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Good Stewardship and the Challenges of Managing the Stuart Royal Forests in England, 1603–1714

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This article explores some practical difficulties of environmental stewardship through an examination of the complexity of competing interests in the English royal forests in the seventeenth century. Various human, animal, and other environmental interests often came into conflict in ways that defied any easy solution. While some instances of poor stewardship came from intentional exploitation of the forests for short-term gain, others were the unintended consequences of well-intended policies and practices. The ambiguity of the most prudent course of action led many to experiment, leaving behind a whole body of literature—some more helpful than others—on the right practices of good stewardship of forests. In the end, the sustainability of the forests required a near-impossible balancing act between multiple stakeholders and care for the environment that went beyond mere good intentions.

Introduction

The stewardship of the English royal forests was a challenge from the outset. The first difficulty was protecting deer and trees simultaneously when the deer often damaged trees by stripping bark and eating new growth. The other challenge was managing these resources within a space containing many different interests and claims: the Crown and other landowners, their tenants—those with commons rights of use and access; forest officers; and, increasingly, industrial interests from iron masters, colliers, and tanners. The multiple use of the royal forests meant that while they were subject to laws designed to protect resources of deer and trees for the Crown's use, there were private landlords, villagers, and farmers

relying on the same space for their survival as pastures for sheltered grazing and forage for pigs and cattle. The story of the royal forests demonstrates how good stewardship in the midst of multiple stakeholders can require a near-impossible balancing act of interests, complicated by the need to avoid unintended consequences that could endanger the long-term survival of such an essential resource.

The Origins and Development of the Royal Forests

Designated as royal hunting forests by Norman kings soon after 1066, the royal forests were handed down as part of the Crown estate and survived into the medieval and early modern periods.[1] The royal forests were governed by special laws to protect deer and trees—*venison* and *vert*—for the king's pleasure and were overseen by forest officers appointed to protect these resources.[2] *Royal forest* meant the area within the forest bounds that was subject to forest law, whereas *royal woods* were those woods owned by the Crown. In England, forest law took precedent over common law in territories designated as a royal forest; all use of lands within the bounds of a royal forest was subject to these laws.

The English royal forests were territories containing woods and pastures with wild beasts (mostly deer and some hare) and fowls that were safely protected for kingly delight and pleasure. Forests were bounded and guarded by forest officers, replenished with wild beasts, and managed to keep "great Coverts of Vert" for deer to find shelter and to browse. The venison and vert in the forests were protected by special laws, privileges, and forest officers. These officers answered to the forest courts "for the Preservation and Continuance" of the forest with its deer and trees. Each forest had various forest officers to maintain the venison and vert: a steward; verderers, who protected both deer and trees; foresters; regarders, who regulated the bounds; agistors, who managed the number of animals pastured in the forest; and woodwards.[3]

The English royal forests were wood pastures that were similar to a modern park with grass lawns and thickets of bushes and stands of trees. The early modern forests were not continuous blankets of wood cover like modern plantations because it was impossible to hunt safely in very dense woods. Grassy open spaces punctuated by groves of trees and bushes not only allowed hunters to see the deer during the chase but also provided shelter for deer at night. There were inhabitants who owned lands within the royal forests in addition to the king; there were also others with rights of common usage and access to woods and wastes. Most of the forest lay open. There were some enclosures but they were regulated to allow the deer free passage throughout the forest. At certain times

of year, the forest laws restricted the use of land such as during "fence" month in May through June. These forest laws also prevented any pasturing of cattle and pigs on common lands within the forest. Also protected were the deer while they were fawning. Common pasture rights were also strictly regulated by agistors who limited the number of animals entering the forest to graze, thereby ensuring that sufficient feedings remained for the royal deer at all times.[4] The efficient management of the forest allowed large numbers of forest dwellers to have access to lands and rights simultaneously; this only proved to be effective when the monarch exercised relative rather than absolute property rights over the forest.

By the medieval period, the monarchs were not the sole owners of the lands within the royal forests; they had granted land to monasteries and private lords together with rights of common to forest villages in the open woods and wastes. Landowners, including the king, had tenants and commoners. Forest villages also attracted poor vagrants and squatters without land because there were generous commons in the woods, wastes, and pastures of the forest. The early seventeenth-century royal forests of James I (1603–1625) contained many different landowners, tenants, and claimants to commons rights of pasture for access to woods and various *botes* or wood rights, such as *fencebote* to collect wood for fencing and *firebote* to access kindling wood for heating. The royal forest surveys that survived for Sherwood Forest in Nottinghamshire and Wychwood Forest in Oxfordshire for 1609–1610 show two important characteristics. First, the lands contained within the boundaries of royal forests were not owned solely by the king, nor were they covered entirely by wood. Second, they contained a mixture of pastures, open wastes, woods, and forest villages along with arable land in the open field system.[5]

The king possessed the privilege to hunt at will or to grant hunting rights to others as gifts or payments to forest officers. However, the trials and tribulations of the English civil wars and the interregnum during the mid-seventeenth century left many royal deer herds severely depleted and in need of restocking. Throughout the medieval period and into the early seventeenth century with the rule of the early Stuart kings, James I and Charles I (1625–1649), the royal forests were prized as royal hunting grounds. From the late medieval and early modern periods, there was increased competition for hunting deer and other royal beasts, which put forest officers and poachers at odds with each other within the forests. The game laws of the early seventeenth century were designed to protect royal deer from hunters and poachers.[6] A surge of early Stuart game laws protected their hunting interests, and they made regular visits to their royal forests for sport. However, these monarchs experienced financial difficulties, and their relationships with the English Parliament began to sour; hypercritical parliaments were loath

to grant these monarchs any money through the right to raise taxes. Both James I and Charles I looked to their royal forests as lucrative assets within the Crown estate that might ease their financial difficulties. At the end of his reign, James I began selling off some of his forests in the west of England that, predictably, ignited riots and protests, particularly for the loss of commons rights belonging to the poor inhabitants of forest villages who relied on woods and open wastes for their survival.

During the 1630s, Charles I followed his father's lead; he proposed the sale of several royal forests, mostly ones that had ceased to offer hunting opportunities either because they were too remote or the deer were crowded out by illegally grazed sheep and goats. Charles I resorted to forest sale or *disafforestation*, especially during his years of personal rule (1629–1640), which was when he ruled without Parliament and tried to raise money in any way possible. The sale process and the protests that ensued in many of these forests have been well documented.[7] In 1660, Charles II took immediate charge of stewardship within his forests by replenishing red deer herds in the forests of Sherwood and Windsor with donations from German princes and local English gentlemen. The late seventeenth-century monarchs allowed deer populations to recover not only through stricter game laws—including restrictions like those of Charles II that prohibited hunting unless in the company of the monarch—but also through harsh penalties—including deportation to deter poachers.[8] By the later seventeenth century, timber resources belonging to the royal forests took precedence.

Thus, in the early- to mid-seventeenth century, royal forests of the Crown estate were a commodity for cash-strapped monarchs who were avoiding the wrath of Parliament, first by James I in the 1620s and later by Charles I under his personal rule. In the 1630s, Charles took the sale process to a new level—landowners benefitted from the removal of forest law that had restricted their use of lands, which now became more profitable without the deer. Those with commons rights lost access to valuable open wastes and woods because often the lands designated in lieu of these rights were insufficient to support the population that had relied on the royal forests.

The Stewardship of Charles I

Charles I's management of the royal forests during his personal rule raises the important issue of his stewardship. The monarch was not only the steward of the trees within his own woods and the deer that roamed throughout the forest, but he was also entrusted with the stewardship of other lands, woods, and wastes that did not belong to the Crown estate but were subject to forest law. His responsibility

was to maintain forest law and the efficient running of the forests for those that dwelled within them. While Charles I sold a number of his forests legally, the result was eradication of the forest economy and life for its inhabitants after such a sale. However, the question to be asked remains: Was he otherwise a good or bad steward of his forests? His role was to uphold forest laws and the management of the forests and their resources according to these laws.

At the end of his period of personal rule without Parliament, Charles I was judged by the Long Parliament in The Grand Remonstrance of 1641, which dealt with many other issues besides his conduct in the royal forests.[9] As for his stewardship of the royal forests, he was deemed a bad steward—accused of being both too lax and too strict at the same time. His management of the royal woods was too lax because he had failed to protect the woods from damage within royal forests. He had allowed indiscriminate felling if it was profitable. In some cases, such as his grant of the Forest of Dean to an ironmaster (John Wintour), Charles I had promoted the destruction of woodland cover by allowing Wintour to fell at will and to operate his business within royal woods.[10] The Long Parliament took exception to the "general destruction of the King's timber," especially reserves in the Forest of Dean, which was described as "the best store-house in this kingdom for the maintenance of our shipping." This Puritan Parliament was indignant that Charles had sold Dean's royal woods to a papist.[11] The extensive damage occurring in these woods was outlined in a 1650 petition from Isaac Bromwich to the Commonwealth government.[12] A royal survey of these woods in 1662 showed there were barely fifty trees remaining across the 18,000 acres of royal forest that Charles I had legally granted to Wintour in 1640.[13]

However, the most important charge in The Grand Remonstrance brought by the Long Parliament against Charles I's stewardship of the royal forests was his enlargement of the forest bounds. In many of the royal forests, he extended boundaries to increase their size, which was contrary to the ancient *Carta de Foresta*; he had then imposed composition fines on those accused of breaking forest laws in areas that were never royal forests.[14] Charles I began this fundraising effort during the 1630s within the royal forests of southern England, especially in the forests of Windsor, Dean, Waltham, and New Forest. In some cases, such as Windsor Forest in Berkshire and Surrey, he had extended forest boundaries over entire counties; he then called the highest forest court, the justice seat or forest *eyre*, to punish the inhabitants according to forest law. Charles instructed his Chief Justice in Eyre south of Trent (Lord Holland) to impose harsh sentences. This meant extracting high fines from wealthy landowners for infringements of forest law across a wide swathe of southern England, most of which were never legally part of the royal forests.[15] To reverse some of these injustices of Charles

I's interference in forest matters, Parliament passed an Act for the limitation of forests in August 1641, which returned all forest boundaries to their limits in 1623 during James I's reign.[16] Thus, the Long Parliament's actions in 1641 were to return the forests to the *status quo* of James I's reign. Since Charles I had failed to protect and act as a good steward of the royal forests and all interests contained within, Parliament stepped in to redress the balance. As an absolute ruler, Charles I paid the ultimate price for his offences, which were not just in forest matters, when he was captured and executed by Parliament in 1649.

The Revolution and Restoration

After the Restoration of 1660, monarchs ruled with the permission of Parliament in a constitutional monarchy, rather than by absolute rule—monarchs had to govern with the approval of Parliament. The case of Needwood Forest in Staffordshire illustrates the greater scrutiny of forest stewardship in the later seventeenth century. In 1683, Charles II (1650–1685) agreed to sell part of Needwood Forest and the Honor of Tutbury to Colonel Edward Vernon, a prominent forest official who became the sole Governor and Lieutenant of Needwood.[17] An inquiry in October 1689 by the Duchy of Lancaster, the part of the Crown estate to which this forest had belonged, found that under Vernon's personal rule in Needwood the forest was not being maintained properly. Vernon had failed to keep up woodmote courts to manage the woods, he refused to allow keepers to give accounts of deer killed by warrants, and he also took presentments for offences privately in his own room.[18] As a result, the forest courts and any regulation over land use virtually ceased in Needwood until William III passed an Act of Parliament in 1696 that returned Needwood Forest to the royal forest system, which, in essence, restored it to the Crown estate.[19] Furthermore, the Act to reafforest (return to forest law) Needwood in 1696 stipulated that the forest should not be alienated again without the consent of Parliament, indicating the House of Commons' further commitment to upholding management practices and the good stewardship of the royal forests in the seventeenth century.

Royal deer and trees were particularly under threat during the English Revolution from 1640 to 1660. Reports from the Nottinghamshire forest of Sherwood from 1646 to 1649 showed that Parliamentary soldiers were eating the king's deer and cutting down trees to sell for timber and use as firewood. By 1648, there were few deer to protect in Sherwood, with only 258 deer remaining from the vast herd of more than 1,300 recorded in 1635.[20] After the Restoration of 1660, the deer were slow to return to the royal forests. Charles II established strict game laws to prevent hunting deer within royal forests unless the monarch

was present, all in an effort to reduce illegal hunting and poaching. Some royal forests such as Sherwood and Windsor forests received gifts of deer from abroad in 1661 from foreign princes to assist with recovery of royal game resources.[21]

During the Interregnum (1649–1660), the Commonwealth and Protectorate governments had seen little value in royal deer because they were viewed as wasteful and a frivolous use of land badly needed for cultivation. Agrarian writers such as Walter Blith and Silvanus Taylor promoted improvement ideas for forests, commons, and wastes by converting them to new uses with the enclosure of commons and waste grounds and employing more efficient farming methods. Silvanus Taylor was a former soldier in the Parliamentary army, who in 1652 wrote *Common-Good*, urging new agrarian uses for idle royal forests. In his mind, good stewardship meant bringing unused wastes under the plough to feed more people and to support a bigger army to defend the Commonwealth. Taylor also saw the importance of protecting the woods for the navy. For this reason he was opposed to any sale of the royal forests, expressing the age-old fear that forest sale threatened to destroy the navy's timber supply within the forests.[22] Taylor believed "all men's eyes are on [the forests]," and thought it most advantageous for the Commonwealth to promote enclosure, but only if forests remained under state control.[23] By maintaining the forests in the state's hands and letting out parts at reasonable rates, it was easier to accommodate commons rights and prevent fragmentation of the forests. It also made tenants more answerable to the state and more inclined to protect their own properties than to ransack the forest if local disturbances occurred. Other reasons given for retaining the forests were that they were profitable assets for the Commonwealth for the service and "glory of the nation" and, at the same time, they were for assisting the military forces on land and the navy at sea.[24] While the Commonwealth government had little time for deer, they understood the importance of managing the royal timber woods within the Crown forests. This also meant preserving the world of forest commons rights and a way of life and economy based on unenclosed woods and wastes.

Thus from the mid-seventeenth century and into the eighteenth century the royal forests were starting to be prized for their homegrown timber and other wood resources, free from foreign interference by blockades of the traditional Baltic timber routes. Whilst the timber volume in the royal forest was not extensive compared to the Baltic, New England, or the Home Counties of England, they represented a homegrown supply, which was free to the Crown other than the labor and costs of cutting and carriage to dockyards.[25] From the later seventeenth century, especially during the three Anglo-Dutch wars and then fighting against the French, timber and wood resources from the royal forests became more important as a strategic supply. The navy purveyors did not have to haggle

the price of timber in the royal forests; they just had to get the timber to the dockyards on the river Thames.

The Balancing Act of Forest Stewardship

Timber and wood, then, were the equivalent to our modern-day oil reserves because they provided lifeblood to the economy. Trees provided the raw materials for building houses, carts, fencing of young woods, enclosing animals, as well as most of the tools and implements used by farmers. Trees also supplied fuel to heat homes and support early industries such as charcoal iron making, soap boiling, and dyeing. With the development of the English navy, beginning from the mid-seventeenth century, timber resources for shipbuilding became a primary concern in the management of woods within the English royal forests. Charged with protecting the deer and allowing them to roam freely through the forest unhindered, forest officers balanced this task alongside conserving timber for the navy and wood for all manner of activities within the English forests. Sometimes protecting the royal deer proved detrimental to the royal woods; at other times, protecting the trees negatively impacted the deer, as even well-intentioned management practices designed to protect the trees were unsuccessful or damaging.

The stewardship of the English royal forests during the early modern period was a balancing act to ensure that timber woods belonging to the Crown were preserved, that the deer had ample feeding within the forest, and that the deer were not subjected to illegal hunting and poaching. Sometimes protection of the deer and their liberty to pass freely through all parts of the forest to graze and browse meant that private coppice woods were invaded by hungry deer and royal woods were never able to be coppiced because they had to lie open. There was also the implicit moral obligation to uphold the forest landscape and lifestyle for those with ancient commons rights to pasture or forage within the open wastes and woods within the forest, whether they belonged to the Crown or to private lords. Regulation of these activities was in the hands of the forest officers, who were sworn to uphold forest law and report all infringements to the forest courts. Good stewardship of deer and the trees simultaneously was a juggling act alongside the interests of other landowners, their tenants, and commoners. Essentially, good stewardship required maintaining the status quo of the traditional use and users of the forests. Charles I's attack on the status quo in the management of the royal forests was clearly bad stewardship. He neglected to use the forest courts to catch those who were damaging the woods, and he actively sold his woods to ironmasters to raise quick money, knowing that the loss of these resources undermined those villages relying on forest commons.

Similarly, extending forest boundaries over whole counties to include areas that were never part of a royal forest enabled Charles to use his highest forest court of *eyre* to collect fines for contravening forest laws. This was not only illegal but also immoral.

The value of wood resources in royal forests cannot be overemphasized, especially from the mid-seventeenth century onward. Wood was the heartbeat of the preindustrial economy and became vital to new shipbuilding projects from the 1660s. The traditional role of the royal forests was to provide the monarch with ready access to timber and wood for building and repairs to the Crown estate; forests also supplied fuel to heat royal manors and castles. As the largest landowner, the English monarchs granted timber resources to others for repairing villages, bridges, and churches within the royal forests, in addition to customary rights to wood for fuel and fencing. Increasingly throughout late medieval England and during the early modern period, the forests became more settled with farms, villages, and emerging industries. Trees and wood resources were essential to the early modern economy as well as to maintaining the Crown estate. Fuel was urgently needed to heat homes and support early industries such as charcoal iron making, soap boiling, brewing, and dyeing. The farming economy within royal forests relied on raw materials for building houses, furniture, carts, and wagons; fencing young woods and animal enclosures; and for tools and farm implements. The traditional demands on the forests, from forest inhabitants and their animals, were joined by newly developing industries and other interests that competed with the Crown for resource use within these forests.

A significant new interest was the English navy, which by the mid-seventeenth century placed greater demands on royal forests. The navy needed secure supplies of homegrown timber. Timber resources for shipbuilding became a primary concern for managing woods within the English royal forests well into the eighteenth century. Drawn into a trade war with the Dutch beginning in the 1650s, the Crown looked to its own resources within the royal forests for timber to supply the navy. Although these were small in total, royal woods offered assured supplies of mature standing timber belonging to the Crown that lay within England.[26] Any reliance on a Baltic timber supply during the Anglo-Dutch wars, which lasted into the 1670s, was subject to uncertainty because Dutch pirates preyed on English timber ships. The demand for forest timber in the 1660s coincided with the publication of John Evelyn's *Sylva* (1664), a famous treatise on woods and forests, which became one of the most influential manuals on forests and woodland management in England. Evelyn challenged English gentlemen and private land owners to plant their estates with trees for supplying future years of naval demand, and thereby protecting England with "wooden walls."[27] Timber

and wood at this time not only became important for defending the realm with a strong navy, but it was also essential for the function and development of the early modern economy.

Woodland Management: Old and New

From the later seventeenth century, the management practice employed within the royal forests was a mix of old and new. Traditionally, woods were managed by natural regeneration, but after 1660 the Crown experimented with timber plantations established within two royal forests. Natural regeneration was the tried and tested woodland practice that had made possible the survival of all woods and forests for centuries. After felling, trees were rejuvenated when young shoots sprouted from the felled tree stumps. Woods naturally recovered in this way unless there was a conscious effort to kill the tree by removing the stump and digging up the roots. During the medieval and early modern periods, the traditional practice of natural regeneration occurred in all English woods and forests, not just the royal forests.[28] In the second half of the seventeenth century, early experimental forestry or *silviculture* began to influence the craft of woodland management. Experimental foresters employed within two royal forests established new plantations for the navy from the late seventeenth century.[29] The majority of timber and wood for the navy before the late eighteenth century came from traditional management practices rather than from the new plantations introduced into the Forest of Dean and the New Forest. It took eighty to one hundred years to grow mature oaks for naval use, and advances in management techniques were not effective until the late eighteenth century.

The traditional management of woods by natural regeneration was practiced from time immemorial. Forest laws regulated cutting of all woods, including privately owned woods within royal forests. In the Crown forests, private owners had to petition the forest attachment court for a license, allowing them to fell their woods. Forest verderers then viewed the woods and decided on the suitability of making an enclosure around the wood and felling. They ensured that the enclosure, which excluded the deer and other animals, was not harmful to the survival of royal deer herds. The court then issued a license giving the owner permission to enclose the wood before felling and the license was entered in the attachment court books. Numerous petitions, verderers' reports, and licenses to enclose and fell woods in Sherwood Forest have survived in the early eighteenth-century attachment court records.[30]

There were several important statutes in the early modern period to promote good stewardship and management practices in all English woodlands, not just

royal woods. These statutes regulated the enclosure period for coppiced woods when they were felled. The most famous royal order for woodland management was the sixteenth-century statute of "coppice with standards" made in 1543 by Henry VIII (1509–1547). All coppiced woods remained enclosed for seven years after felling; woods were divided into equal sections with the owner felling a portion for each year the coppice was enclosed. For every acre felled, the owner had to leave at least twelve standing trees, sometimes called "standards," "staddles," or "storers," which then grew to maturity. The standards were not felled until they became timber trees, ensuring that all woods across England, including the royal forests, maintained a minimum number of mature trees suitable for the navy at any time. In 1570, Elizabeth I (1558–1603) reaffirmed this important statute and extended the enclosure period from seven to nine years for better protection of her woods. She added restrictions to discourage farmers from enclosing their larger woods for arable or pasture, allowing only woods less than two acres for conversion to other uses.[31]

The enclosure of coppice woods before felling prevented deer and other animals from nibbling on fresh shoots at the time they were most susceptible to damage. Thomas Tusser, one popular agricultural writer and farmer in the sixteenth century, published his tips for good stewardship of woods in his *Five Hundred Points of Good Husbandry* (1573). He advised farmers to keep oxen out of wooded enclosures after felling and to guard against rabbits eating the new growth, or "spring" wood that sprouted from old stumps. Tusser told farmers to follow the statute, keeping the required number of staddles or standards growing after felling the coppice.[32] Another sixteenth-century observer offered similar advice. William Harrison, author of *The Description of England*, recited the 1543 statute, telling his readers to keep at least twelve "storers" (or stored timber) for future use, especially in any woods that were felled at twenty four years growth or less.[33]

Thomas Tusser also offered advice to his readers on the correct season for felling and taking bark. In preparation for felling, his almanac for April suggested that farmers sell all the tree bark to tanners for use in the leather industry the winter before felling the trees. It was easier to strip the bark from standing trees, rather than when they were on the ground.[34] As timber trees became more valuable to the navy in the later seventeenth century, Robert Plot (another writer) experimented with the best time to strip the bark from trees not only to improve the seasoning of the timber but also to get the best price for bark. Stripping the bark from standing trees and leaving them to weather through the hot summer and another winter for spring felling was called *pilling*. The results of Plot's experiments on the methods and best season for taking bark were published in

a 1687 pamphlet, which he sent to Samuel Pepys and the Navy Board. Pilling allowed timber oaks to dry out through the summer before felling the following spring. Leaving trees to stand for a year before felling produced sound timber that was less likely to rot.[35]

The majority of the trees, woods, and bushes in the English royal forests were not enclosed. By definition, royal forests were territories of open ground for the deer and other animals to graze in wood-pastures. Royal woods were exempt from the statutes regulating coppiced woods after felling where the Crown had an obligation to keep wood-pasture areas open. The survival rate for any new shoots or *spring* wood growing by natural regeneration was greatly diminished in unfenced woods. This was the challenge facing foresters who were managing Crown woods within the royal forests.

Thomas Corbin, one royal surveyor working in Sherwood Forest during the 1660s, gave suggestions for protecting new growth if the navy felled in royal woods. In 1662, he had viewed 2,000 acres of royal woods called Birkland and Bilhagh, which he estimated had 42,000 giant oaks for winter felling. Corbin provided a rare account of traditional woods management by natural regeneration. The roots of the trees were very strong and promised to "put forth very strong shoots, if preserved from sheep and cattle."[36] Without temporary enclosure any regrowth was eaten by forest animals, thus leaving stumps. In 1664, Corbin found old trees to be suitable for navy use. A wood of old oaks without young trees or mixed ages indicated an old growth forest that had not been previously coppiced. However, Corbin needed to enclose them if they were to survive and regenerate from their sound roots. He recommended an immediate order for fencing to exclude sheep, cattle, and especially pigs that feasted seasonally on the acorns.[37] While the woods were important for naval use, they were essential to the early modern economy as part of the open forest, accessible to nearby villages with rights to grazing as well as to collecting firewood and fence wood. Later woods surveys indicate that Corbin's request was not granted. These surveys record old oaks without young trees, meaning the woods were never enclosed and felled in 1664. Oaks in Birkland and Bilhagh were old in the 1660s, even older in a naval survey of 1686 and older still in 1793.[38] It may appear that these woods were neglected by being left standing for years past their prime and eventually becoming of little use for navy timber. However, in terms of stewardship of the forest, by leaving these ancient woods as open-wood pasture, it allowed for their traditional usage for the forest economy as shelter and browse for royal deer as well as for providing commons rights for surrounding villages to graze their cattle and access *pannage* (eating acorns) for their pigs.

During the seventeenth century, another new interest emerged apart from the navy. The charcoal iron industry found in several forests relied on regular supplies of fuel for making charcoal. The common belief was that iron works undermined the survival of timber trees. This assumed that the iron masters were in competition with the navy for the best mature timber trees. Charcoal iron makers needed a constant supply of young woods from coppices that produced mostly small, thin trees with a few trees left to become mature timber. The ancient system of coppice with standards promoted the survival of large trees for the navy and encouraged growth of coppices for periods of between eighteen and twenty-three years that were subsequently used in the charcoal iron industry. In 1677, Andrew Yarranton, an agricultural writer and Worcestershire iron master, argued that iron works promoted the health of English woods rather than destroying them. By regularly cutting coppices and managing them according to the statute, which left standard trees, the charcoal iron industry benefitted the navy in areas that otherwise might have gone unmanaged. Yarranton argued that coppices encouraged careful management of timber trees, whereas enclosure for pasture and arable land removed them. He even suggested introducing the iron industry into the New Forest to absorb the large quantity of small wood in that forest and to provide a system for regulating the woodlands.[39] Yarranton believed in the compatibility of iron works with naval interests in the management of woodlands within royal forests because they used different types and ages of trees. However, the prevailing view remained that charcoal iron works within royal forests threatened the survival of timber.

By 1660, scientific ideas of timber management were emerging alongside traditional practices of natural regeneration and coppicing. New methods of woodland management were discussed and circulated in academic circles by John Evelyn and other members of the Royal Society. John Evelyn popularized the idea of planting trees in his address to the Royal Society in October 15, 1662, and his experimental work became more widely known among gentlemen readers of his treatise on forest trees. In 1664, he pleaded with his readers to plant and repair royal forests and other "magazines" of timber that promised to benefit the royal navy.[40] The Crown adopted the idea of permanent enclosures to grow trees for the navy in plantations. These new methods became enshrined in two royal enclosure acts for the Forest of Dean and the New Forest in the late seventeenth century. The Crown established royal plantations for naval use by Acts of Parliament in the Gloucestershire Forest of Dean in 1668 and in Hampshire's New Forest in 1698. The 1668 act for the Forest of Dean proposed fencing 11,000 acres of the total 18,000 acres in the forest and limiting the number of deer to 800. This

meant that almost two-thirds of the open forest was enclosed as plantations at any one time.[41] In 1698, the act for enclosing parts of the New Forest was not as sweeping as in Dean where the loss of vast swathes of open forest had provoked conflict. The 1698 statute proposed enclosing up to 6,000 acres of New Forest at any time, without limiting the deer population.[42]

Experimental methods used in plantations were still very rudimentary during the seventeenth and early eighteenth centuries. These planting techniques were not very successful initially, but by the late eighteenth century, methods were less haphazard and became easier to control in the forest environment of multiple stake holders. Employing plantations in the royal forests was complicated by the ancient mesh of rights and interests and the problem of containing animals, especially the deer that were allowed free passage by forest laws. The failure of the early plantations was due, in part, to local resistance toward enclosing open grounds for more than a temporary arrangement of a few years whenever ancient commons rights were interrupted. The organized plantation experiments in the Forest of Dean and New Forest were undermined by local farmers and those with commons rights during the early years. In the Forest of Dean, inhabitants sabotaged the young plantations, broke down fences, set fires, and allowed their animals into royal timber enclosures.[43] In both cases, the Crown's plantations for growing naval timber had extinguished traditional commons rights over parts of the forest, which, in turn, affected the local pastoral economy that relied on feeding cattle and pigs in the open woods of the royal forests.

In practice, the new methods were less successful on the ground than on paper in agricultural manuals and the printed enclosure acts. Planting oaks from acorns proved difficult during the 1660s. Daniel Furzer, a naval purveyor working in the Forest of Dean began collecting acorns strewn around the forest floor after a big storm in 1660. He used baskets to store the acorns, but quickly found they were hard to preserve for later planting. Furzer complained that the acorns were already sprouting before he had time to plant them.[44] Furzer was not alone in his frustration. John Evelyn's experiments with planting acorns directly in the ground initially proved to be disappointing. In 1664, Evelyn had found that mice ate the acorns; his recommendation was to establish nurseries "or seminaries" of oak saplings and to set traps.[45] These methods were better suited to gentlemen's private woods. Royal forests faced a unique problem, which impeded oaks growing from acorns or saplings. Many forest villages had customary grazing rights for pigs, or *pannage*, which allowed their animals to eat acorns in oak woods or mast from beech trees. Pigs were very successful at rooting out acorns along with grubs, worms, beetles, and other insects. For this reason, woods growing from acorns by natural means within royal forests were

most successful when surrounded by bushes, thus preventing access for pigs or deer. Holly bushes within the open woods of the New Forest protected the natural growth of oak woods for centuries.[46] The growth from acorns or mast in areas protected by bushes was another type of natural regeneration. It relied on falling acorns rather than any formal plantation schemes and worked best where bushes or shrubs excluded animal access without enclosing open woods. Before 1800, the practical management of woods largely depended on traditional methods rather than on experimental forestry. Tried and tested customary practices, which were rarely described in detail, have proven to be much less appealing to historians than neatly printed Parliamentary acts for enclosure. The planting and timber enclosure acts for the Forest of Dean and the New Forest in the later seventeenth century have grabbed the historian's attention. A closer look showed that early plantations were not well tended and were often invaded by villagers who were angry at the loss of commons rights. Even with optimal management, royal timber plantations contributed little until the end of the eighteenth century. It took nearly a century after initial planting in 1668 or 1698 for these woods to produce mature timber fit for naval use in 1768 and 1798 respectively. Before 1800, there was a mismatch among the everyday practice of foresters working on the ground, the experimental theories of planting, manuals for potential foresters, and the royal enclosure schemes. Pre-1800 traditional woodland management methods were used more often than experimental forestry, and it was only in the nineteenth century that royal timber plantations reached their zenith.[47]

Assessing Stewardship with Multiple Stakeholders

The early timber plantations within the royal forests in the later seventeenth century had experienced difficulties from the outset. Resource management was complicated due to multiple demands and interests by different stakeholders. These original interests were the Crown, villages with commons rights for their animals, and the royal deer; by 1660 the navy and iron masters added even more demands on the royal forests. However, new interests were not always to blame for incompatible management of resources. There were inherent problems associated with the management and protection of both deer and trees concurrently. Protecting the deer and their free movement in the forest damaged woods. Constant browsing of lower branches, twigs, and vegetation left browse lines showing the upper extent the deer reached for food. They rubbed their antlers up and down branches and tree trunks to remove irritating felt. Within unenclosed royal woods deer moved freely, and inside newly felled areas they feasted on juicy shoots and inhibited natural regeneration of young trees. The overzealous

guardianship of timber woods in royal forests was also potentially detrimental to deer survival if animals were excluded from shelter or food for long periods. The role of verderers was to ensure that deer were not adversely impacted by temporary enclosures for coppices or cultivation. By the late seventeenth century forest officers juggled the safety of royal deer together with stewardship of timber and wood for Crown buildings, for repairing royal estates, for navy use, as well as for providing fuel to heat homes and forest industries. Sometimes protecting the royal deer proved to be detrimental to the woods, and at others, protecting trees negatively impacted the deer. Even well-intentioned management practices designed to protect the trees or deer were not always successful, or had unintended outcomes.

The unique system of forest law, specialized forest courts, and statutes covering the royal forests provided ample evidence of efforts to deter bad stewardship from the management of trees and deer. It was hard to eliminate all theft of trees or deer, but court records for the early modern period indicated charges, prosecutions, and fines against routine infringements in the attachment courts for Sherwood Forest.[48] There were also more daring examples of malpractice and blatant abuse. For example, Mr. Clarke had purchased extensive woods from the State in Sherwood Forest by 1655; he began clear-cutting, "leaving no standards," which was a direct contravention of all the statutes regulating the management and survival of woods from Henry VIII's reign. Clarke wanted a quick profit and ignored all sense of stewardship over his woods, believing the State had no recourse because Parliament had just confiscated the woods from a leading royalist family. The full force of forest law came down on Clarke in April 1655 for his damage against the *vert*, even though he owned the woods.[49]

Another flagrant case of abuse in royal woods was the ingrained malpractice of colliers in the Forest of Dean. Coal mines had existed in Dean since medieval times and free miners had rights to wind fallen wood there for pit props, for shafts, and for making repairs. By the early eighteenth century, the miners were also helping the trees to fall by boring holes into the trunks. Puncturing the bark and drilling into the heart of trees made them more susceptible to decay and instability in strong storms. In 1735, miners claimed the windfalls; any damaged trees were felled, cut up, and sold to iron masters who enjoyed regular supplies of small wood for charcoal.[50] Another established practice in the eighteenth century damaged trees fit for naval use in Sherwood Forest's royal woods. The verderers were entitled to fell customary fee trees, but they bored into the largest and most valuable timber oaks to pick the very best trees and discarded any with signs of imperfection. From the late seventeenth century and repeatedly in the early eighteenth century, Sherwood's verderers continued to bore trees, despite

prohibition against the practice and attempts to substitute money payments. The verderers even disobeyed the Surveyor General of Woods appointed by the Crown to protect all royal woods; when the Surveyor visited Sherwood he was powerless to stop the local authority of the verderers who issued their own warrants to collect fee trees. Sherwood Forest's verderers had gone rogue and continued to exercise their traditional customary right of fee trees, even though George I (1660–1727) had offered money payments to stop them from felling according to their own rules.[51] In terms of intent, the verderers were greedy and wanted to find the most valuable trees in the royal woods rather than directly sabotaging and damaging the trees, which miners of the Forest of Dean had encouraged to produce more windfalls.[52]

Blatant examples of bad stewardship were easy to identify, such as Charles I's personal rule of the 1630s and his abuse of forest institutions for easy profit, John Wintour's wholesale felling in the Forest of Dean, and Mr. Clarke's clear cutting in Sherwood Forest in the 1650s. These were easier to comprehend than good practices gone badly or some forestry methods that intended good stewardship but failed or went awry. New experiments in woodland management showed that sowing acorns in plantations was wasteful if eaten by mice or other animals. The early plantations that grew timber for the navy were not very successful until the end of the eighteenth century when there was more precedent for segregating the use of land and extinguishing commons rights. The flurry of parliamentary enclosures in counties all across England from the late eighteenth century meant that the loss of commons rights became more widespread in enclosure agreements. This new precedent for abolishing old commons rights from the later eighteenth century made it easier for woodwards to enforce enclosures within the Forest of Dean and New Forest. Until this point, plantations in these royal forests were sabotaged by local interests: commoners, villagers, iron masters, or miners, all of whom resented infringements to their traditional rights on open commons.[53]

While some early measures had failed, there were other forms of forest management that proved to be positively harmful. For example, the well-intentioned practice of marking trees, especially in the eighteenth century to prevent theft, was later found to damage the trees and encourage decay. Unintentional damage resulted from forest officers' marking out the King's oaks with the "broad arrow." Land Revenue Commissioners visiting Sherwood in 1793 reported that the "mode of marking," once practiced to preserve oaks, had damaged the trees and caused decay. The outcome was similar in the Forest of Dean because forest officers marked royal trees with the Crown's mark to prohibit miners from taking away fallen trees.[54] By the late eighteenth century, Commissioners across all the royal forests advised woodwards against excessive marking of trees, which

involved puncturing the bark, because it allowed moisture and insects to enter the tree and led to decay from the inside.

Another established practice mistakenly regarded as good stewardship by contemporaries was the preservation of ancient trees for naval use. Well-intentioned protection easily became one of neglect when very old trees were kept beyond their prime, as in late eighteenth century Sherwood. Guided by statutes preserving mature trees for naval use, old standing trees were future resources to ensure the safety of the realm by wooden walls. Yet if they were left too long, they were only fit for firewood. In 1598, the trees in the royal woods of Birkland and Bilhagh were at least 200 or 300 years old. In 1608 and in 1686, the woods were very old trees, which were decaying and needed felling. By 1793, many of the same trees were still standing but their aged condition made them worthless for the navy.[55] The squandering of wood resources for the navy in this way was not the intention of royal surveyors and woodwards. However, it highlighted their need to understand that without constant vigilance good stewardship easily became neglect.

Conclusion

The English royal forests contained multiple stakeholders, and their survival depended on the Crown's stewardship. Besides the lands owned by the Crown estate, with its tenants, there were increasingly more owners who held lands within the royal forests. Efforts of the early Stuart kings to survive financially led to their *bona fide* sale of manors, parks, and lands, not only within royal forests but all across the country. In Sherwood Forest, a snapshot of these sales appears in the survey of the forest in 1609; the Crown did not own the vast majority of the forest and over the seventeenth century the Stuarts continued to sell manors, parks, and woods. The Parliamentary surveys of the 1650s show under 10,000 acres belonging to the Crown out of almost 100,000 acres: four woods, one large park, some coal mines, and forest wastes.[56] The Crown and other landowners had obligations to their tenants and forest commoners to maintain the forest. Forest villages relied heavily on access to ample commons within open wastes and woods of the forest for grazing and wood rights, many of which had existed for hundreds of years. The challenge was always to balance the demands of the Crown (which had wavered during the Stuart age between protecting deer and trees to liquidating land and woods for cash) with those of the forest inhabitants, both human and animal: commoners and their beasts, other owners, tenants, ironmasters, forest officers, navy purveyors, and at times with disruptive influences, such as Parliamentary soldiers.

One of the primary aims of good stewardship within the royal forests was the almost impossible task of protecting deer and trees simultaneously. Good management practice or good stewardship of the forests was a complex and almost impossible task of balancing the various demands and contradictory interests of multiple users in the English royal forests. However, it is clear that for most of the Stuart period during the seventeenth and early eighteenth centuries, except for the exploits of Charles I and the difficulties of sustaining order during the civil wars, English monarchs tried to manage the royal forests for survival instead of sabotaging their future.

Notes

1. J. C. Cox, *The Royal Forests of England* (London: Methuen, 1903), 1–9. I am grateful to Dylan Pahman who encouraged me to write this article based on an earlier presentation at the Sixteenth Century Society and Conference.

2. Cox, *The Royal Forests of England*, 10–75.

3. John Manwood, *Treatise of the Forest Laws*, 4th ed. (London: E. Nutt, 1717), 143, 147. The continued importance of forest law from 1598 through the seventeenth century and into the eighteenth century was clear from Manwood's various editions: 1st edition 1598, 2nd 1615, 3rd 1669, and 4th 1717.

4. Manwood, *Treatise of Forest Laws* (1717), 144.

5. The National Archives, Kew (TNA), LR 2/201, LR 2/202.

6. R. B. Manning, *Hunters and Poachers: A Social and Cultural History of Unlawful Hunting in England, 1485–1640* (Oxford: Clarendon, 1993); D. Beaver, "The Great Deer Massacre: Animals, Honor, and Communication in Early Modern England," *Journal of British Studies* 38 (1999): 187–216.

7. B. Sharpe, *In Contempt of All Authority: Rural Artisans and Riot in the West of England, 1586–1660* (Berkeley: University of California Press, 1980). See also various essays in R. W. Hoyle, ed., *The Estates of the English Crown 1558–1640* (Cambridge: Cambridge University Press, 1992): Joan Thirsk, "The Crown as Projector on Its Own Estates, from Elizabeth I to Charles I," 297–352; Richard Hoyle, "Disafforestation or Drainage: The Crown as Entrepreneur?" 353–88; and Peter Large, "From Swainmote to Disafforestation: Feckenham Forest in the Early Seventeenth Century," 389–417.

8. See *Calendar of State Papers, Domestic Series, 1660-1685 of the Reign of Charles II with Agenda 1660-1685*, 28 vols. (London: Longman, 1860-1947). Hereafter *Calendar of State Papers Domestic Charles II*, followed by volume year and page numbers. The citation here comes from vol. 2: 1661–1662, 145, 158, 423; P. B. Munsche,

Gentlemen and Poachers: The English Game Laws, 1671–1831 (Cambridge: Cambridge University Press, 1981).

9. S. R. Gardiner, ed., *The Constitutional Documents of the Puritan Revolution, 1625–1660* (1889; repr., Oxford: Clarendon Press, 1962), 202–32.

10. C. E. Hart, *Royal Forest: A History of Dean's Woods as Producers of Timber* (Oxford: Clarendon, 1966), chaps. 5 and 6, 86–135.

11. Gardiner, *The Constitutional Documents of the Puritan Revolution, 1625–1660*, 211.

12. Isaac Bromwich, *The spoiles of the forest of Deane asserted in answer to a scurrilous libell lately set forth to blast the justice and proceedings of some commissioners of Parliament in that behalfe by Isaac Bromwich, Esq a well wisher to the preservation of that forest, and a joynt commissioner* (London, 1650).

13. Hart, *Royal Forest*, 124–25. The royal grant of March 21, 1640, allowed Wintour to enjoy 17,000–18,000 acres of the royal Forest of Dean. See 1662 survey in Hart, *Royal Forest*, App. XI, 286.

14. Gardiner, *The Constitutional Documents of the Puritan Revolution, 1625–1660*, 211.

15. G. Hammersley, "The Revival of the Forest Laws under Charles I," *History* 45 (1960): 85–102.

16. Gardiner, *The Constitutional Documents of the Puritan Revolution, 1625–1660,* 192–95.

17. On November 21, 1683, Charles II granted Needwood Forest to Vernon for the sum of £7,000. See *Calendar of State Papers Domestic Charles II*, 1683, 433; *Calendar of State Papers Domestic Charles II*, 1683–1684, 336, 373–74; *Calendar of State Papers Domestic Charles II*, 1684–1685, 78; Victoria County History, *Staffordshire*, 2, 353; *Commons Journal*, 26, 540, 573–75; *Commons Journal* 11, 477.

18. TNA, DL 39/10; *Calendar of Treasury Papers, 1556/1557–1696*, 151, 170.

19. TNA, DL 39/10. For the Needwood Reafforestation Act, 1695–96, 7 & 8 William III, c. 40. For "An Act for revesting in his Majesty the Honor of Tutbury, Forest of Needwood, several Manors, Parkes, Lands and Offices," see *Statutes of the Realm,* 7, 157–58.

20. Nottingham University Manuscripts and Special Collections (NUMASC), Pw V 5, ff. 340, 344. Only 258 deer remained in 1648 from herds of 1,200–1,300 deer in 1616 and 1635, see Pw V 5, ff. 336–37; Nottinghamshire Archives (NA), DD 382/3, f. 143.

21. Arthur MacGregor, "Deer on the Move: Relocation of Stock Between Game Parks in the Sixteenth and Seventeenth Centuries," *Anthropozoologica* 16 (1992): 178.

22. Silvanus Taylor, *Common-Good* (London: Tyton, 1652), 42, 48–49.

23. Taylor, *Common-Good*, 29.

24. Anon., "Waste Land's Improvement," in *Seventeenth-Century Economic Documents*, ed. J. Thirsk and J. P. Cooper (Oxford: Clarendon, 1972), 138–39; Taylor, *Common-Good*, 33.

25. R. G. Albion, *Forests and Sea Power: The Timber Problem of the Royal Navy 1652–1862*, Harvard Economic Series, vol. 26 (Cambridge: Harvard University Press, 1926; repr. by Hamden, CT: Archon, 1965), 106. Albion argues that the royal forests were a wasted opportunity for the navy because they rarely supplied more than a tenth of the navy's supply, whereas there were several plans to plant the royal forests of Dean in 1668 and the New Forest in 1698. These schemes were never very successful and were often sabotaged by local forest inhabitants.

26. On the importance of timber for navy building, see R. G. Albion, *Forests and Sea Power*, 95–135.

27. John Evelyn, *Sylva, or A Discourse of Forest-Trees, and the Propagation of Timber in his Majesty's Dominions* (London, 1664), 1. Editions of Evelyn were reprinted and revised into the early nineteenth century, including a very popular 5th edition annotated by Alexander Hunter in 1825.

28. O. Rackham, *Trees and Woodland in the British Landscape* (London: J. M. Dent & Sons, 1976), 20–22, 34–36.

29. Albion, *Forests and Sea Power*, 132–33; N. D. G. James, *A History of English Forestry* (Oxford: Basil Blackwell, 1981), 139–60.

30. Petitions for permission to enclose woods for coppices appear in Sherwood Forest's attachment court in the early eighteenth century. See Nottinghamshire Archives, DDP 27/3; SO.FR 6.

31. Acts of the Parliament of England, *Statutes of the Realm*, vol. 2, 977–80:35 Henry VIII c. 17, 1543–44. Elizabeth's 1570 "An Act for reviving and continuance of certain statutes," sections 18–19 refer to reviving Henry VIII's original statute for coppice with standards; see James, *A History of Forestry,* 125, 306–7.

32. Thomas Tusser, *Five Hundred Points of Good Husbandry* (London, 1573). See the modern version edited by Geoffrey Grigson (Oxford: Oxford University Press, 1984), 45, 98.

33. William Harrison, *The Description of England* (1577), with a modern version edited by George Edelen (New York: Dover Publications, 1994), 281, 283.

34. Tusser, *Five Hundred Points of Good Husbandry*, 98.

35. *Eleventh Report of the Commissioners Appointed to Enquire into the Woods, Forests, and Land Revenues of the Crown* (London, 1792), 167–71: Robert Plot, "Discourse of the most seasonable Time of felling Timber, written for the Use of His Majesty" (1687); Plot's treatise was enclosed in a letter from Secretary Samuel Pepys to the Navy Board in 1687–1688.

36. *Calendar of State Papers Domestic Charles II, Addenda 1660–1685*, 118.

37. TNA, SP 46/136/236.

38. *Fourteenth Report of the Commissioners Appointed to Enquire into the Woods, Forests, and Land Revenues of the Crown* (London, 1793), 15.

39. Andrew Yarranton, *England's Improvement by Land and Sea* (London, 1677), 60, 45; G. Hammersley, "The Charcoal Iron Industry and Its Fuel 1540–1750," *Economic History Review*, 2nd Series, 26 (1973): 593–613.

40. "To the Reader," October 15, 1662 address to the Royal Society in Evelyn, *Sylva* (1664).

41. *Third Report of the Commissioners Appointed to Enquire into the Woods, Forests, and Land Revenues of the Crown* (London, 1788), 10, 15; Statute 19 a 20 Charles II, c. 8 in *Statutes of the Realm*, vol. 5, 636–39.

42. *Fifth Report of the Commissioners Appointed to Enquire into the Woods, Forests, and Land Revenues of the Crown* (London, 1789), 6, 24; Statute 9 & 10 William III, c. 33 in *Statutes of the Realm*, vol. 7, 405–8.

43. *Seventeen Reports of the Commissioners Appointed to Enquire into the Woods, Forests, and Land Revenues of the Crown* (London 1787–1793) showed common problems in all royal forests over woods management with so many stakeholders and ancient forest rights. Even organized plantation experiments in the Forest of Dean and New Forest were undermined by inhabitants in the early years.

44. *Calendar of State Papers Domestic Charles II 1661–1662*, 522.

45. Evelyn, *Sylva* (1664), chap. 2, on oak seminaries. Alexander Hunter provides excellent notes on mouse traps in his 5th edition of *Sylva*, vol. 1 (London: Henry Colburn, 1825), 41.

46. *Fifth Report* (1789), 20. The holly and thorn bushes were wasted by 1789.

47. James, *A History of English Forestry*, 161–88; Albion, *Forests and Sea Power,* 133–38.

48. Attachment court records for 1647–1653 and 1703–1727, University of Nottingham Archives and Special Collections, Pw V 5; Nottinghamshire Archives, DDP 27/3, SO.FR6.

49. *Calendar of State Papers, Domestic Series, 1649–1660 of the Commonwealth*, 13 vols. (London: HMSO, 1875-1893), vol. 8: 1655, 137; TNA SP 18/96/52.

50. *Third Report* (1788), 22; Hart, *Royal Forest*, 195.

51. Sara Morrison, "Fee Trees and Rogue Verderers in Early Eighteenth Century Sherwood Forest," *Transactions of the Thoroton Society* 117 (2013): 97–107.

52. *Fourteenth Report* (1793), 15.

53. *Third Report*, 19–20, 34, 45; Hart, *Royal Forest*, 186, 192; C. R. Tubbs, *New Forest: An Ecological History* (Newton Abbot: David & Charles, 1968), 105.

54. *Fourteenth Report* (1793), 15. On puncturing bark, see App. 6, 29; *Third Report*, 20, 34.

55. *Fourteenth Report*, 14–15.

56. TNA, LR 2/201; E 317 Nottinghamshire 1, 10, 14, 11, 15, 16, 22, 23; *Fourteenth Report*, Appendix 10, 31–32.