeed, a preoccupation with earth far outweighs love or bread in the Bible: 960 references in the edition of King James! For bread, for order, one needed tillage, always more tillage. There were other foods to be won of course aside from cultivating the fields and gardens; bounties of hedgerow, lakes, rivers and streams, of wild creatures, although many of these had been declared off-limits and prerogatives of the nobility (who of course had no great need of such things). And *in toto* they were meagre enough measured against the totality of need. In the worst cases people choked down animal feed, adulterated breads that sent them mad, the very grass of the fields. The straw found boiling in small pot over the fire to soften it when neighbours broke into a cottage in the town of Reggio in April 1601, to find three abandoned sons, two dead from hunger, one barely alive

¹⁴ Kaplan, *Bread*, passim; Stephen Hipkin, 'The structure, development and politics of the Kent grain trade, 1552–1647', *EcHR* 61(S1) (2008), pp. 118–25; Abel, *Massenarmut*, passim; Paul Warde, 'Subsistence and sales. The peasant economy of Württemberg in the early seventeenth century', *EcHR* 59 (2006), pp. 289–319; Paul Warde, 'Origins'; Hindle, 'Harvest crisis', pp. 76–7.

and with the halms stuffed between his teeth in a last desperate resort to hold body and soul together.¹⁵ One does not live on bread alone; but even more certainly, one does not live at all from straw. How to get bread? How to increase the supply of crops? It was through asking these questions, and investing them with political urgency, that eventually people would come to turn the question round. Have we over-extended ourselves? Does current plenty store up future penury? It would be a long time before such speculations appeared, but to understand one of the routes by which people got there, we will start with the question of tillage.

Tillage

Sir Thomas More's *Utopia* was a bit of a joke. The perfect place that he described in 1516 was no place that anyone would want to live, but at the same time, it showed that one might live better. So what should one know about this land of *Utopia*, or any polity for that matter? A trusty guide should 'set out in order all things relating to their soil, their rivers, their towns, their people, their manners, constitution, laws'. If the size of individual city populations grew out of balance, the imagined guide to the island, Raphael Hythloday tells us, 'they supply cities that do not increase so fast, from others that breed faster'.¹⁶ He does not tell us why a population could become too much, but clearly there were limits:

if there is any increase over the whole island, then they draw out a number of their citizens out of the several towns, and send them over to the neighbouring continent; where, if they find that the inhabitants have more soil than they can well cultivate, they fix a colony, taking the inhabitants into their society, if they are willing to live with them; and where they do that of their own accord, they quickly enter into their method of life, and conform to their rules, and this proves a happiness to both nations; for according to their constitution, such care is taken of the soil that it becomes fruitful enough for both, though it might be otherwise too narrow and barren for any one of them.¹⁷

¹⁵ Camporesi, *Bread of dreams*, p. 85.

¹⁶ Thomas More, *Utopia, or, the Happy Republic*, trans. G. Burnet (Glasgow: Hamilton and Balfour, 1743), pp. 43, 60.

¹⁷ More, *Utopia*, p. 60.

Self-evidently, then, Utopians managed their soil well. How precisely this was done was not a concern for Thomas More and drew no further comment. In fact, the only real lesson was political. Any society that did not nurture the sod to utopian standards was ripe for justified expropriation.

But if the natives refuse to conform themselves to their laws, they drive them out of those bounds which they mark out for themselves, and use force if they resist. For they account it a very just cause of war, for a nation to hinder others from possessing a part of that soil of which they make no use, but which is suffered to lie idle and uncultivated; since every man has by the law of nature a right to such a waste portion of the earth as is necessary for his subsistence.¹⁸

Here succinctly expressed was a manifesto for a coming whirlwind of colonisation, forced migrations and subjugation.¹⁹ The voyagers and conquistadors who were launching out from European shores as More wrote this may not have ever considered themselves as spreading an unassailably virtuous order, yet they understood well that any land that did not conform to their ideals of cultivation and civilisation – ideas that could barely be distinguished – was open to claim. By the seventeenth century colonial magistrates would opine from their benches that only ‘improved’ land – that is, land that had demonstrably received investment in the form of recognised agricultural practices from the Old World – could confer title. The ecology of native farming, and indigenous claims to the land, were rendered invisible.²⁰

Yet More’s claim related to a more local concern than the practice of great European land grab in the New World. The Utopian

¹⁸ More, *Utopia*, p. 60.

¹⁹ A century and a half later Locke made a related argument, implying the native Americans had no store of value and hence no incentive to ‘improve’ their lands. Nor, by implication, could they justly prevent others from using it. John Locke, *Two treatises of government* (London: Awnsham & John Churchill, 1694), II.V.48–9. Later still, the same argument was employed by Emmerich de Vattel in his *Law of nations* of 1758 to justify claims to colonial sovereignty. Cited in Richard H. Grove, *Green imperialism. Colonial expansion, tropical island Edens and the origins of environmentalism 1600–1860* (Cambridge: Cambridge University Press, 1995), pp. 266, 286.

²⁰ For example, William Cronon, *Changes in the land. Indians, colonists and the ecology of New England* (New York: Hill & Wang, 1983), ch. 4.

justification rested on an argument that had a widely recognised status in European law: each man [*sic*] had a right to the ‘necessary for his subsistence’, his *necessitas domestica*, in German his *Notdurft*, all those things that maintained his household. The principle of granting access to necessity, but no more, was frequently applied to common rights, determining the level at which individual households could extract collectively managed resources. Equally, petitioners pressed authorities to ensure that basic necessities were available on the market, and at times, although controversially, it could be claimed as a justification for theft.²¹ Subsequently great legists and philosophers would view the labour which fenced a plot of ground and cultivated it to secure enough to eat as the primordial underpinning of private property, and the first justification for extracting a patrimony from the common waste.²² But in a world distant from treatises and jurists, the rough justice of the squatter also saw a patch of untilled ground as fair game for hungry bellies, and indeed it was conceded in natural law as evoked by Locke ‘that men, being once born, have a right to their preservation, and consequently to meat and drink, and such other things as nature affords for their subsistence’.²³ A whole society might be judged by the quality of its environmental management (to use a very anachronistic phrase). And better management, in the view of many, meant more tillage.

Thus across numerous lands in sixteenth-century Europe, people became preoccupied with the balance of tillage and other uses of the soil: pasture, meadow, vineyards, marsh, heath, woodland, although these all played an essential role in the agrarian economy. As populations bounced back from the post-Black Death nadir, cultivated land began to edge out into abandoned territory again, or fill in leys left to grass amid the great open fields. Poorer families without a fortunate inheritance sought ‘waste’ to colonise, while the better endowed sought to profit as a gap opened up between food prices and relatively lower wages. By default, much of this expansion and assarting was ‘enclosure’; in other words, it effectively abolished the possibility of common rights of grazing or fuel-gathering being exercised on the

²¹ Martina de Moor, Leigh Shaw-Taylor and Paul Warde (eds), *The management of common land in north west Europe 1500–1850* (Turnhout: Brepols, 2002); Hindle, *On the parish*, pp. 89–91.

²² Locke, *Two treatises*, II.V.27–30.

²³ Locke, *Two treatises*, II.V.25.

newly cultivated land, frequently without any actual legal change in the land's status. When it was a matter of a fraction of an acre here or there, the institutions which governed the common rights frequently turned a blind eye, if they noticed at all. In much of Europe the governing 'institution' over the land was the lord of the manor, or indirectly, the prince of the state who oversaw the local courts. Tillage brought more revenue to landowners and such 'enclosure' was often uncontested.

There was, however, enclosure of another kind to be found in England. This entailed the much larger-scale removal of rights by lords from great expanses of the common waste, or the abolition of collectively agreed regulation over arable fields and pastures. The land was then turned over to more commercially profitable farming, often sheep-raising to supply the textile industry. It might involve large-scale expropriation and drew howls of righteous anger from the affected peasantry. Such enclosure was highly controversial, and a tendency to provoke unrest jangled the nerves of government sufficiently to lead to measures that – at least for the sake of appearances – limited or outlawed the practice, or made it much easier for tenants to defend their rights. Fear of enclosure was a prominent theme in the 1510s and 1520s and a series of commissions investigating the practice had proven a trigger for widespread revolt in southern England in the summer of 1549.²⁴ Enclosure later in the sixteenth and seventeenth centuries was not usually of this type; it extended tillage into the waste, or undid communal regulation of land already under the plough, although in some parts of the country, notably the East Midlands vales, new commercial incentives saw a shift to pastoral farming and stock-fattening, while other farmers became more flexible in switching land between arable and grass leys ('convertible husbandry') to enhance productivity. But whenever scarcity reared its head, enclosure provided a ready-made scapegoat. It angered those relatively poor commoners who saw the stock of available resources shrunken. In some places it seemed to extend pasture; and it always evoked the bad memories of the sheep ranchers of earlier decades. If England seemed to be bursting at the

²⁴ R.C. Allen, *Enclosure and the yeoman* (Oxford: Oxford University Press, 1992); Andy Wood, *The 1549 rebellions and the making of early modern England* (Cambridge: Cambridge University Press, 2007).

seams and hungry, then enclosure might be to blame, the devourer of tillage.²⁵

The English Parliament thus received many bills on the subject of tillage, often directly introduced by senior government ministers, and some of which became law. Frequently they reacted to dearth and recent or ongoing crisis, as did the great majority of European legislation on welfare, market controls and resources. Bills appeared in 1552, 1555, 1563, 1571, 1589 and 1597. The purpose was sometimes not quite clear: was it 'converting land into tillage', 'the maintenance of tillage', the 'increase of tillage', the 'preservation of tillage'? Sometimes these terms were used for one and the same bill. But the common sentiment was that there should certainly be no less tillage, and preferably more.²⁶ In the midst of the great European crisis of the 1590s, statesman, lawyer and savant Francis Bacon moved a motion to protect tillage in November 1597, linking it to a simultaneous bill banning forestalling and re-grating, and complaints against depopulating enclosure. At the same time the first bill for the Poor Laws was edging towards the statute book, that over the next three years reshaped English welfare provision into a national, parochial-based system. England was no anomaly. The principalities of Germany published numerous ordinances defending tillage, frequently seeking to arrest a perceived expansion of vineyards (although vineyards often took up land ill-suited to the plough, and in any case provided employment and a ready source of income from exports which grain cultivation could not).²⁷ But there is little evidence of these efforts by parliaments and privy councils having much effect, certainly in the longer term. In the end, tillage ebbed and flowed with the population, with some regional adjustments in land use as markets became better integrated

²⁵ J.R. Wordie, 'The chronology of English enclosure, 1500–1914', *EcHR* 36 (1983), pp. 483–505; Leigh Shaw-Taylor, 'The management of common land in the lowlands of southern England, c. 1500–c.1850', in de Moor et al., *Common land*, pp. 59–85.

²⁶ '4 March 1552', *JHC* 1: 1547–1629 (1802), p. 19; '15 November 1553', *JHC* 1, p. 30; '12 November 1555', *JHC* 1, p. 44; '23 March 1563', *JHC* 1 p. 70; *JHL*: 'April 1563', *The Journals of all the Parliaments during the Reign of Queen Elizabeth* (1682), pp. 72–7; 'Journal of the House of Lords: May 1571', *JPQE*, pp. 145–54. *JHL*: 'March 1589', *JPQE*, pp. 424–7; *JPQE*, pp. 551–66; *JPQE*, pp. 536–44; *JPQE*, pp. 660–89; '4 May 1624', *JHC* 1, pp. 697–8.

²⁷ Warde, 'Origins'; Walter Achilles, *Landwirtschaft in der frühen Neuzeit* (Munich: R. Oldenbourg, 1991); Wilhelm Abel, *Geschichte der deutschen Landwirtschaft*, 2nd edition (Stuttgart: E. Ulmer, 1967).

and specialised. In southern Germany it was a deteriorating climate from the 1560s onwards that would stop the vines in their tracks, especially bitterly cold years around 1600 and again in the 1620s that simply killed the plants and literally froze the peasants' investments.²⁸ What was more important than the *effect* of such legislation for the story of sustainability was the fact that government attention had been drawn to the problem.

In truth tillage was expanding, but people thought it was not, or that it was not expanding fast enough. How then could it be encouraged? Early modern Europe was not some Utopia where things just got done at a timely moment. Attempts at regulation provoked argument and men were alive to apparent contradiction. Surely the main incentive to till the land was profit, the source of 'gayness' that would inspire more cultivation, argued Sir Thomas Smith? Smith penned a work in the tumultuous, blood-soaked year of 1549 defending enclosure but equally calling for the expansion of tillage through loosening restraints on trade, although it did not see the light of day for three decades. Smith's inspiration to more husbandry was 'To let them have more profit by it then they have, & liberty to sell it at all times & to all places as freely as men may do other things... the ye price would provoke every man to se ye plough in the ground, to till waste grounds.' According to him higher grain prices would extend tillage, and lower the incentive for depopulating enclosure for pasture. Much of the logic of regulation, that sought to control prices, would militate against the expansion of cultivation.²⁹

Similarly, five decades later Sir Walter Raleigh argued at the Parliamentary session of 1601 that bans on forestalling and re-grating, key tools of consumer protection, simply reduced commercial possibilities, and while they squeezed down prices in hard years, they equally

²⁸ Erich Landsteiner, 'The crisis of wine production in late sixteenth-century Central Europe. Climatic causes and economic consequences', *Climatic Change* 43 (1999), pp. 323–34; Paul Warde, *Ecology, economy and state formation in early modern Germany* (Cambridge: Cambridge University Press, 2006), pp. 84–91.

²⁹ The work was not published until 1580 and for a long time wrongly attributed to Sir John Hale. Smith [published as Gentleman, W.S.], *A compendious or briefe examination of certayne ordinary complaints* (London: Thomas Marshe, 1581), pp. 22–3; Paul Warde, 'The idea of improvement, c. 1520–1700', in Richard Hoyle (ed.), *Custom, improvement and the landscape in early modern Britain* (Farnham: Ashgate, 2011), pp. 127–48.

reduced profit and incentives to investment.³⁰ In the longer run, it meant less grain to go round – a classic critique of market restrictions and the French and Spanish practice of setting price ceilings that would echo through the seventeenth and eighteenth centuries. Francis Bacon's measure to protect tillage of 1597–8 was thus at best an emergency provision that should be repealed as swiftly as possible (and it should be noted that much of this legislation across Europe was only ever intended for dearth years). Yet the seeds of an idea had been sown, that a goal of government was to promote *expansion* and intensification of the use of the land.

Tudor preoccupation with the extent of tillage seems to have ebbed away in the reign of James I, marked by a single bill on the 'decay of tillage' in 1624. Periodic trade restrictions continued. In response to the dearth of 1622–3, whose manifestation in the Cumbrian uplands is now considered the last famine in English history,³¹ the government proposed the setting up of corn magazines to provide both a source of subsidised grain for the poor, and a guaranteed market for farmers. This was a model widely applied in the great cities of the continent, and that with government encouragement had spread into even small settlements in the Duchy of Württemberg. In an England already becoming ill-disposed towards government interference in the grain market, the proclamation does not seem to have been followed up.³²

If more tillage seemed the solution to Tudor gentlemen, historians have long been schooled by reading Thomas Malthus to view the core problem from the other side of the equation: too many people. The capacity for agricultural expansion would always, necessarily, be limited by technique and land area, and thus the variable that shifted to cause problems was growing numbers of people: 'It

³⁰ Simon d'Ewes (ed.), *Journal of the House of Commons* (Shannon: Irish University Press, 1682), Dec. 1601, pp. 660–89.

³¹ Andrew B. Appleby, *Famine in Tudor and Stuart England* (Liverpool: Liverpool University Press, 1978); on the events of 1622–4 in the British Isles, see Richard Hoyle, 'Famine as agricultural catastrophe. The crisis of 1622–4 in east Lancashire', *EcHR* 63 (2010), pp. 974–1002; and a more general discussion can be found in the essays collected in John Walter and Roger Schofield (eds), *Famine, disease and the social order in early modern England* (Cambridge: Cambridge University Press, 1989).

³² James F. Larkin and Paul L. Hughes (eds), *Stuart royal proclamations. Vol. 1. Royal proclamations of King James I 1603–1625* (Oxford: Clarendon, 1973), no. 248, pp. 585–8; Warde, 'Origins'.

is an obvious truth, which has been taken notice of by many writers, that population must always be kept down to the level of the means of subsistence', wrote Malthus in the first version of his famous *Essay*, published in 1798.³³ Malthus's foray into demography was intended as a private document refuting what he saw as misguided cornucopian optimism among sympathisers of the French Revolution. He would develop an argument in later editions of the book that people could indeed regulate population change by altering the birth rate. But if they did not, they would be repeatedly plunged into periods when the number of people surpasses their means of subsistence, a 'necessary oscillation... constantly subsisting cause of periodical misery' that through higher mortality would bring supply and demand for food back into line.³⁴

Two centuries before Malthus people had no notion of restraining population. If pressure became too much, then the indigent were expected to simply head elsewhere, as the Utopians did. Indeed, while the run of opinion in late sixteenth-century Europe was that population had increased, no-one had attempted, or had the capacity, to take the measure of it outside of some limited urban censuses.³⁵ The great surveyor and mapmaker John Norden delivered a report to the Privy Council on how the Crown might enhance revenue by enclosing parks and chases in 1607; he wrote at a turning point in policy when government no longer shied away from enclosure and began consistently to view it as a tool to enhance productivity and improve the desperate royal finances. The proximate cause of Norden writing was the latter issue, but it did no harm to throw in that: 'It is great providence to adjust of some course to increase not only meadow and pasture but especially tillage in this Kingdom consider the dayly increase of whose wants of corn in years of no extreame necessity.' Shortages sucked coin from the realm to pay for Baltic imports, an issue that had also exercised

³³ Thomas R. Malthus, *Essay on the principle of population* (London: J. Johnson, 1798), p. 7. It should be added that Malthus did not imagine agricultural production to be invariant, but that its capacity for growth was always less than 'the power of population', so that even a world turned into a garden would still, eventually, hit a Malthusian crisis; although he also argued that Europe had already reached the crisis point.

³⁴ Malthus, *Essay*, p. 46.

³⁵ One Henry Martyn did suggest that the government should keep a register of the entire population, probably in 1612. BL Additional MS 10038.

Sir Thomas Smith. Norden continued, 'if there be no prevension had to increase corn cattle and habitations, there will shortly be (without means of diminishing the multitude of people) neither houses for many destitute families nor food to relieve the mean rank of people if a time of any extra scarceity should come'. Thus both the rescue and promise of the world lay in better husbandry and greater tillage.³⁶

There was one celebrated thinker of the age who did raise the issue of population in general, and rates of growth: the Italian theorist Giovanni Botero. He was (and still is) best known for his *Reason of State* of 1589, a counter-blast to Machiavelli that stressed the importance of princely rule through virtue, and that was rapidly translated into German by 1596, and by the end of the century into French. Also bound into the German edition was a treatise of Botero's first published in 1588, and known as the *Greatness of Cities*. Botero was interested in the effects of urban life on population and hypothesised that density of living led to poor sanitary conditions and greater mortality in epidemics, a problem familiar enough to public health officials of the day. But towards the end of the *Greatness of Cities* he wondered why Imperial Rome, and modern metropolises such as Milan and Venice, seemed to settle at certain population ceilings. Indeed, this was not just an urban phenomenon, but one that pertained to 'the whole world': why was the population growth so evident over three millennia since Adam and Eve had left the Garden of Eden no longer (in his perception) taking place?³⁷ Botero assumed that the 'generative power' of people had changed little or not at all over three thousand years, so the cause of arrested population growth must be the shortage of foodstuffs.

Botero noted that cities could either supply themselves with provisions locally, or by trade. It was however the barriers to trade (hypothesising a merchant travelling to Italy from China or India) that he stressed as limits, in part due to issues economists would today call 'institutional': these ranged across 'the roughness of the places, the height of the mountains, the depth of the valleys, the unstoppable floods, the dangers of the seas, seizure by pirates, the inconstancy of the winds, the great costs, the poor condition of

³⁶ BL Additional MS 38444 f. 5r.

³⁷ Ioannis Botero, *Von der Stätten / Auffgang / Grösse und Herzlichkeit / kurtzer / doch gruntlicher Bericht* (Strassburg, 1596), pp. 432–3.

the roads, the envy of neighbours, the hatred and attack of enemies', and so the list goes on, also covering price rises of goods and religious turmoil. All these combined to set a ceiling to a city's growth, such that dearth and poverty would eventually prompt people to emigrate. Nevertheless, Botero also hypothesised, if rather vaguely, that the world had reached some kind of population limit, that 'the world was so full of people... such that the fruits of the earth, from which people must draw their sustenance, cannot feed a greater number'. As evidence he pressed into service migration to the farthest corners of the world, and strife both current and historical between nations, and the barbarian invasions in Europe which he explained through a lack of domestic resources pushing tribes into the Roman Empire. Further examples of this phenomenon were the selling of oneself and one's family into slavery in contemporary Africa, or cannibalism in the Americas. This rather eclectic mix prompted Botero to make the dismal observation that 'What else can this mean, but that the world is too narrow to satisfy our needs or bring satisfaction to our wants and desires.'³⁸ Much the same kind of arguments would be made by Matthew Hale in his *The Primitive Origination of Mankind* of 1677, given a providential twist as being part of God's design to limit 'over-plenitude... in the Number of Men'.³⁹ Yet neither of these dismal prognoses was followed up with further analysis. On the contrary: most thought that there was plenty more that could be got out of the ground yet. We now turn to examine the literature on agriculture to ponder why this might be the case.

Husbandry

If some governments were worried about the production and distribution of food, and their vulnerable subjects all the more so, a few writers focused directly on the means by which farming might improve yields.

³⁸ Botero, *Von der Stätten*, pp. 434–7. See also Clarence Glacken, *Traces on the Rhodian shore. Nature and culture in Western thought from ancient times to the end of the eighteenth century* (Berkeley, CA: University of California Press, 1967), pp. 368–74; also Giovanni Botero, *On the causes of the greatness and magnificence of cities*, trans. Geoffrey W. Symcox (Toronto: University of Toronto Press, 2012).

³⁹ Matthew Hale, *The primitive origination of mankind* (London: William Shrowsbery, 1677), p. 215. Also discussed in Glacken, *Traces*, pp. 400–5.

This literature was generally focused on the management of the estates of the well-to-do, and written from the perspective of the lord or the steward concerned to make best use of land, labourers and servants. In developing writing on agricultural practice from its medieval and classical antecedents, authors working in this tradition would eventually have their attention drawn to the very roots of agricultural success. What made plants grow, and what made them yield more profusely? By this means could agricultural 'science' be put at the service of the state. But we are getting ahead of ourselves.

As with so many things, the Renaissance saw a rapid expansion in the provision of books and manuscripts concerned with agriculture. This doubtless reflected both supply, in an expanding literary culture, and demand, in the growing opportunities for profit that a rising population entailed. The classical inheritance of ancient Greece and above all Rome, however, was less to place husbandry at the centre of the polity, than to see the land as an escape from the vice and corruption of the city, an uncorrupted and autonomous place to practise virtue (or, indeed, simply a source of income). Of course, in truth the surviving great classical books of agronomy and household management, penned by men such as Xenophon (Socratic Athens), Cato, Varro, Virgil (in the late Republic), Columella (first century CE) and Palladius (possibly fourth or fifth century CE), were all the products of a moneyed elite who stood close to the heart of either imperial politics, or in the case of Xenophon, had been under the tutelage of Socrates in the busy heart of metropolitan Athens.⁴⁰ The assumed seat of residence of the landowner was always the city; he might have a country estate to retire to, or he might ride out to view his fields that lay under the shadow of urban fortifications. So portraying farming as an agrarian idyll could be a stratagem, either an evasion for men who had reason not to antagonise capricious rulers, or itself a form of critique of the dubious morals and priorities of the society in which they were immersed; but in some cases, they were more simply useful sets of notes for farming.⁴¹ Yet if such texts still bore the stamp of politics in the very genre they adopted, that genre ruled out formulating tillage or husbandry as a political cause in itself; in no case do we find the rural estate connected

⁴⁰ Palladius, *The work of farming (Opus Agriculturae)*, trans. John G. Fitch (Totnes: Prospect, 2013), p. 11.

⁴¹ Of course, these varied purposes were not mutually exclusive.

to the advancement or orderliness of the commonweal through the state of the fields.⁴²

The most extensive works of husbandry passed down from antiquity were those of Columella, Varro and Cato, running to many hundreds of pages and providing a rich source of information for those who could read them.⁴³ Although manuscript copies and some printed works (including translations into Italian) made their way across the Channel into a few libraries, no English translation of the major works would appear until Columella's *On husbandry* was published in London in 1745, although Palladius' *De re rustica*, in many regards a potted Columella, was translated as early as 1442.⁴⁴ Thus while the imprint of these classics on contemporary agronomy in continental Western Europe was direct, in England their reception was largely mediated by Renaissance interpreters.

In contrast, many a budding Latin scholar on either side of the Channel was confronted with Virgil's *Georgics*, a poetical homage to animal husbandry and cultivation; while Xenophon's *On the household* was translated into English as early as 1532 and went through numerous subsequent additions. In truth, neither contained much useful agricultural content, especially Xenophon's work which devoted far more space to justifying writing about husbandry at all, and keeping the patriarch's wife in order, than it did to actual farming. While it dignified 'the ordrynge of an house, [with] the name of a science, lyke wyse as phisike is, and masons & carpenters crafte', and thus licensed an interest in these workaday topics by learned men, it nevertheless concluded that husbandry itself was easily learned and differences in agricultural fortunes were to be explained by diligence, not knowledge. The most pressing task for an estate owner was to find a bailiff or steward they could trust.⁴⁵ Virgil's stanzas became ever more popular,

⁴² Nevertheless, some of the authors, such as Cato and Varro, were military commanders, public officials, politicians and commentators of great distinction.

⁴³ Lucius Junius Moderatus Columella, *Of husbandry*, trans. (London: A. Millar, 1745); Marcus Terentius Varro, *On Agriculture*, trans. William Davis Hooper (Cambridge, MA: Harvard University Press, 1934); Marcus Porcius Cato, *On Agriculture*, trans. William Davis Hooper (Cambridge, MA: Harvard University Press, 1934).

⁴⁴ Columella, *Of husbandry*; Palladius, *The work of farming*, p. 23; See also Mauro Ambrosoli, *The wild and the sown. Botany and agriculture in Europe 1350–1850* (Cambridge: Cambridge University Press, 1997).

⁴⁵ Xenophon (trans. G. Hervet), *Treatise of housholde* (London: Thomas Berthelet, 1532), esp. pp. ii, 57–8.

reaching an apogee of acclaim in England after Dryden's translation of 1697, but those authors who declaimed that no work of agronomy could surpass him were perhaps better at demonstrating their literary sensibilities than their wide knowledge of agricultural writings. The practical knowledge to be gleaned for farming was relatively scarce and quite possibly entirely drawn from literature.⁴⁶

By the late sixteenth century classical husbandry could be absorbed directly, or through more recent works composed in a range of countries: by many authors in Italy, but prominent among them Agostino Gallo; Olivier de Serres and Charles Estienne in France, and Conrad Heresbach in Germany. These efforts were not themselves entirely novel, having medieval antecedents such as Walter of Henley, and most influentially, the early fourteenth-century *Liber cultis ruris* of Pier de' Crescenzi that drew heavily on Palladius and enjoyed lasting and wide popularity.⁴⁷ Such authors drew very widely on the classics, and whilst they were certainly imitative, they were far from slavishly so. The organisation of these books, often written as a kind of manual for managing a country estate for a wealthy landowner as were the works of Antiquity, only loosely resembled their Roman antecedents. In the nineteenth century, the term *Hausväterliteratur* was coined to describe their output: the writings of the patriarchs or 'fathers of the house'.⁴⁸ They drew on a variety of authors as seemed appropriate; Cato for constructing a house, Theophrastus or Pliny the Elder on botanical observation. Conrad Heresbach, a senior government official and renowned humanist scholar in the Duchy of Cleve in the lower

⁴⁶ Varro was obviously a significant source for Virgil, among others. There is no evidence that Virgil was ever directly engaged in farming. It was Virgil in particular who drew a sharp contrast between the city and the 'easy livelihood', of the cultivator. L.P. Wilkinson, 'General introduction', in Virgil, *The Georgics* (London: Penguin, 1982), pp. 35–49; and Virgil, *Georgics*, p. 92. On the reception of Virgil, see Andrew McCrae, *God speed the plough. The representation of agrarian England, 1500–1660* (Cambridge: Cambridge University Press, 1996), passim.

⁴⁷ Estienne, *Maison rustique*; Olivier de Serres, *Théâtre d'Agriculture* (Paris: Saugrain, 1600); Conrad Heresbach, *Rei rusticae libri quatuor* (Köln: Johann Birckmann, 1570); Ambrosoli, *Wild and the sown*; Palladius, *The work of farming*, pp. 25–6. See also Martin Grosser, *Kurze und gar einfeltige Anleitung zu der Landwirtschaft, beides im Ackerbau und in der Viehzucht nach Art und Gelegenheit dieser Land und Ort Schlesien*, ed. Gertrud Schröder-Lembke (Stuttgart: Fischer, 1965 [1589]).

⁴⁸ Jörn Sieglerschmidt, 'Die virtuelle Landwirtschaft der Hausväterliteratur', in Rolf Peter Sieferle and H. Brueninger (eds), *Natur-Bilder. Wahrnehmungen von Natur und Umwelt in der Geschichte* (Frankfurt: Campus, 1999), pp. 223–54.

Rhineland, cited no fewer than 57 ancient and 18 modern authorities in his work (plus the Bible). He introduced discussion of local agricultural practice too, and where appropriate, drew distinctions between his own observations and those of the illustrious forebears. Columella might argue that dung should be dry when laid on the field, but Heresbach considered him in error, 'as dayly experience teacheth'.⁴⁹ In many ways these texts represented an incremental development of agricultural knowledge that had been arrested by the 'Middle Ages'; that enduring historical caricature elaborated since Leonardo Bruni's Renaissance history of Florence in 1442 seems apposite in the history of agrarian literature, at least. As Palladius adapted Columella who had built on Varro who had built on Cato (among over 50 authors he cites), so the sixteenth-century authors introduced local knowledge and new mixes to the genre.⁵⁰ Charles Estienne, born of a prominent Parisian family of printers and physicians compiled his *Praedium Rusticum* in 1554. Around 1570 this was translated into French as *La Maison Rustique* by his son-in-law, Jean Liebault, and the sections on arable cultivation were expressly limited as a description of practices in the land lying between the Oise, Marne and Seine.⁵¹

We may dwell a minute with Heresbach and Estienne because it was their works that would be translated into English and provide a direct route for the classical tradition to reach a wider readership in the Tudor and Stuart polity. Of course, the late sixteenth-century English gentry were well enough lettered in their Latin. But importantly, in translation these works were further embellished with observations derived from local practices known to the translators. The now elderly Heresbach came to England on a diplomatic mission in 1570, having previously dealt with Henry VIII in his courtship of Anne of Cleves in the 1530s. It was probably at this time, just as his *Rei rusticae libri quatuor* were published in Germany, that he encountered the Lincolnshire squire Barnaby Googe, who was himself clearly familiar with classical authors such as Xenophon, as well as the few native volumes

⁴⁹ Conrad Heresbach, *Four books of husbandry*, trans. Barnaby Googe (London: John Wight, 1577), pp. iv–v, 20. On Heresbach, see Joan Thirsk, 'Plough and pen. Agricultural writers in the seventeenth century', in T.H. Aston, P.R. Coss, C. Dyer and J. Thirsk (eds), *Social relations and ideas. Essays in honour of R.H. Hilton* (Cambridge: Cambridge University Press, 1983), pp. 297–9.

⁵⁰ See for example, Varro, *On Agriculture*, pp. 165–7.

⁵¹ Estienne, *Maison rustique*, p. 527.

on husbandry. Googe's embellished translation of Heresbach, *Four books of husbandry*, appeared in 1577. Similarly, Liebault's *Maison rustique* was translated into English by Richard Surfleet around 1600, and then further recast by that irrepressible scribe Gervase Markham (more of whom later), who added in material from other continental writers as well as asides on English agriculture. Markham was also on Heresbach's case, to ensure it was 'renewed, corrected, enlarged, and adorned with all the experiments and practices of our English nation, which were wanting in the former editions' before his own emerged in 1631.⁵² Both Heresbach and Estienne's works ran through several editions, and the genre remained popular until the middle of the eighteenth century.⁵³ Thus was Renaissance agronomy simultaneously vested with the dignity of classical learning, and acclimatised to the likely experiences of its readership.

It is perhaps not surprising that the politician Heresbach also made husbandry *political*, in that he presented his subject as being of relevance to the fortunes of the polity. The *Rei rusticae* was written in the studied classical style of a dialogue that dramatised what must have been a tension for a man such as himself, privy councillor, leading diplomat and tutor to princes; the antique trope of country living as an easeful retirement, personified by Cono, versus the imperative to take an active role in history, embodied in Rigo. This was an echo of the Socratic dialogue, employed by Xenophon using the person of Socrates himself. Rigo declaimed, 'you know we are not borne to live our selves, nor at our owne pleasures: but for our countrey, our common weale and state whereto we are called'.⁵⁴ For this voice the dissemination of agricultural knowledge was neither simply a means to a richer estate, nor a hobby for the leisured gentleman. It was a duty: and as well as a tutor to the princely offspring of Cleves, Heresbach wrote on education

⁵² Estienne, *Maison rustique*; Conrad Heresbach, *The whole art of husbandrie contained in foure books*, trans. Richard Surfleet and enlarged by Gervase Markham (London: Richard More, 1631).

⁵³ In Germany major works were Iohannis Colerus, *Oeconomicae oder Hausbuch* (Wittenberg: Paul Hefrig, 1598 [1595]); Herr von Hohberg, *Georgica Curiosa Aucta, das ist. Umständlicher Bericht und klarer Unterricht adelichen Land- und Feldleben* (Nürnberg: Martin Endte, 1701 [1682]); Francis Philipp Florinus, *Oeconomus Prudens et Legalis oder allgemeiner kluger und Rechts-verständiger Haus-Vatter* (Nürnberg: Christoph Riegels Wittib, 1750 [1701]); Otto von Münchhausen, *Der Hausvater* (Hannover: Nic. Försters und Sohns, 1765).

⁵⁴ Heresbach, *Four books*, p. 1.

and was friends with Erasmus. Heresbach was still however more in thrall to the classical ideal than that other another scholar-statesman, Francis Bacon. He did not argue that propounding agricultural knowledge should be a mission of government itself.⁵⁵

England produced its own agronomic writings, although very limited in number. The pace of publication picked up from the 1580s, although largely with a horticultural rather than agricultural focus. Before this time, only two works stand out as handling husbandry extensively: the works of Fitzherbert on farming and surveying from the early 1520s, and reprinted ten times up to 1598; and Thomas Tusser's *Fiue hundred pointes of good husbandrie*, which first appeared with a mere one hundred points in 1557, but was expanded and reprinted in nine editions up to 1672. Neither of these men were simple rustics. The books of husbandry and surveying of 1523 were probably written by John Fitzherbert, scion of a family of leading family of gentry, lawyers and justices whose brother published on legal matters.⁵⁶ Tusser was a Cambridge-educated court musician who turned to farming.⁵⁷

Yet both of these writers could draw on their own farming experience as the basis of authorial credibility. Tusser delivered his entire *oeuvre* in pithy stanzas of decidedly unVirgilian poesy: 'By practise, and ill speeding/ these lessons had their breeding.'⁵⁸ Fitzherbert noted he had been 'an householder this X L yere, and more', and reflected that he had drawn his knowledge 'by experience'.⁵⁹ While Tusser's argument suggests wisdom born of trial-and-error, we should remember that the late medieval idea of experience, drawn from Aristotle, saw

⁵⁵ That the extant Roman authors made no political points in their husbandry manuals is not to say that the Roman state had no interest in such matters. It seems that the Senate ordered translation of the 28 agronomic volumes of Mago the Carthaginian, who was extensively drawn on by Varro. None of the original Punic or translation survives. Wilkinson, 'General introduction', p. 31.

⁵⁶ Indeed, there has been discussion on which Fitzherbert precisely authored the works. E.F. Gay, 'The authorship of the Book of Husbandry and the Book of Surveying', *The Quarterly Journal of Economics* 18(4) (Aug. 1904), pp. 588–93. A brief survey of agricultural writing is also provided in S. Todd Lowry, 'The agricultural foundation of the seventeenth-century English economy', *History of Political Economy* 35(Suppl. 1) (2003), pp. 74–100.

⁵⁷ Andrew McRae, 'Tusser, Thomas (c. 1524–1580)', in *Oxford Dictionary of National Biography* (Oxford: Oxford University Press, 2004).

⁵⁸ Thomas Tusser, *Fiue hundred pointes of good husbandrie* (London: Henrie Denham, 1580), f. 5r.

⁵⁹ Gay 'Authorship', p. 589.

it as a category formed from habitual practice and an observation of the usual. It implied neither a theory to explain *why* things were the way they were, nor an attempt to isolate and test the implied relations of cause-and-effect that we would come to name *experiment*.⁶⁰ The authority of experience rested on the more commonsensical observation that people who did things for a long time were more likely to know what to do, and for all its place in scholastic thought, had a close kinship with the authority of custom. 'What champion knows/ That custom shoves'.⁶¹ Or as Colerus put in Germany a little later, 'one must also, as it cannot be bettered, follow those who have long dwelled on the land and have tilled for a long age before him'.⁶²

The learned men did not thus elevate themselves above other farmers. Indeed, their other explicit source of authority was the neighbourly exchange of information. The husbandman was an assayer of fact and feeling who sought an ever more refined intuition from observation and lore. In the end one fell back on an individual faculty of judgement, or as Fitzherbert wrote, 'there is a sede that is called discretion, and yf a husbände have of that sede and myngle it amonge his other cornes, they wyll grow moche the better, for that sede wyll tel hym how many castes of corne every lande ought to have'.⁶³ This discretion was cultivated in part by observation of neighbour's fields (as recommended when purchasing a farm by Cato and Columella), and in part by conversation; in the words of Barnaby Googe, one drew on, 'the experience and husbandry of our owne husbands of England, as farre as eyther myne own observations, or the experience of sundry my freendes would suffer me'. A little later the German writer and

⁶⁰ Brian Ogilvie, *The science of describing. Natural history in Renaissance Europe* (Chicago, IL: University of Chicago Press, 2005), pp. 18–21; Peter Dear, *Discipline and experience. The mathematical way in the scientific revolution* (Chicago, IL: University of Chicago Press, 1995); Peter Dear, 'Mysteries of state, mysteries of nature. Authority, knowledge and expertise in the seventeenth century', in Sheila Jasanoff (ed.), *States of knowledge. The co-production of science and social order* (Abingdon: Routledge 2004), pp. 205–9; Peter Dear, 'The meanings of experience', in Katherine Park and Lorraine Daston (eds), *The Cambridge history of science. Vol. 3. Early modern science* (Cambridge: Cambridge University Press, 2006), pp. 106–31.

⁶¹ 'Champion' is the name for the open field country of England, with few hedgerows and dominated by arable. The word has the same root as the French *campagne*, and, of course, *champ*. Tusser, *Five hundred* (1580), f. 19v.

⁶² Colerus, *Oeconomicae*, pp. 2–3. This is also noted by Sieglerschmidt, 'Virtuelle Landwirtschaft', p. 242. See also Grosser, *Anleitung zu der Landwirtschaft*.

⁶³ John? Fitzherbert, *The boke of husbandrie* (London: Thomas Berthelet, 1533), p. 9.

princely official (with a similar background to Heresbach) Johann Coler (Latinised to Colerus) stated that he would write about managing woods, 'As I have myself seen and experienced. But whoever wishes to learn and experience more in regard to woodlands should seek the counsel of woodcutters, peasants and other wood-worms who deal with such things daily, and there will find much more report. Because they take such matters in hand every day... one can experience and learn much from such people that others do not know or understand.' But as one also comes across divergent opinions, in the end one must also test ideas oneself to find 'who is correct and who is not, because one's own experience teaches everything'.⁶⁴

Despite differences in structure, scope and source, the English works shared with ancient writings a common preoccupation with farming *practice*. They were not concerned to explain *why* things worked, except in the vaguest of attributions to the Gods. Fitzherbert's book launched straight into detailed advice on how thickly to sow seed,⁶⁵ ploughing and the appropriate plough for different soils (described as red clay, gravel and sand), sowing time, varieties of oats, barley, paying attention to the weather, and weeding. There is not a hint of theory as an explanatory guide to what bred success. Estienne organised his book around the spatial division of the farm, starting with the farmstead and outbuildings, and moving out through arable and meadows to woodlands, as a landowner might survey his demesne. Others took a roughly calendrical view of sequential tasks, as had Virgil and later Palladius; Tusser's manual took one systematically through the months of the year.⁶⁶ Farming success was accomplished by shunning extravagance and performing one's tasks, and ordering one's household diligently, just as Xenophon prescribed. This is why many works of husbandry devoted extensive sections to housewifery and the proper bearing and obedience of a wife (as well as bailiff, overseer, housekeeper, slave or labourer, as appropriate).⁶⁷ A key virtue to husband was 'thrift', and to avoid all that was 'unthriftiness,

⁶⁴ Heresbach, *Four books*, p. iii; Colerus, *Oeconomicae*, p. 209.

⁶⁵ Fitzherbert provided very precise figures but this approach was eschewed by Heresbach who followed the ancients in arguing the variable quality of land undermined such prescription.

⁶⁶ Palladius, *The Work of Farming*, p. 14.

⁶⁷ Varro wrote his treatise as a compilation of advice for his wife in his eightieth year, so he could dispense with the duties of the patriarch.

slouthfulness, careless and rash'. It was all about modest behaviour, good neighbourliness, sensible use of credit, hard work, honesty and prayer.⁶⁸

In this world, farmers were not expected to understand any of the ecological processes that governed yield. It was enough to read the signs of what was simply 'good' or 'bad'. Here classical authors such as Columella or Varro who organised topographical sections advising on ideal spots for farming with a tripartite division of mountain, hill and plain had little to say of use to the dull, dank flatlands of the north. One merely drew on the observation that different soils were suited to different plants, and you could tell what plants were best suited to each by what grew best there! Cato arranged land into nine categories: suited for vines, a water garden, osier beds, olives, and so on. Varro went a little further in discussing the 'thinness' of soil or whether it was wet or dry.⁶⁹ At times this reasoning was entirely circular, as exemplified in Tusser:

The straw and the eare, to have bignes and length
Betokeneth land to be good, and in strength.
If eare be but short, and the straw be but small:
it signifieth barennes, and barren withall.⁷⁰

But there were other outward signs as to quality: colour; which weeds thrived; taste, how hard it was to work; what birds followed the ploughman. In the end these were signs that led one to apply different varieties of diligence; no-one sought to provide an explanation. The farmer matched his cards to what the ground turned up. 'Each divers soile/ Hat divers toile.'⁷¹

It was thus possible to get a poor yield by inappropriate use of land: an error in reading the signs. This is why neighbours were of particular use to the novice in any given locality. One could also overtax the land, again as evidenced by the dismal return for one's efforts.

⁶⁸ Tusser, *Five hundred*, f.8; Columella, *On husbandry*, p. 49.

⁶⁹ Columella, *On husbandry*, p. 49; Varro, *On Agriculture*, pp. 191, 197, 203.

⁷⁰ Tusser, *Five hundred*, f.21r; Heresbach, *Four books*, pp. 17–18.

⁷¹ Tusser, *Five hundred*, f.19. See also p. 21. Although Palladius had considered colour an 'unreliable guide to goodness'. Palladius, *The work of farming*, 1.6.1, p. 38; see also Columella, *On husbandry*, pp. 52–3; Sieglerschmidt, 'Die virtuelle Landwirtschaft', pp. 231–2.

Where barlie thee sowe, after rie or else wheat,
if land be unlustie, the crop is not greate.
So lose ye your cost, to your coresie and smart:
and land (overburdened) is cleane out of hart.⁷²

Agriculturalists had understood for many centuries, of course, that a piece of land became 'out of heart' if repeatedly cropped.⁷³ One knew this because the crops got worse. Why did they get worse? Because the land was out of heart. This was one (although not the only) reason for crop rotations; such wisdom was an absolute commonplace: 'you must observe the olde saying of the husbande, Take not too muche of your ground', just as observers noted native Americans in New England fertilising their maize-grounds with fish when 'bad or worn out'.⁷⁴ Vast acreages of fields across Europe were fallowed each year, whether lain in two-, three- or more rarely four-course rotations. Certainly by the latter part of the sixteenth century innovative farmers were beginning to make inroads into this periodically uncropped land with grassed leys, sometimes artificially sown, and new fodder crops. More commonly, fallow persisted on a large scale into the nineteenth century. There were various reasons for this supposed 'conservatism'. Peasants might know of no alternatives; reorganisation of common and open fields to accommodate different cropping patterns was complex and consent difficult to achieve; the quite reasonably risk averse wanted to stick with tried and tested methods, and the use of fallow for flocks of sheep were an important part of the pastoral economy, while the urine and dung collected in the sheepfolds was an almost labourless way of replenishing fertility. But equally, people knew that the land needed 'recreation', and at the very least rotation, a change being in some circumstances as good as a rest. But without having any explanation of why this was so, what could lead one to think that you could reasonably change things? Virgil had already said it

⁷² Tusser, *Five hundred*, p. 22.

⁷³ 'herbes and rootes doe so much waste the fertilitie and fatnesse of the ground, that without continuall refreshing it would quickly become so poore and barren, that it would not yeelde the worth of the seede.' John Parkinson, *Paradisi in sole paradisus terrestris* or *A garden of all sorts of pleasant flowers which are English ayre will permit to be nursed up* (London: Humfrey Lownes & Robert Young, 1629), p. 462.

⁷⁴ Heresbach, *Four books*, f.22v; John Winthrop, 'The description, culture, and use of maiz. Communicated by Mr. Winthrop', *Philosophical Transactions* 12 (1677), p. 1066.

all so many centuries previously in noting the replenishing power of stubble-burning:

Again, it often pays, when fields are cropless
To fire the stubble with rapidly crackling flames –
Whether it is that hence the soil derives
Mysterious strength and nourishing enrichment;
Or that the fire burns out all noxiousness
And sweats our surplus moisture; or that the heat
Opens new paths and loosens hidden pores
To let the seedlings drink; or tightens rather
And closes gaping ducts, less seeping rains
Or power of parching sun, too fierce, or cold,
The north wind's penetrating cold, may blast them.⁷⁵

In other words, we have no idea why this works, and the possible proximate reasons are highly contradictory, never mind the occult explanations which actually explain how substances interact. But do it anyway.

And in this pragmatic worldview there was a fundamental optimism about the capacities of farming. One could always make the land productive, more or less. Columella interpreted the obvious fact that newly cleared land gave more abundant crops that declined over time not as evidence of degradation, but simply that the land had been dunged and nurtured to a high degree by leaf fall from trees. 'Stercoration' could imitate this and raise yields to the heights again.⁷⁶ If it had become barren, this was the result of permitting it to be cultivated by 'slaves, criminals, and malefactors', in the words of Pliny.⁷⁷ Rather, one just had to find the right thing for the right place. Heresbach had Rigo ask if poor grounds may be 'mended by arte'. Cono replied, 'there is no Countrey that the most gracious Lorde hath left without sufficient yeelde, yf labour and travayle not be refused'. We hear an echo of More, perhaps? You will reap what you sow, and those who do not reap are too indolent to sow. All that is required is, 'douncing and diligent labour'.⁷⁸

⁷⁵ Virgil, *Georgics*, pp. 59–60.

⁷⁶ Columella, *On husbandry*, pp. 48–9.

⁷⁷ His contemporary Columella made much the same argument. Columella, *Of husbandry*, pp. 1–2.

⁷⁸ Heresbach, *Four books*, p. 19.

Theory

‘Dounging’? The adding of manures to the soil was recommended in the earliest husbandry manuals and doubtless was ancient practice then.⁷⁹ Manures came in three kinds. Animal dung that had fallen directly on the ground, and that promoted in some circumstances plant growth; observing this was in all likelihood what prompted humans to first ‘artificially’ manure: ‘we might receive a greater product, if the earth was refreshed and cherished with frequent, seasonable, and moderate stercoration’.⁸⁰ Second, the use of ‘green manures’, crops or straw dug back into the soil; and finally, the mixing in of other materials of all kinds, but especially marls, lime and chalk. We know now that the benefit of marling and liming is to alter the acidity of the soil and make it more amenable to cropping. There were perennial debates about which dung was best. Cassius, drawing on a Mediterranean menagerie, commended first pigeon dung (always a popular choice), then human (always a controversial choice), then in sequence the excrement of goats, sheep, asses and finally horses. Varro opined that the very best dung came from aviaries of thrushes and blackbirds. This idea failed to excite the farmers of subsequent centuries.⁸¹

While the use of manure was ubiquitous, the intensification of agriculture attendant on population growth stimulated a greater interest in anything that might maintain or enhance the productivity of the land. The gradual building up of higher quality fields had long been a characteristic of very marginal communities that lived amid land difficult to till, and who had to carefully maintain ‘infields’ for their crops.⁸² In the sixteenth century, the frontier of intensification

⁷⁹ Richard Jones, ‘Why manure matters’, in Richard Jones (ed.), *Manure matters. Historical, archaeological and ethnographic perspectives* (Farnham: Ashgate, 2012), pp. 5–8; Verena Winiwarter, ‘Böden in Agrargesellschaften. Wahrnehmung, Behandlung und Theorie von Cato bis Palladius’, in Rolf-Peter Sieferle and H. Breuninger (eds), *Natur-Bilder. Wahrnehmungen von Natur und Umwelt in der Geschichte* (Frankfurt: Campus, 1999), pp. 181–221; Verena Winiwarter, ‘Soils in ancient Roman agriculture. Analytical approaches to invisible properties’, in H. Novotny and M. Weiss (eds), *Shifting boundaries of the real. Making the invisible visible* (Zurich: vdf Hochschulverlag AG an der ETH, 2000), pp. 137–56.

⁸⁰ Columella, *On husbandry*, p. 49.

⁸¹ Varro, *On Agriculture*, pp. 263–5.

⁸² S. Foster and T.C. Smout, *The history of soils and field systems* (Aberdeen: Scottish Cultural Press, 1994).

arrived on the urban fringe as increased demand made horticulture a commercial proposition and market gardening became established, especially in the Low Countries. The import of vegetables, especially onions, became a major staple of London’s trade, largely in the hands of Dutch merchants. With the upheaval of revolt and mass migration in the Low Countries, soon Flemish and Dutch refugees brought their knowledge directly across the sea, settling in Norfolk, Essex and Kent.⁸³ These trends were mutually reinforcing. The expansion of gardening stimulated greater attention to the qualities of the soil. Equally, urban growth made cities more significant as a store of ‘night soil’, a resource already exploited in medieval times. It was partly just a straightforward question of cost: cities gave ‘great store of Manure... and so consequently [it] is very cheape’.⁸⁴

In keeping with their pragmatism, most of those writing on husbandry cared not a jot why manure worked; or at least they did not discuss it. But the human mind was not so incurious as to never have contemplated mud. Earth was, after all, one of the four elements first isolated by Empedocles in the fourth century BCE.⁸⁵ It was fundamental to the order of things, and was part of any schema that sought to explain the physical make-up of the universe, the most influential of which was Aristotle’s rendering of the theory. In Renaissance agronomy, it was Charles Estienne who provided a more formal theory of soil that explained its widely noted variation through different combinations of the humours. Soils consisted of two fundamental kinds: clays that were cold and moist, and sands that were hot and dry. All other soils depended on the mix of these two and their humoral qualities. For others, it may have been that this Aristotilean schema was so ingrained it did not require any description.⁸⁶

For Estienne, dunging and meliorating the soil was about providing the correct balance of humours, which had been drawn

⁸³ This can be found in the customs records, or ‘Port Books’ of the late sixteenth century. TNA E190, passim. See also Joan Thirsk, ‘Agricultural innovations and their diffusion’, *AHEW* V, pp. 533–89; Malcolm Thick, ‘Garden seeds in England before the late eighteenth century’, *Agricultural History Review* 38 (1990), pp. 58–71; Malcolm Thick, *The neat house gardens. Early market gardening around London* (Totnes: Prospect, 1998).

⁸⁴ Gervase Markham, *The English husbandman* (London: William Sheares, 1635), p. 82.

⁸⁵ Glacken, *Traces on the Rhodian shore*, pp. 9–10.

⁸⁶ Sieglerschmidt, ‘Virtuelle Landwirtschaft’, p. 226.

out unequally by the growth of plants and presented the problem of imbalances for subsequent crops. Animal manures rotted and produced heat, so cold, moist fields were to be dunged more, to heat them and avoid them freezing. But rich and fat clays need little manure. All the different kinds of manure essentially performed the same action of rebalancing. Dung was not an unmitigated panacea; as balance was the key, there could be too much: 'as a field starveth, if it not be dunged at all, so it burneth of it be over-dunged'.⁸⁷ This was true of both animal and avian dung, with highly prized bird-droppings especially prone to 'burn' ground if over-applied, and the marls and other earths larded into the fields. Barnaby Googe warned his readers that: 'In some countries they make their land very fruitful with laying on of a Chalke... But long use of it in the end, brings the ground to be starke nought, whereby the common people have a speech, that ground enriched with Chalke makes a rich Father and a beggerly Sonne.'⁸⁸ Advice was proffered by authors ancient and modern on what made the best manures, when it should be done, whether it was best wet or dry. There was a theory of sorts here, but the ethos was practical, ever practical, and the explanatory framework based on the humours registered only phenomena straightforwardly present to the senses.⁸⁹

Who was more practical than Hugh Plat? Born in 1552, Plat was a gentleman of extraordinary range and enthusiasm, whose literary career began as a very minor poet in the 1570s, but who dedicated himself to the betterment of the nation through the dissemination of nearly any knowledge that came across his path. He owned a number of properties in the vicinity of London, and a peculiar retail establishment where he collected, made and sold any ingenious device that might promote productivity and health. If he had a profession, it was enthusiasm. Some of Plat's properties nestled in suburban London, including a zone of market gardens, tenements and old estates that bordered the eastern

⁸⁷ Estienne, *Maison rustique*, p. 536. These kinds of argument endured in the continental *Hausväterliteratur* until the eighteenth century, when arguments shaped by concepts in chemistry won wider influence as discussed in Chapter 6. Sieglerschmidt, 'Virtuelle Landwirtschaft', pp. 236–7.

⁸⁸ Heresbach, *Four books*, p. 100.

⁸⁹ See for example the work of the Brunswick father-and-son double-act, Jacob and Johann Colerus whose discussion of dung and manure went no further than to note positive effects and a descending list of preferred manures. The focus on vision, smell and taste can be found throughout the husbandry literature and into the eighteenth century. Colerus, *Oeconomiae*. Bd. II, pp. 29–30.

fringes of the capital around Bethnal Green. Here he could observe, exchange, and banter with horticulturalists working their soils hard to provide the city with fresh vegetable fare.⁹⁰ In the 1590s Plat became preoccupied with projects to enhance national welfare through more productive use of its resources, and produced two volumes dedicated to this cause: the *The iewell house of art and nature Containing diuers rare and profitable inuentions, together with sundry new experimentes in the art of husbandry, distillation, and moulding* (1594) and a more narrowly botanical volume, *Floraes Paradise* (1608). He was, as we have seen, in tune with times that were blighted with dearth and the need to expand tillage. Where he stood out was not, as with the English legislation on tillage, in any effects of his ideas on productivity, but his desire to bring *theory* to bear on the problem. Indeed Plat never won the attention of his Italian near contemporary, Camillo Tarello, who in 1566 won the right from the Venetian state to receive payment for every acre of land planted according to his direction.⁹¹

At first sight Plat's publications are an encyclopaedic and highly idiosyncratic mix of observations and projects, *The iewell house* arranged according to the alphabet – in other words, apparently randomly when measured against the standards of calendrical or spatially orientated works. But we can read this very differently, as has been pointed out by Ayesha Mukherjee: the 'alphabetical index' provided the means by which the actively engaged and thoughtful reader could select topics of particular interest and enjoy the wealth of advice that the polymathic Plat had assembled. He did not write for the owner of the country estate, or the family member coming into their inheritance, or even the simple husbandman. He wrote for anyone who desired the enhancement of the 'weale publicke', and produced a work that was in

⁹⁰ For example, Hugh Plat compiled a manuscript for his own use of 'what is to be done euery moneth', apparently compiled from the 'Rules of Gardening by Clement King Gardner to the Lo. Burghley Lo. Treasurer of England'. Mukherjee, *Penury into Plenty*, esp. pp. 65–8, 82; Sidney Lee, 'Plat, Sir Hugh (bap. 1552, d. 1608)', rev. Anita McConnell, in *Oxford Dictionary of National Biography* (Oxford: Oxford University Press, 2004); Plat (1594), p. 2v; Deborah Harkness, *The Jewel House. Elizabethan London and the scientific revolution* (New Haven, CT: Yale University Press, 2007), pp. 211–12; Malcolm Thick, *Sir Hugh Plat. The search for useful knowledge in early modern London* (Totnes: Prospect, 2010).

⁹¹ See *The Complete Farmer; Or a General Dictionary of Husbandry in All Its Branches, Containing the Various Methods of Cultivating and Improving Every Species of Land*, 4th edition (London, 1793), p. 529.

fact user-friendly in that it did not assume the precise context in which the knowledge might be used.⁹² *Floraes Paradise* would be organised more conventionally, as a very roughly calendrical list of tasks.

Not long afterwards, Plat might have been called an ‘improver’; after a few decades in obscurity his work was taken up with enthusiasm by the projectors of the mid-seventeenth century, who we will meet in Chapter 3, and his works reissued. But it was too early for that: ‘improvement’ still had the more limited meaning of raising rents, not the glorious imprimatur of a national mission.⁹³ Perhaps because of his own immense curiosity, perhaps because of his wide social network embracing the rapidly growing metropolis, its suburbs and rural hinterland, for Plat the intensely pragmatic, the *how*, was always linked to the *why*. He was a man of theory – despite his book that appeared to have no system except the alphabet. He was determined to use knowledge that contemporaries would have called ‘occult’, meaning that he wanted to look behind those easily legible signs that indicated that something was good or bad for a particular purpose, to the hidden relations that actually *caused* phenomena. Thus theory could be combined with ‘sundrie observations, drawn from experience herselfe the undoubted mother of all true and certaine knowledge’⁹⁴ to create new, innovatory routes to profit. He was trying to create a new kind of agricultural expert.

But before he could make the world better, first Plat needed to address an age-old question: were things just getting worse? More precisely, was the Earth itself ageing and going into decline? So said Virgil, though perhaps with a poet’s licence: ‘everything by nature’s law/ Tends to the worse, slips ever backward, backward.’⁹⁵ Arguments about the ‘senescence’ of the world – whether it aged like all living things – were part and parcel of discussion of nature in Antiquity and would remain a matter of heated controversy across the seventeenth century.⁹⁶ The discussion was however pitched at an extremely general level and might seem to have no relevance to any particular farm, or indeed manual of husbandry. But when *regions* seemed to decline

⁹² Mukherjee, *Penury into plenty*, pp. 66–7.

⁹³ Warde, ‘Idea of improvement’.

⁹⁴ Sir Hugh Plat, *The iewell house of art and nature* (London: Peter Short, 1594), p. 1.

⁹⁵ Virgil, *Georgics*, p. 63.

⁹⁶ Glacken, *Traces on the Rhodian shore*, pp. 383–90, passim; Columella, *On husbandry*.

in fertility, then the question was posed more forcefully as to whether the advancing decrepitude of the very Earth would eventually preclude efforts to make it more productive. In our twenty-first-century terms, we might understand this not so much as a sustainability problem, as one of managing ageing; raising yields would be akin to extending an active life and seeking to hold decrepitude at bay. Heresbach noted the alleged phenomenon, drawing on Pliny: ‘You must remember also, that ground wyll some times change, and of fruitfull become barren, whiche hath been seens, as Plinie reporteth, in the olde time in Thessali, and in our time, in sundry places of our Countrey.’ Pliny in fact denied that declining fertility came from ageing, and blamed it on poor husbandry.⁹⁷

But Plat bought it. ‘For what eie doth not pittie to see the great weakness and decay of our ancient and common mother the earth, which now is grown so aged & stricken in yeares, & so wounded at the hart with the ploughmans goad, that she beginneth to faint under the husbandmans hand, and groneth at the decay of her natural Balsamun.’⁹⁸ His explanation is both based on senescence and the impact of human intervention, that farming has somehow bled the Earth. Yet if husbandry could cause infertility, this was not for Plat an issue of diligence but ignorance. The ‘Balsamun’ was being lost. There was a substance that was ebbing away from the soil, and his mission was to restore it. Decrepitude could be delayed.

The idea of an active agent, a first cause of fertility and the need to conserve it, will be a red thread running through this book. The idea was not Plat’s. He tapped into a school of thought that had been gathering force across Europe for decades, a train of speculation and experiment that was strongly shaped by the Swiss physician, mine assayer, and searcher after occult lore, Paracelsus; or as he was baptised, most splendidly, Philippus Aureolus Theophrastus Bombastus von Hohenheim (1493–1541). Paracelsus would play a prominent part in the history of Renaissance medicine and chemistry.⁹⁹ But while Plat drew on the Paracelsian tradition through English adherents such as John Hester, the immediate source of his

⁹⁷ Heresbach, *Four books*, p. 18; Columella, *On husbandry*, p. 47, n.1.

⁹⁸ Plat, *The iewell house*, p. 3.

⁹⁹ Allen G. Debus, *The chemical philosophy. Paracelsian science and medicine in the sixteenth and seventeenth centuries* (Mineola, NY: Science History Publications, 1977).

thinking about the fertility of the soil was Frenchman Bernard Palissy (c. 1510–1589) and his *Discours Admirables* of 1580.¹⁰⁰ Palissy has been disarmingly referred to as a potter, but while this captures much of the everyday activity of the man, it captures his significance and essence in the same way that one might comprehend all that was important about Louis Bourbon (XIV) by calling him an ‘actor’.¹⁰¹ Palissy was a surveyor, a ceramicist who harboured a famous and ultimately futile obsession to reproduce Chinese porcelain; friend to royals; a portraitist; engineer; and lecturer who can fairly be called a Renaissance man, an embodiment of his age. The service that Plat would render to English agronomy was to translate Palissy in his *Diverse sorts of soil*. He set agronomy on the search for *causes*: a theory to explain what could be observed.

Of course, this causal agent was occult; it was hidden, beyond measurement, and it is perhaps not surprising that the Paracelsians were not entirely clear or consistent in explaining what it was. Yet while their theorising about the occult would come to seem fantastical and chimerical to later empiricists, the Paracelsian chemists made important contributions to the development of what we now think of as the experimental method, seeking to isolate the properties of objects and transformations that are not immediately apparent to mere observation. For Bernard Palissy, the key agent in the soil that brought life was a salt: the fifth element (although in his text Plat also suggests that this element was, in fact, a special kind of water that could draw heat from salt, a notion that also had Paracelsian origins).¹⁰² ‘Salt’ was a term used much more liberally than today, and embraced substances like copper and sugar, although writers correctly tended to stress the alkaline properties of salts. Consequently, the bleaching properties of plant ashes could be taken as clear evidence of a saline presence in vegetable matter.¹⁰³

¹⁰⁰ See Allen G. Debus, ‘Palissy, Plat and English agricultural chemistry in the 16th and 17th centuries’, *Archives internationales d’histoire* 21 (1968), pp. 67–9, 71, reprinted in Allen G. Debus, *Chemistry, alchemy and the new philosophy 1550–1700* (London: Variorum Collected Studies, 1987).

¹⁰¹ G.E. Fussell, *Farming technique from prehistoric to modern times* (Oxford: Pergamon, 1965), p. 91.

¹⁰² Plat, *iewell house*, p. 23; See also Debus, ‘Palissy, Plat and English agricultural chemistry’, pp. 73–6.

¹⁰³ Plat, *iewell house*, p. 11.

Thus Plat declared:

And it is a salt that maketh all seedes to flourish, and growe, and although the number of those men is verie small, which can giue anie true reason whie dungue shoulde doe anie good in arable groundes, but are ledde thereto more by custome than anie Philosophicall reason, neuerthesse it is appaunt, that no dungue, which is layde vpon barraine groundes, coulde anie way enrich the same, if it were not for the salt which the straw and hay left behinde... it is not the dung itselfe which causeth fruitfulness: but the salt which the seed hath sucked out of the ground.¹⁰⁴

As a theory this did not perhaps have anything more to recommend it than the idea of the humours, but it contained a key notion, and one that will have some significance in one of the stories told in this book. There was a finite substance in the soil that could be identified by the experimenter and the master chemist, and it was the circulation of this substance – and mastery of this circulation – that would lead to the growth of plants. Dung contained the residual salts of consumed plants and this had to be restored, else ‘the hungry seede in time will drinke vp all the salt of the earth, whereby the earth being robd of her salt, can bring forth no more fruit untill it bee dunged againe, or suffered to lie fallow a certaine time: to the ende that it may gather a newe saltnesse from the cloudes, and raine that falleth vpon it’.¹⁰⁵ Here lay the germ of later theories of plant nutrition, a substance found in the earth, in the air and in rainwater that could explain why plants prospered from contact with all three. It also introduced an essential idea for later thinking: at a particular place, at least, in any given field, this substance could become deficient. It would be a long time before

¹⁰⁴ Plat, *iewell house*, pp. 14–15; on the degree to which this is a direct translation of Palissy, see Debus, ‘Palissy, Plat and English agricultural chemistry’, p. 72; see also the helpful discussion on salts and Palissy in Mukherjee, *Penury into plenty*, pp. 98–9, 104–13.

¹⁰⁵ Plat, *iewell house*, p. 16. In her book on Plat and ‘dearth science’, Ayesha Mukherjee makes a case that circulation theory was an important part of Plat’s work and not anomalous at the time. I have not found any clear evidence in her text of this type of thinking (that is, as I understand it, circulation as thinking about ‘circular processes’, as opposed to simply the flowing movement of things), although Plat opened up the possibility of this approach. Mukherjee, *Penury into plenty*, p. 88, and for discussion of circulation, e.g. pp. 106, 109; for the sake of clarity I note that her statement on my work on p. 141 is contradicted in Warde ‘Invention of sustainability’, p. 156.

this view became widely significant, but at the end of the sixteenth century, drawn from the alchemical tradition, it was being articulated.

The 'Skillfull Clowns'

A giant of English intellectual life in the early seventeenth century, although much more with hindsight than at the time, was the lawyer, statesman and polymathic thinker Francis Bacon: often considered the founder of modern experimental science and the tradition that led to expertise being defined by method and institutional training, subsequently being both praised and blamed for all the results of those 'scientific' habits of mind in the modern world. Gervase Markham, however, cut a rather different figure. Markham is best known now as the writer of a popular book on the duties and callings of housewives. He was from a well-to-do Nottingham gentry family, and probably enjoyed a university education before serving as a soldier in Ireland. From 1593 he was residing in London and began an extraordinary literary career, as a poet of some distinction, and writing books on a vast array of topics, especially matters veterinary and relating to horsemanship (where his capacity for self-plagiarism led to five rather similar volumes being on the market simultaneously, leading to the stationers' company that controlled publishing in London forcing him into an agreement in 1617 to have no more printed on the topic!). Hitching his fortunes to the Earl of Essex, he too crashed with the disastrous failed rebellion, disgrace and execution of his patron in 1601. Markham spent the next decade as a modest tenant farmer, and on taking up the pen again, agricultural works became a major part of his output.¹⁰⁶ It was Markham who dominated publishing on matters agricultural in the 1610s and 1620s. Rather like Plat, much of his oeuvre was derivative of older works, especially the continental *Hausväter* like Estienne and Heresbach whom he edited.¹⁰⁷ But in his recasting of this knowledge,

¹⁰⁶ Matthew Steggle, 'Markham, Gervase (1568?–1637)', in *Oxford Dictionary of National Biography* (Oxford: Oxford University Press, 2004); online edn, Oct. 2006. Somewhat bizarrely, this entry makes no mention of his extensive agricultural writing. On a surprisingly limited survey of Markham's contributions, given her mastery of the contemporary sources, see Thirsk, 'Plough and pen', pp. 302–3.

¹⁰⁷ George Fussell, *The old English farming books from Fitzherbert to Tull 1523–1730* (London: C. Lockwood, 1947), pp. 13, 29.

and combining it with his own experience, he presented the reading world with a novel approach to farming: he made the enrichment of the soil the first and most central issue in his work.

This manoeuvre was most manifest in *Markhams farwell to husbandry or, The enriching of all sorts of barren and sterill grounds in our kingdome, to be as fruitfull in all manner of graine, pulse, and grasse as the best grounds whatsoever*, published in 1613 and that went through at least nine further editions from 1620. This was more original than his later *The English husbandman* which still discussed house and climate first, in the manner of the estate-owning *Hausvater*. Markham was clearly well read in sixteenth-century agricultural writing, and the classics. Arguably *Markhams farwell* was the first manifesto for improvement, as it later came to be understood. Good crops could be won out of barren soils! One did not simply have to adapt to what providence, or nature, had bequeathed your land. Rather, the task of the husbandman was to 'nobly and victoriously boast the conquest of the Earth, hauning conquered Nature by altering Nature, and yet made Nature better than shee was before'. Here was Markham's call to action, a sentiment simultaneously so reminiscent of the famous prescription of the still more famous Francis Bacon that nature could be commanded by being obeyed; yet more pragmatic, and yet more immodest, and perhaps truer to the times.¹⁰⁸

Markham also looked to the future in that he claimed to be not a peculiar genius in his own right, but a reporter of the wisdom of correspondents, filtered through his own experience of farming. These were comments reminiscent of Fitzherbert almost a century before, but the earlier author, and many later, would claim simply to have spoken to wise neighbours, rather than being, 'a publique Notarie, who record[s] the most true and infallible experience of the best knowing Husbands in this Land.' Markham was allegedly a hub, a role later exemplified in actuality in the middle of the century by Samuel Hartlib, and later on men like the John Worlidge and Houghton (see Chapter 3); and a century after them, Arthur Young (see Chapter 6). Markham desired his book to 'belongeth... to the plaine russet honest Husbandman... and the Kingdomes generall profit'.¹⁰⁹ By this, like Thomas Tusser, he meant a substantial farmer with perhaps one or two servants, but someone of

¹⁰⁸ Markham, *English husbandman*, p. 9.

¹⁰⁹ Markham, *English husbandman*, pp. iii, 147.

a lesser social rank than each of those downwardly mobile men was born into.

Markham recognised that, in fact, the combination of soils tended to determine the husbandry applied, and local and regional variations in farming practice were to be explained thus: 'every man in his owne workes knows the alteration of climates'.¹¹⁰ His theory did not move beyond Estienne, whom he drew on extensively, dividing soils into the clays, sands, gravels, and their mixes and properties. As well as the mix of soils, a fine-grained tilth was important to bring a 'soft libertie' that prevented dense earths from choking plants and allowing the ground to heat. In fact, Markham's intent was not to promote theory at all, and this was not his service. His focus on soil was practical, and for practical men, that they might understand through his provision of 'fixt rules' how different soils affected crops, so the simple farmer could follow his prescriptions 'without the study of his braines'. Yet he proclaimed himself determined that men should not settle for what they found, and that husbandry should not be mere habit. It should be a transferable skill, an applied art, and a process of betterment, and the route to this was to read men such as himself.

Yet for so much as this labour of Husbandry, consisteth not for the most part in the knowing and understanding breast, but in the rude, simple, and ignorant Clowne, who onely knoweth how to doe his labour, but cannot give a reason why he doth such labour; more than the instruction of his parents, or the custome of the Country, where it comes to passe (and I have many times seene the same to mine admiration) that the skilfullest Clowne which is bred in the Clay soyles, when he hath beene brought to the sandy ground, hee could neither hold the Plough, temper the Plough, not tell which way in good order to drive the Cattell.¹¹¹

Implicit in earlier arguments about ideal husbandry was the idea of farming as a slow, evolutionary process of adaptation that had brought the wisest methods to each particular place and clime. This, as we will see in Chapter 3, would no longer satisfy the improving mood of the seventeenth century. And of course the fact of change was not new either; in practice one could never be sure if 'optimal' methods had been

¹¹⁰ Markham, *English husbandman*, p. 95.

¹¹¹ Markham, *English husbandman*, pp. 95–6.

attained, even if one was schooled to think in such terms (and Tudor cultivators certainly were not). In practice, then, there was always a degree of innovation going on, and probably rather more failure than success. In some regions of the country, however, the Elizabethan era had seen notable changes in technique that were inspiring to authors such as Markham and John Norden, the former describing his inspiration from new meadows around Chatsworth in Derbyshire, on Exmoor and north Devonshire – 'allmade by industry & not nature'.¹¹² This was the age of the advancing water meadow and convertible husbandry, of greater opportunities for profit as prices rose but real wages were depressed, and to some degree the agricultural writers moved in the wake of pioneers on the ground.¹¹³ Literature could help in the dissemination of best practice, and thus also facilitate change that was not based on anything genuinely new, but just more widely applied, such as the description by surveyor John Norden of how 'In *Shropshire, Denbighshire, Flintshire* and now lately in some parts of Sussex they fetch limestone, erect kilns, and burn it on their own farms... On the south-east coast from Rye to Suffolk they burn pebbles for the same purpose.'¹¹⁴ In the farm accounts of Robert Loder of Harwell in Berkshire we can trace how one farmer, albeit one who for those times somewhat eccentrically kept meticulous records of all his expenditure, experimented with the use of malt dust and black ashes to meliorate the soils on his open-field farm between 1610 and 1620.¹¹⁵

Markham, although a self-styled herald of change, was more unusual than original in his breadth of interests and writings. For the most part, the old and classical ways remained central to his work, and

¹¹² Gervase Markham, *Markhams farwell to husbandry or, The enriching of all sorts of barren and sterill grounds in our kingdome, to be as fruitfull in all manner of graine, pulse, and grasse as the best grounds whatsoever together with the annoyances, and preservation of all graine and seede, from one yeare to many yeares. As also a husbandly computation of men and cattels dayly labours, their expences, charges, and uttermost profits. Attained by trauell and experience, being a worke neuer before handled by any author: and published for the good of the whole kingdome.* (London: Roger Jackson, 1620), p. 69.

¹¹³ For example, Hadrian F. Cook and Tom Williamson (eds), *Water meadows. History, ecology and conservation* (Oxford: Windgather, 2007); Eric Kerridge, *The agricultural revolution* (London: George Allen & Unwin, 1967).

¹¹⁴ John Norden, *The surveyors dialogue* (London: Hugh Astley, 1607), p. 228; Fussell, *Old English farming books*, p. 100.

¹¹⁵ Fussell, *Old English farming books*, p. 101.

much of his writing was derivative. One would not find any author a few decades later attributing mysterious ailments of crops to ‘planet strooke... sometimes from the euill aspects of the Starres, sometimes from the rotten corruptions of the ayre, sometimes from the contagion and unfection of the winds, and sometimes from the euill habits of dewes’.¹¹⁶ Authority on farming remained, as it had been earlier in the Renaissance, a mixture of ancient writings, more contemporary writers and observations from the authors’ own experiences or those of their wise neighbours. Little or no consideration was given to the active agents in promoting plant growth, and this had next to no impact on recommendations for husbandry, which remained highly practical. For the most part Markham’s writing was heavily orientated towards practice, so even more theoretical passages posited a range of possible causes for phenomena, without deciding on what was the most likely; it was not considered possible or necessary to verify any particular one. Equally, no consideration was given to what made the soil fertile, aside from noting the obvious benefits of externally observable factors, such as heat, moisture, or the colour and texture of soils. Growing crops successfully was thus simply about balance and climate, and good husbandry. Raising output was largely a question of what kind of agriculture was applied to each ground: and the extent of tillage was either a juridical matter, determined by manorial and legal controls over the land, or one shaped by market incentives and opportunities to profit.

But nevertheless Markham’s works contain the germs of later developments, and a framework that could absorb the thoughts of men like Plat: an emerging focus on soil management, and concern for the quality of land and labour, rather than the more general descriptions of techniques of ploughing, sowing density or the timing of work found in Tusser and Fitzherbert. In filtering earlier works Markham foregrounded the soil, and the possibility of enhancing its productivity; by no means an entirely new theme, but one given much greater prominence. Equally, men like Palissy and Plat, though apparently of minor influence before the 1640s, presented a theoretical and chemical approach to agriculture that would draw attention to the role of manures and especially dung in promoting soil fertility by suggesting there was some unique, single causal agent at work. They presented their works as a means not only to extend the area of tillage onto

¹¹⁶ Markham, *Markhams farewell*, pp. 100–1.

‘barren’ soils, but to improve the output of those soils already under the plough, arguments calculated to appeal not just to the profit-maker, but those concerned with the needs of the polity.¹¹⁷ Agronomic writers would persist in framing their work in a reflex condemnation of custom and conservatism for centuries to come, and we must always take such caricatures of general practice with a pinch of salt. But as the seventeenth century advanced the role of knowledge and the possibility of changing and shaping nature were emerging with greater clarity in the printed text, with the idea of the possibility of enhancing the soil would come, eventually, the concomitant notion of degrading it.

¹¹⁷ Mukherjee, *Penury into plenty*; see also the complementary development of rhetoric around national needs and profit that would become discredited by favouritism in Elizabethan and Jacobean ‘projecting’, in Joan Thirsk, *Economic policy and projects. The development of a consumer society in early modern England* (Oxford: Clarendon, 1978).