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English Tree Populations: Economics, Agency and the Problem of the "Natural"

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Abbreviations

BRO	Bury St. Edmunds Record Office
ERO	Essex Record Office
HALS	Hertfordshire Archives and Local Studies
IRO	Ipswich Record Office
Lds RO	Leeds Record Office
NHRO	Northamptonshire Record Office
Nrth RO	Northallerton Record Office
NRO	Norfolk Record Office
PRO/TNA	Public Record Office/The National Archive
Shf RO	Sheffield Record Office

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1 Introduction: Trees and Disease in Historical Perspective

Dutch elm disease—caused by the fungus *Ophiostoma ulmi*, disseminated by beetles of the genus *Scolytus*—first arrived in England in the 1920s, but a more virulent strain—caused by *O. novo-ulmi*—appeared in the late 1970s and within a decade had effectively wiped out elm as a tree (Brasier 1991; Gibbs et al. 1994). A series of outbreaks has followed, including *Phytophthora ramorum,* leaf minor and canker in horse chestnut canker (*Cameraria ohridella* and *Pseudomonas syringae* pv.*aesculi*), oak processionary moth (*Thaumetopoea processionea*) and more recently ash dieback (*Hymenoscyphus fraxineus*) (Cheffings and Lawrence 2014). All are caused by invasive organisms—fungi, bacteria or insects—and have thus been seen as a consequence of globalisation, perhaps compounded by climate change (Brasier 2008). There are further threats of this kind on the horizon, including emerald ash borer (*Agrilus planipennis*), pine processionary moth (*Thaumetopoea pityocampa*), citrus longhorn beetle (*Anoplophora chinensis*) and xyella (*Xyella fastidiosa)*. In addition, there are worries that tree health in England is suffering a more general deterioration, with recognition of such complex and diffuse conditions as "oak decline" (Denman and Webber 2009), manifested in progressive thinning of the crown and general ill health, leading to gradual death. An acute variant of this disease, leading to rapid death and with debated causes, has also been identified.

Current concerns need, however, to be placed within a broader historical context: only then can appropriate action be taken—or, in some cases, a more relaxed approach be adopted to arboreal ill health. The discussion that follows is mainly based on archival research (funded by the Arts and Humanities Research Council (AHRC) and the Department for Environment, Food and Rural Affairs (DEFRA)) which examined maps, tree surveys and forestry accounts from four English counties, chosen for their contrasting land use and agricultural histories: Hertfordshire, Norfolk, Northamptonshire and Yorkshire. This was supplemented with further and less detailed examination of the evidence from other areas, principally the counties of Essex, Herefordshire,

Kent, Suffolk and Shropshire. A systematic examination of farming and forestry literature from the seventeenth, eighteenth and nineteenth centuries was also undertaken. The purpose of this research was to characterise tree populations and their management in the period since the sixteenth century; to assess the extent to which trees suffered from endemic or epidemic disease in the past, and to identify any changes in management over time which might have contributed to rising levels of morbidity. One feature which rapidly became apparent as this research proceeded was that, while there is little evidence for large-scale epidemic disease prior to the twentieth century, poor health in trees is not in itself new. Oak, for example, has always been prone to fungal pests, such as *Aetiporus sulphureus* (cuboidal brown rot of heartwood) and *Stereum gausapatum* (pipe rot), while caterpillars of the indigenous micromoth *Tortrix viridana* have caused successive years of severe defoliation. The effects of the common cockchafer (the beetle *Melolontha melolontha*, also known as the May Bug) on trees appear to have been more serious in the past than they are today. In 1787, for example, the oaks around Doncaster "were entirely stripped by them" (Nichols 1795, 31), while fatal attacks on the roots of ash are also reported (Trans of Soc. For the Encouragement of Arts etc., 1795, cxcii). The condition known as "shake"—that is, internal splitting of the timber—in oak, sweet chestnut and other trees is widely reported in documents from the seventeenth century onwards, and the symptoms of "oak decline" are often described. At Prior Royd Wood near Sheffield in Yorkshire it was reported in the late eighteenth century that 206 trees were "nearly all dead top'd" (Shf RO ACM/MAPS/Shef/169), while on the Bolton Estate in Wensleydale in the same county, and period, "many of the trees were affected by crown dieback" (Dormor 2002, 222). "That dead-topped oaks are very common, cannot be disputed" (Pontey 1805, 130). Prior to the appearance of Dutch elm disease in the twentieth century, its vector *Scolytus* caused extensive damage on its own account, leading to the "decay and subsequent death of the finest Elms in the vicinity of London, particularly those in St James' and Hyde Parks" (Selby 1842, 114). Earlier generations clearly considered ill health in trees as normal. The terms used in a survey of timber at Staverton in

Northamptonshire in 1835, for example, include "decayed", "damaged", "small and very bad", "very bad", "decayed very bad" and "dead" (NHRO ZB 887). Moses Cook in the seventeenth century advised regular examination "of your Timber-trees, to see which are decaying … Why should any reasonable Man let his Trees stand in his Woods, or elsewhere, with dead Tops, hollow Trunks, Limbs falling down upon others and spoiling them, dropping upon young Seedlings under it, and killing them?" (Cook 1676, 163). Poor health was simply something to be tolerated, with diseased trees being felled as quickly as possible and sold for the best price possible.

In addition, although the increasing scale of global trade—in timber and live plant materials—is probably, together with climate change, the principal cause of the current increases in tree disease, not only in this country but across the world, it is worth emphasising that neither is new. Imports of timber from the Baltic were common in the Middle Ages—as early as 1273 the chapter of Norwich Cathedral dispatched "John the carpenter" to Hamburg to buy timber (Latham 1957, 28)—and were on a substantial scale by the sixteenth century. In November 1696, the Norfolk landowner Richard Godfrey lamented that frost was preventing the delivery of live fruit trees he had ordered from Holland (NRO Y/C 36/15/18), and live forest trees were also being imported on a significant scale by this date. Some time around 1700, John Bridges of Barton Seagrave in Northamptonshire planted "500 limes from Holland" (Morton 1712, 486). By the eighteenth century, substantial quantities of timber were arriving from the Americas, as well as from northern Europe; and the volume of imports rose steadily thereafter, reaching 2.6 million cubic metres by 1851 and 5.9 million by 1871—around a third of modern levels (Fitzgerald and Grenier 1992, 18). But it was probably the increased speed of transportation, rather than the quantities moved per se, that led to the arrival of oak mildew in the early years of the twentieth century, and to the first epidemic of Dutch elm disease soon afterwards. By the 1880s, the development of the screw propeller, the compound engine and the triple-expansion engine, made trans-oceanic shipping of bulk cargoes by steam economically feasible (Carlton 2012).

2 Historic Tree Populations: Density and Management

An historic approach invites us to consider the contribution made to current problems by long-term changes in the character of tree populations—in their species composition, management and age structure. This is important because—to use an obvious example—if ash was a rare tree, concern about ash dieback would be limited to a small number of botanists. It is important to assess how, and why, rural tree populations have developed in the ways that they have. It is often assumed that the particular kinds of tree we find in the countryside—the ubiquity of ash and oak, for example, and the relative rarity of trees like wild service—is a consequence of natural factors, but this is only partly true. For centuries, the overall numbers of trees, the relative numbers of different species and the ways in which trees are managed have all been embedded in social and economic structures. Tree populations have more the character of a human artefact, than of something essentially "natural".

Some "veteran" trees surviving in the modern landscape date back to the Middle Ages. But most are of early-modern date, and the overwhelming majority of our trees were planted in the eighteenth, nineteenth or twentieth centuries. The relatively recent character of tree populations is mirrored in the nature of our sources, for it is only from the seventeenth century that these provide really useful information about trees and their management. One striking feature they reveal is that, before the mid-nineteenth century, many districts boasted vast numbers of farmland trees. On the boulder clays of East Anglia, Essex and east Hertfordshire, for example, there were usually between 20 and 30 farmland trees per hectare, but often more. On a property at Thorndon in Suffolk, c.72 per hectare were present in 1742 (BRO BT1/1/16), while at Kelshall in north east Hertfordshire a farm contained 59 trees per hectare when surveyed in 1774 (HALS DE/Ha/B2112). Some properties, it is true, had fewer, but this was often the result of particular circumstances. At Saxtead in Suffolk in the 1720s, a tenant had taken down "so many trees that there was not enough wood

left for the dairy, so that firing had to be fetched from up to four miles away", while another, at Cotton Hall, had "managed to strip much of the farm of its trees and hedges" (Theobald 2000, 9–10). Equally striking was the high proportion of trees which were managed as pollards: that is, regularly cropped at a height of two metres or so to produce a harvest of straight "poles". On the eastern boulder clays 70 and 80 per cent were usually managed in this way, but sometimes more, with figures of 92 per cent on a farm at Pulham in Norfolk in 1751 (NRO DN/MSC 2/22-25); 93 per cent at Kelshall in Hertfordshire in 1727 (HALS DE/Ha/B2112); and 94 per cent on a farm at Campsey Ash in Suffolk in 1807 (IRO HD11:475). At Curd Farm, Little Coggeshall Essex in 1734 there were only 46 mature timber trees, but no less than 3591 pollards (ERO D/Dc E15/2). Similar densities are recorded on the poor soils, formed in Eocene deposits, in the vicinity of London—on seven farms on the Broxbournebury estate in south Hertfordshire in 1784, for example, there were 3012 pollards but only 299 timber trees (HALS DE/Bb/E27)—and contemporary commentators record something similar in many western counties. In Herefordshire in 1792, "The Trees are much strip't and lopp'd by the Farmers" (*House of Commons Journal* 1792, 318), while in Shropshire they were "generally found most decayed in consequence of lopping" (Plymley 1803, 213).

This picture—of a countryside densely populated with trees, most of which were pollarded—did not apply everywhere. In particular, there were fewer trees in the "champion", open-field districts of the Midlands, largely because there were fewer hedges in which they could grow. Most of the arable lay in unhedged strips grouped into larger unhedged furlongs, which were in turn aggregated into two or three vast "fields". Nevertheless, these districts contained more trees than is often assumed. The hedges of the village "tofts"—the small enclosures behind the farmhouses—were usually densely planted. A survey of Milcombe in Oxfordshire, made in 1656, describes hundreds of trees in the village closes. One contained "126 trees of Ash and Elm … and 52 withes [willows] small and great and about as many new planted" (NHRO C(A) Box104 4 1656). In the wider landscape, trees grew on roadsides, on patches of waste, in hedges on parish boundaries and in the meadows beside rivers. When Irthlingborough in Northamptonshire was enclosed

in 1808, landowners made claims relating to a total of 3,055 trees growing amidst the fields and meadows (NHRO ZA 906). Sixty-two per cent were willows, growing on the floodplain of the river Nene. The enclosure of open fields proceeded steadily in Midland districts through the seventeenth and eighteenth centuries, and as the numbers of hedges increased, so too did the density of farmland trees. A survey of land on the Duke of Powis' estate in Northamptonshire, made in 1758, records a total of 3004 trees on 770 acres—or 9.6 per hectare (NHRO ZB 1837), while on John Darker's estate in the same county in 1791 there were no less than 10.6 trees per hectare (NHRO YZ 2183). These figures, however, were significantly lower than those found in the old-enclosed districts described above.

In general, by the eighteenth century the lowest densities of trees, and the lowest proportions of pollards, were to be found in northern counties. Even enclosed parishes in the Vale of York only contained between 0.4 and 2.5 trees per hectare, averaging 1.4 (Nrth RO ZNS; Nrth RO ZIQ; Nrth RO ZDS M 2/12; Nrth RO ZMI; Lds RO WYL68/63). In some northern districts, it is true, rather more trees—and a higher proportion of pollards—existed, often for special reasons. In Cumberland in 1776, Thomas Pennant drew attention to the numerous ash pollards, cut for fodder (Pennant 1776), and in places, the remains of these populations can still be seen, growing against or, more rarely, within stone walls, especially in Borrowdale and Langdale. Holly pollards, again used as winter fodder, were a feature of many Pennine townships (Spray 1981). But by the eighteenth century, farmland trees (and especially pollards) were relatively thin on the ground in most northern areas.

3 Explaining Tree Density and Management

Many early writers railed against farmland trees, especially in high densities. The late seventeenth-century agricultural writer Timothy Nourse typically argued that "Corn never ripens so kindly, being under the Shade and Droppings of Trees; the Roots likewise of the Trees spreading to some distance from the Hedges, do rob the Earth of what should nourish the Grain" (Nourse 1699, 27). At Badwell Ash in Suffolk

in 1762, it was said that the land was "capable of great improvement by destroying the timber and pollards that encumber the fields in many places" (BRO B E3/10/10.2/28). Most trees, as noted, were pollards and while the poles they produced had many uses they were mainly employed as domestic fuel. Not surprisingly, where farmland was sparsely treed, especially across much of northern England, there were usually other fuel sources. Peat, both from upland moors and lowland "mosses", was both burned locally and exported to major cities. Many of the inhabitants of seventeenth-century York burned peat brought from Inclesmoor, nearly 30 kilometres away (Hatcher 1993, 124), while peat was taken from the mosses of south-west Lancashire to supply Ormskirk and Liverpool (Langton 1979, 56–57). In addition, from an early date, many northern and western districts had access to coal. As early as the 1530s John Leland described how, although wood was plentiful across much of Yorkshire, many people were burning coal (Toulmin-Smith 1907). By 1790, coal had long been almost the only fuel consumed in Durham, Yorkshire, Nottinghamshire, Staffordshire, Lancashire and Cheshire. In the West Riding "The Use of Coal … has been universal, as far back as can be remembered", while in Staffordshire "Coals are, and have been universally used in this county" (*House of Commons Journal* 1792, 328–329).

In a similar manner, the increasing output of the Warwickshire, Nottinghamshire and Staffordshire mines—coupled with improvements in road transport and the construction of canals, which also allowed the greater dispersal of coal from the great north-eastern coal fields—explains why, as open fields in the "champion" Midlands were gradually enclosed through the seventeenth and eighteenth centuries, the new hedges were never as densely stocked with trees as those in most old-enclosed districts, in the Home Counties and East Anglia especially. These latter areas lay at a greater distance from coalfields. Although "sea coal" from the north east was, by the seventeenth century, widely burned in towns located on the coast, or on navigable rivers, elsewhere organic fuels had to be used. And where peat was in short supply, and heaths—with their combustible gorse and heather—were few, then the importance of firewood, and thus of pollards, was great.

What made the wood cut from pollards particularly important was the fact that early-modern England was poorly endowed with woods. Even in the well-wooded south east of the country, it was rare to find that more than 10 per cent of the surface area was devoted to woodland. In most champion counties, the figure was less than 5 per cent, as it was across the north of England. Estimates made by John Tuke at the end of the eighteenth century, for example, suggest that woodland occupied no more than two per cent of the land area of the North Riding of Yorkshire (Tuke 1800). Before the later eighteenth century, woods were almost all of "coppice-with-standards" type. The timber trees were mainly used for construction; it was the coppiced understory—cut down to ground level on a rotation of between eight and fourteen years—which potentially provided most fuel. Only in a few districts, however—especially in the vicinity of fuel-hungry London—were faggots[1] for burning a major product. Coppices mainly produced high-quality poles, used for making hurdles, fencing, hoops, tools and parts of vehicles, and to provide thatching and building materials. In many districts, only the twiggy residue appears to have been destined for burning. Indeed, variations in coppice management were often closely related to particular demands of local economies. Across much of the north of England, for example, and in the industrialising areas of the west Midlands, the coppice was usually dominated by oak and was cut on a very long rotation, of 20 or even 30 years. In Shropshire, "Large quantities of oak poles are used for different purposes in the coal-pits; as they are required to have some strength, they are seldom fallen before 24 years growth, and the bark (used in tanning leather) is an object of great importance…" (Plymley 1803, 219).

Indeed, bark from long-grown coppice poles, and stripped from felled timber trees, was a major source of profit in all areas, although especially industrialising ones. On the Millford Estate near Leeds in the eighteenth century bark accounted for around 20 per cent of the sale value of oak trees (Lds RO WYL500/939). At Hutton Rudby in the same county in the 1630s, the figure was as high as 33 per cent (Lds RO WYL100/EA/13/38).

4 Explaining Tree Species

Almost everywhere, oak, ash and elm accounted for between 85 and 100 per cent of farmland trees. This is remarkable given that there are at least 25 indigenous, or long-naturalised, species capable of growing into reasonably sized trees, with a height of ten metres or more. The contrast with the situation in remote prehistory, before the advent of farming, is striking: across southern and Midland England small-leafed lime (*Tilia cordata*) , a rare tree by the seventeenth century, had been the most common species (Rackham 2006, 83–85). However, oak, ash and elm became the dominant trees in the farmed landscape of the post-Neolithic, not because they were well adapted to this environment naturally, but because they were deliberately planted. Mortimer, for example, described how "The best way of raising Trees in Hedges, is to plant them with the Quick", but he also gave advice on how to establish them "where Hedges are planted already, and Trees are wanting" (Mortimer 1707, 309). Even where trees were self-seeded they needed to be protected. Initial establishment might be the consequence of natural process, but survival to maturity was a function of human agency. An early eighteenth-century lease for a farm in Barnet in Hertfordshire typically instructed the tenant to "do every Thing in his Power for the Encouragement, and growth of the young Timber Shoots, under the Penalty of Twenty Shillings for every Shoot or Sapling which shall be wilfully hinder'd from growing" (HALS DE/B 983 E1).

Two main factors ensured the overwhelming popularity of these three trees: an ability to thrive in a wide variety of contexts, and the wide range of uses for their timber and wood. Oak was "The best Timber in the World for building Houses, Shipping, and other Necessary Uses" (Meager 1697, 110). It also made good firewood, excellent charcoal and clefts easily, making it suitable for floorboards and fencing while its bark, as we have noted, was employed in tanning. It could grow in most situations: "in any indifferent Land, good or bad, as Clay, Gravel, Sand, mixed, or unmixed Soils, dry, cold, warm or moist" (Meager 1697, 110). Ash was less useful as structural timber, but it had many other uses. Timothy Nourse thought it "a most useful wood to the

Coach-maker, Wheeler, Cooper, and a Number of other Artificers", and that it could be used for making fencing and bins, "for Spittle and Spade Trees, for Drocks and Spindles for Ploughs, for Hoops, for Helves, and Staves, for all Tools of Husbandry, as being tough, smooth and light" (Nourse 1699, 119). Its excellence as firewood was universally praised: "the sweetest of our forest fuelling, and the fittest for ladies chambers" (Evelyn 1664, 40); "Of all the wood that I know, there is none burns so well green, as the Ash" (Cook 1676, 76). And on top of this, ash grew rapidly and, like oak, was not very choosy about *where* it grew. Contemporaries agreed that it would flourish on "any sort of land", provided "it be not too stiff, wet and boggy", although in reality it seems to have been less prominent on more acidic soils (Mortimer 1707, 366).

Elm in its various forms also had many uses. It was "proper for Water-works, Mills, Soles of Wheels, Pipes, Aqueducts, Ship Keels and Planks beneath the Water Line … Axel trees, Kerbs Coppers … Chopping-Blocks … Dressers, and for Carvers work", as well as for making spades, shovels and harrows. But above all it made excellent boards and planks, for floorboards, external weatherboarding—and coffins (Nourse 1699, 115). Again, it could tolerate a wide range of conditions, and early writers singled out another advantage. It caused "the least offence to Corn, Pasture and Hedges of any Tree", in part because (unlike ash) its roots did not spread far, but also because it could be rigorously trimmed up as timber, so that it cast limited shade. Ellis thought that elms "don't damage any thing about them, as some other Trees do, whose Heads must not be trimmed up as these may" (Ellis 1741, 49).

A number of other species are recorded in early surveys, growing in small numbers in fields and hedgerows. These include maple, lime, hornbeam, rowan, aspen, black poplar, alder, sycamore, beech, holly, sweet chestnut, walnut, wild service, willows, crab and fruit trees like apple and cherry: indeed, only whitebeam and birch were regularly shunned by planters, appearing at very low levels only in some western and northern districts. In general, such "minority" species made up less (usually much less) than fifteen per cent of trees recorded, but there were exceptions. In certain districts, fruit trees

might rival or outnumber oak, ash and elm in hedges—especially in parts of Herefordshire, Worcestershire and Shropshire, but also in Kent, Hertfordshire and Middlesex. A few farms in Essex and east Hertfordshire boasted diverse mixtures of trees: maple, lime, hornbeam and wild service made up a surprising 61 per cent of the trees on a farm at Navestock in south Essex in 1772 (ERO T/A 783). Such cases are rare, however, and in most places surveys reveal an overwhelming dominance of oak, ash and elm.

In most cases, the relative rarity of "minority" species was due to the fact that they had fewer uses, grew more slowly, or were more demanding in their requirements than oak, ash or elm. Some, however, were infrequent as *trees* because contemporaries thought they were better managed as coppice, in woods or hedges. Maple, for example, is widely recorded as a pollard and, more rarely, as a timber tree, but only infrequently did it account for more than 5 per cent of trees on a property. It was presumably common, as it is today, as a shrub in hedges, where it seeds relatively easily. It was also—usually in combination with hazel and/or ash—a frequent component of coppices, especially in the Midlands and south. Farmers and landowners evidently preferred to manage it as underwood, rather than as a pollard: if it self-seeded in a hedge, it was usually plashed or laid with the rest of the shrubs. Moses Cook in 1676 explained that:

> If you let it grow into Trees, it destroys the wood under it; for it leaves a clammy Honey-dew on its Leaves, which when it is washed off by Rains, and falls upon the Buds of those Trees under it, its Clamminess keeps those Buds from opening, and so by degrees it kills all the Wood under it; therefore suffer not high Trees or Pollards to grow in your Hedges, but fell them close to the Ground, and so it will thicken your Hedge, and not Spoil its Neighbours so much. (Cook 1676, 99)

The distribution of minority trees—and the relative importance of oak, ash and elm—displayed a measure of spatial variation, the consequence of a complex interplay of environmental and economic factors. Farmers and landowners, knowledgeable about the local environment, planted or encouraged trees which they knew would both flourish, and

produce wood or timber of value or utility. But it was not only the trees of farmland which were shaped by such factors. Woods and wood-pastures (grazed woods on commons and in parks) also had their distinctive species, the result of choices made by land managers, or a side effect of management systems.

The timber trees in coppiced woods were mainly oaks, valuable as timber and able to self-seed and flourish under the canopy shade. Again and again we find a sharp contrast between the trees growing in woods, and those on adjacent farmland, clearly illustrating the highly artificial character of both populations. Three examples from Essex make the point well. On the Topping Hall estate in Hatfield Peverel oak made up 48 per cent of the farmland trees in 1791, but accounted for all but one of the 2000 trees growing in the Great Wood; at Finchingfield in 1773, oak constituted 57 per cent of the farmland timber but 100 per cent of the 968 trees in the four woods on the property; while at Little Baddow in 1777 it made up 65 per cent of the trees growing on the lands of Bicknaire Farm but 99.5 per cent of those in Bicknaire Wood (ERO D/DRa C4; ERO D/D Pg T8; ERO D/DRa C4). Even woodland coppices, which displayed much more variety in their composition, were not simply the "wild" vegetation of the places in question, tamed by management. The main coppiced species—ash, hazel and oak—were all of particular value for construction, tools, fencing and the like and the comparatively pure stands which often existed were in part the consequence of deliberate weeding and replanting. Boys in 1805 suggested that many coppices in Kent were regularly augmented with new plants simply because "wood, like everything else, decays and produces fewer poles every fall, unless they are replenished" (Boys 1805, 144). A lease for a wood in Wood Dalling, Norfolk, from 1612 bound the lessee to plant sallows in cleared spaces following felling (NRO BUL 2/3, 604X7); the tithe files of 1836 describe how there were 35 acres of coppice in Buckenham in the same county, "part of which has been newly planted with hazel" (PRO/TNA IR 29/5816); while Lowe described how on one Nottingham estate the hazel and thorns were stubbed up after the coppice was cut "and young ashes planted in their stead" (Lowe 1794, 34, 114). Rudge in 1813 described how ash was regularly replanted in the coppices in Gloucestershire and Vancouver in

1810 noted how, in Hampshire, ash shoots were plashed "in the vacant spaces" to form new plants (Vancouver 1810, 297); a similar practice is recorded in Surrey woods in 1809 (Stevenson 1809, 127). Coppiced woods, in short, were very far from being "natural" environments. They were intensively managed factories for the production of wood and timber, and their trees and coppiced stools were selected or manipulated accordingly.

In wood-pastures, oak was likewise usually the main tree but on commons and in deer parks in the Cotswolds and Chilterns, and on poor soils around London, beech was prominent, while in the latter district hornbeam was also present in vast numbers. No less than 24,000 hornbeam pollards were recorded on Cheshunt Common in south Hertfordshire in 1695: Rowe has argued that they were often deliberately planted on the wastes of this district by manorial lords in the early-modern period, responding to the high fuel prices in the proximity of London (Rowe 2015). Hornbeam wood had a range of specialised uses but it was mainly valued as firewood and as a source of charcoal. Beech and hornbeam have good resistance to grazing, especially when compared to ash or elm, and also produced mast which was consumed by deer and other livestock. How far their prominence in wood-pastures was a side effect of intensive grazing, how far they were deliberately planted, remains unclear, but as with woods the contrast with trees growing on the adjacent farmland was often sharp. At Drakes Hill Farm, Navestock, Essex, in 1772 hornbeam made up 16 per cent of the 419 mature trees growing in the fields and hedges, but 85 per cent of the 959 growing on the adjacent area of common land (ERO T/A 783).

5 The Age of Trees in the Past

Everywhere we look, early-modern tree populations were shaped by intensive management. One striking example is the way in which most timber trees were felled at a young age. Trees containing around 50 cubic feet of wood are, in general, likely to be around 80 years old, but most trees measured in surveys, or when felled, were much smaller than this. Of the 762 oaks (mainly in hedges) growing on an estate

in Waltham Abbey in Essex in 1791, only 2 per cent were thought to contain more than 25 cubic feet, and none more than 40; all the 255 ash were thought to contain less than 15 cubic feet; and while some of the 197 elm were larger, one containing an estimate 40 cubic feet, most contained less than 15 (IRO HA 116/5/11/2). Many surveys, it is true, reveal larger trees, but they usually form a small minority, and Pringle, writing about Cumberland in 1794, noted that it was "general opinion in this and, I believe, in other counties that it is more profitable to fell wood at fifty or sixty years growth, than to let it stand for navy timber to 80 or 100" (Pringle 1794, 12). In part, such a practise was encouraged by the fact that bark was of better quality, and more easily peeled, from younger oak trees. But more importantly, before the development of industrial sawmills in the middle of the nineteenth century it was easier to select the size of timber for the job at hand, rather than to let a tree grow to a substantial size and then saw it up—especially as, from around sixty or seventy years, the growth rate of oak, in particular, begins to slow. It made more sense to fell trees at an appropriate size for gate posts, building repairs or whatever, and get others growing in their place.

It might be thought that pollards, which often formed the majority of farmland trees, were in general older, because they could continue to produce a reasonable crop of poles for centuries. But as Thomas Hale explained in 1756, "Pollards usually, after some Lopping, grow hollow and decay… The Produce of their Head is less, and of slower Growth". They should be taken down before the trunk rotted badly, and lost value; and the farmer should ensure a constant succession, by regularly replacing old pollards with young trees destined to be managed in the same manner (Hale 1756, 141). While neglect clearly allowed a proportion to reach a venerable old age—the veteran trees of today—these were exceptions. One eighteenth-century observer, railing against the dominance of old pollards in the hedges of East Anglia, commented disparagingly that these were "of every age, under perhaps two hundred years" (Middleton 1798, 345). In addition, we might note in passing that actively managed pollards were anyway maintained, in effect, in a state of permanent juvenescence (Read 2008, 251). In Lennon's words, because "the crown is constantly having to reform, pollarding can delay the emergence of the tree from the formative growth period… This can

extend the natural lifespan of the tree significantly…" (Lennon 2009, 173). Compared with today, the countryside was filled with very young trees.

6 Changes in the Nineteenth and Twentieth Centuries

During the nineteenth century, the numbers of farmland trees in England declined steadily. Pollards gradually became redundant as better roads, the construction of canals and ultimately the spread of the rail network allowed coal to become the normal domestic and industrial fuel throughout the country. They were removed wholesale from farmland hedges. So too, in many areas, were timber trees, as a fashionable interest in agricultural improvement and a rising tide of imports (especially from the Baltic) ensured that forestry operations were increasingly concentrated in woods and plantations, so that felled hedgerow trees were not replaced.

Further changes followed in the twentieth century. As large landed estates experienced financial difficulties—or were broken up altogether—in the first half of the century, large numbers of trees were cut down. Much timber was also felled during the two World Wars, while post-war agricultural intensification and hedgerow removal, and the impact of Dutch elm disease, all took a terrible toll.

In most Midland and southern districts, tree densities were roughly halved in the nineteenth century and had more than halved again by the late 1970s (Williamson et al. 2017, 139–143). Since then, amenity planting and the growth of ash and maple in neglected hedges have, on some measures, reversed the decline: but it rather depends on what is being counted, for free-standing trees in hedges have continued to fall in numbers (Forestry Commission 2002).

Equally important, however, is the fact that, since the mid-nineteenth century, tree populations have become much less intensively managed, and the number of old trees in the landscape has in consequence increased markedly. The development of industrial sawmills and

improvements in transport made it possible for more mature timber trees to be processed into smaller timber, leading to a rise in felling age. This was followed by an effective cessation of economic management as the increasing scale of timber imports made it less economically attractive to extract individual trees in hedges, and as post-war agricultural intensification encouraged the view that the countryside was for growing food, not trees. Where trees were allowed to remain in hedges, they thus gradually grew old and were not replaced when they died.

Increases in tree age were also arguably a consequence of social factors. The late nineteenth and early twentieth centuries saw the establishment of a number of organisations dedicated to the conservation of rural landscapes, open spaces and wildlife, including the Commons Preservation Society (1865); the Society for the Protection of Birds, later the RSPB (1889); the National Trust (1895); the Society for the Promotion of Nature Reserves (1912); and the Council for the Protection of Rural England (1926) (Evans 1992; Sheail 2002). Changes in the distribution of wealth and improvements in transport meant that middle-class urbanites, with little real experience of rural living, visited the countryside on a larger and larger scale, and increasingly settled in it, or in suburbs on its margins, and began to take an active interest in its conservation. The idea that the countryside was essentially "natural", which had been developing (alongside urbanisation and industrialisation) since the eighteenth century, now triumphed. Felling prominent hedgerow trees gradually came to be regarded, even by many landowners, not as a normal part of land management, but rather as a desecration. Such ideas were manifested with particular clarity, somewhat paradoxically, where countryside was being lost to urban or suburban development. It was proudly claimed that Letchworth Garden City, established in Hertfordshire in 1902, had been built on virgin farmland without the loss of a single tree (Rowe and Williamson 2013, 274). By the time of the Second World War, the idea—long promulgated by land use planners like Patrick Abercrombie and campaigners like Clough Williams Ellis—that state intervention was required to preserve the rural landscape from large-scale development was widely accepted, culminating in the Town and Country Planning Act of 1947

(Rowley 2006, 112–115). As well as introducing, for the first time, workable systems of spatial planning, this also established Tree Preservation Orders (TPOs), which allowed specimens deemed to be of particular value to be preserved from felling. Although largely applied in urban areas, TPOs represented the triumph of the new attitude to trees, as objects of the natural world to be preserved, rather than as economic objects to be husbanded and exploited.

The increasing age of farmland trees was manifested, in particular, in the growing incidence of "stag-headedness" or dieback. Photographs of the countryside dating from the late nineteenth century show, by modern standards, remarkably few stag-headed trees. Those taken in the post-war period, in contrast, show far more. By the 1950s and 60s, the ageing character of trees in the countryside was becoming a matter of concern. The *Report of the Committee on Hedgerow and Farm Timber* of 1955 estimated that over a third of hedgerow trees had girths in excess of 1.5 metres, that is, were at least sixty years old: the age by which, a century earlier, most would have been felled. The great gale of 1987 thinned a large number of old trees, but much remains, and while recent conservation and amenity planting have lessened the numerical dominance of old trees, in visual terms they often remain prominent in local landscapes.

7 Lessons from History?

It is within this broad historical context that we need to consider current concerns about tree health. Perhaps the main point to emphasise is that there is little that is "natural" about our farmland trees, a comment that applies more generally to our semi-natural woodlands and to a range of other valued habitats (Rackham 1986; Barnes and Williamson 2015; Fuller et al. 2017). Tree populations have, for centuries, been artefacts of management, and the same may well be true of some of the vaguer pathologies currently affecting English tree species, such as oak decline, a condition which principally affects trees a century or more in age. In historical terms, as the data discussed above should have made clear, these are over-mature trees, and these conditions may,

to an extent, simply represent normal ageing, transformed into a "disease" by modern and unrealistic expectations of perpetual arboreal health. Equally important is the fact that, when tree populations were rigorously managed, few specimens would have exhibited symptoms of "decline" for very long, for they were simply taken as signs that useful growth was over. As Moses Cook put it in 1676:

> When a Tree is at its full Growth, there are several signs of its decay, which give you warning to fell it before it can be quite decay'd; as in an Oak, when the top boughs begin to die, then it begins to decay; in an Elm or Ash, if their Head dies, or if you see wet at any great Knot, which you may know by the side of the Tree being discolour'd below that place before it grows hollow …these are certain Signs the Tree begins to decay; but before it decays much, down with it, and hinder not your self. (Cook 1676, 171)

Although "oak decline" was only formally named and characterised in the 1920s, trees exhibiting the appropriate symptoms are referred to in early texts, but on an increasing scale from the nineteenth century. Curtis in 1892 described how "dead upper branches or 'stag-horn top', as it is usually called, is often met with… The manifestation needs but little remark, for it is apparent to all. The top branches die, the yearly growth is meagre, and the whole tree presents an enfeebled condition" (Curtis 1892, 25). It is noteworthy, however, that he drew attention to the prevalence of the condition, not on farmland or in woods, but "on lawns and pleasure grounds … and park lands"—that is, in locations where many trees were already, by the late nineteenth century, being retained beyond economic maturity, because they were primarily valued as ornaments to the landscape. The spread of the condition more widely, in other words, may simply reflect a decline in intensive management, and an increase in the proportion of over-mature trees in the countryside.

Of course, other changes in the rural environment over the last two centuries will have contributed to poor arboreal health. The increased scale of land drainage and water abstraction, and changing patterns of cultivation (with a shift to late summer cultivations and continuous

courses of crops), have been noted by several authorities (e.g. Forestry Commission 1955). Less attention has been paid to the impact of the large-scale application of manufactured fertilisers, potentially an important influence given the suggestion that inorganic fertilisers can suppress the development of mycorrhizal fungi, on which tree health depends (e.g. Ryden et al. 2003). The amount of dead wood in the environment has also risen steeply over the last century or so, due to the decline of wood burning: in the past, any dead wood was rapidly gathered up by the local poor. The native buprestid beetle *Agrilus biguttatus*, thought by many to be a factor in acute oak "decline", was until recently considered a "red book" species, to be encouraged by the retention of fallen wood. Certainly, an earlier generation of foresters was clear about the potential threat posed by accumulations of decaying wood: "At the risk of repetition I would impress upon all foresters the necessity of cleaning up after every fall of timber, and the total destruction by fire of all dead organic matter" (Curtis 1892, 46). A decline in the practice of "quarantine felling", so regularly practised in earlier periods, may also be important: Curtis recommended it as the best way of dealing with fungal attacks, and with infestations of *Scolytus*. But the large numbers of old trees in the countryside, the main consequence of less rigorous management, may be key. Overall, the message from history may be, not so much that disease is a natural condition of trees, but that the most unnatural and most rigorously managed tree populations are also the most healthy ones. Forms of management that benefit rare saproxilic insects may not be so good for the health of trees themselves, and thus for the species which depend upon them; and difficult choices may need to be made by conservationists in the future.

But there are other important things that we can learn from history. It is clear that our present situation is uniquely serious. Elm has been lost from the landscape; ash, and possibly oak, are under threat. If we wish to ensure the continued presence of trees in the countryside, then we are obliged to plant a different and wider range of trees. At the same time, there is little doubt that the traditional dominance of oak, ash and elm in the countryside was mainly a consequence of economic rather than environmental factors. Recognising this essential artificiality of tree populations gives us more freedom in our choices of what we

should plant in order to diversify and thus ensure future resilience, and history can suggest the kinds of species we should use. Some authorities have proposed the large-scale establishment of southern European varieties (such as downy oak (*Quercus pubescens*)), in anticipation of climate change, but given that many of our indigenous species have distributions extending far south into Europe this seems unnecessary. Instead, attention should turn to the "minority" trees, whose distributions—as we noted earlier—are often strongly regional in character. In Hertfordshire, for example, there were significant differences between the west of the county—the Chiltern dipslope, with soils largely formed in clay-with-flints and outwash gravels—and the east, with soils mainly formed in boulder clay. Before the mid-nineteenth century, cherry was regularly found, together with smaller amounts of apple, in the hedges of the west, together with aspen and beech. All were rare in the east of the county, where instead maple and hornbeam were present, with small quantities of black poplar on damper sites. Replicating, restoring and accentuating such patterns would ensure that a measure of regional diversity could be perpetuated into the future, providing a "sense of place" and a measure of historical continuity, things which might be lost if new species from abroad, or some indiscriminate "conservation mix" of indigenous species, were instead to be widely established. In addition, such "minority" trees are "tried and true" and likely to succeed in the localities in question. But we could also be bolder. In Hertfordshire, for example, attempts might be made to recreate the great wood-pastures of hornbeam, lost from the south of the county only relatively recently. There are arguments, too, for the large-scale planting of small leafed lime (*Tilia cordata*), largely banished from the landscape before the historic period. We need to plant very large numbers of trees, and we need to plant them now. But we need to think carefully about what we should plant, and where, and here the history of the landscape, and an awareness of its essentially anthropogenic character, ought to be one influence on our planning. Indeed, our habit of thinking of tree populations as primarily "natural" may be one of the problems we face when formulating future policy.

Quite how such ideas might, in practice, be implemented is a more complex question. Britain's exit from the EU, and more specifically

from the Common Agricultural Policy, provides an opportunity for targeting grant aid towards large-scale replanting of a more diverse range of farmland trees, and also perhaps towards support for the more commercial, and more rigorous, management of farmland timber. But in addition, those currently involved in land management and conservation—county councils, trees wardens, the National Trust, the Forestry Commission, landowners—urgently need to be made aware of just how far our "natural" tree populations are, in reality, historically contingent; and of how some wildly shared aspects of current conservation policy, such as careful replication of their existing character in replanting programmes, or the retention on a large scale of over-mature trees and dead wood in the landscape, may be bringing as many problems as benefits.

Note

1. A bundle of sticks bound together as fuel.

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