14 000 years of trees: How have British woodlands changed?

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0. Abstract:

14 000 years ago, the last Ice Age ended, and trees began to colonise the UK and form dense woodland. Since then, there has been a great amount of change in the composition, coverage, and overall health of our country's woodlands. This essay briefly describes the ways in which the woodlands themselves have changed and how people have interacted with the woodlands over the millennia, from Stone Age sustainability to Roman ownership, and Medieval stability to Modern destruction.

1. Introduction:

It is hard to imagine a world without trees. From providing the fuel and timber needed to create the civilisation we are now familiar with, to trapping carbon and increasing health and well-being, trees play vital roles in everyday human life and have done for millennia. Trees, or more specifically woodlands, are not static, however. They are everchanging, especially due to the intervention of humans. Indeed, there was a time when trees did not fill the countryside as they do today. The last ice age lasted for approximately 100 000 years and finally ended about 12 000 years before common era (BCE). During this time, the UK was likely covered in a sheet of ice which prevented the growth of many plants, including trees[1]. As the climate began to warm and the end of the ice age approached, the lower edge of the ice began to move northwards, revealing a tundra-like grassland which began to be colonised by trees from the south[2]. This colonisation marked the start of a 14 000-year-long history of trees, woodlands, and humans' relationship to them; a relationship which has mostly been harmonious and mutualistic, but which has become more antagonistic in recent centuries. Scientists have used many methods to elucidate the history of trees including inferring woodland composition through pollen analysis and existing plants, estimating woodland distribution through written records, and deducing the relationship between humans and trees through testimony and landscape archaeology[3]. This essay will provide a timeline of British woodlands from 12 000 BCE to today and will hopefully provide the reader with a new appreciation for some of the most impressive and oldest aspects of nature: trees. There is some debate among historians as to the precise start and end dates of certain 'ages' within our current post-glacial era. I will therefore be generally using the dates mentioned in Rackham (2020)[3] as a guide to divide up this essay, with some deviations where I feel appropriate. Furthermore, this essay concerns itself solely with trees in woodlands, defined as at least 2 hectares of at least 20% tree crown cover[4]. The history of trees outside woodlands, including in parks and cities, as well as other countryside features such as hedges, is fascinating but beyond the scope of this essay: see Rackham (2020)[3] and others for more information regarding this. Finally, although this essay may use the term 'UK' and 'British', the woodlands of Northern Ireland are not typically considered in my discussion.

2. Palaeolithic (12 000 – 10 000 BCE):

The post-glacial Palaeolithic era occurred between 12 000 and 10 000 BCE and was characterised by warming temperatures, melting ice, and the spread of grassland throughout the UK. It is thought that, throughout the glacial period, hardy trees such as birch, willow, and aspen were able to survive at the southernmost edges of the ice sheet[1] and, as the climate continued to warm throughout the palaeolithic, these species began to colonise more northerly portions of the country until, by the end

of the era, they had formed dense woodlands throughout the country[2]. Some animal species from the glacial period such as deer continued to thrive in this warmer, woodland environment, although the reindeer became locally extinct within the UK soon after the last ice age[3]. The environmental changes of the palaeolithic were gradual but nevertheless important for the more extreme changes yet to come.

3. Mesolithic (10 000 – 4 500 BCE):

The Mesolithic era occurred between 10 000 and 4 500 BCE and can be split into two sub-eras, Early Mesolithic characterised by continued environmental change and tree colonisation, and Late Mesolithic, a time of environmental stability.

3.1. Early Mesolithic (10 000 – 7 300 BCE):

The climate continued to warm throughout the Early Mesolithic which, combined with the soil stabilising properties of the initial pioneer trees[2], allowed for the introduction of more temperate tree species that were not present in the UK during the glacial period. Pine and hazel began to replace the previously dominating birch trees[1] and their spread north was imitated by oak, elm, and alder[5]. Finally, towards the end of the Early Mesolithic, trees requiring warmer conditions such as holly, lime, beech, hornbeam, and maple began to colonise southern Britain, but were generally unable to progress further north due to the climate and lack of available space.

3.2. Late Mesolithic (7 300 – 4 500 BCE):

Following the great environmental changes of the Early Mesolithic, the Late Mesolithic was a time of stability. By this time, stable wildwood had emerged as the dominating habitat with small amounts of natural grassland at high altitudes[1] and clearings in the woodland made by native herbivores and Mesolithic man[6]. The precise composition of the wildwood differed throughout the country with Highland and upland Scotland being predominated with Pine and Birch woods, Highland England covered with Oak and Hazel woods, and lowland England characterised by Lime woods. This resembles the order of tree colonisation, with the first trees to colonise spreading further north than those that came to UK later, and this pattern can be generally seen in ancient woodlands today[3].

Mesolithic humans were starting to interact with and shape their environment as there is evidence of fire being used to burn parts of the woodland to create clearings[6]. However, as pine is the only native tree that can be burnt within a woodland stand[7], it is unlikely that this had much effect on the

general composition or distribution of the wildwood. Mesolithic hunters may have influenced woodland composition more indirectly through the hunting of mammals such as deer, elk, wild boar, beaver, and aurochs as these species were important in the creation and maintenance of the woodland-grassland mosaic that is likely to have dominated the landscape[6]. Although it is believed that elk became extinct soon after the Mesolithic period, primarily due to hunting pressures[3], all of the other species remained abundant for several millennia with red and roe deer remaining so today, suggesting that this hunting was not aggressive enough to completely remove the large herbivores from the British landscape. Ultimately, it appears that any interaction Mesolithic man had with their environment was sustainable and did not greatly alter the wildwood.

4. Neolithic (4 500 – 2 500 BCE):

The Neolithic era occurred between 4 500 and 2 500 BCE and can be separated into Early and Late Neolithic with the Early period consisting of deforestation followed by re-afforestation, and the Late period characterised by little human woodland destruction[6].

4.1. Early Neolithic (4 500 – 3 500 BCE):

While Mesolithic humans are considered nomadic hunter-gathers, Neolithic people are generally seen as farmers with more permanent settlements. This means that larger openings in the wildwood were required to support people, their livestock, and their crops so the Early Neolithic was dominated by the removal of in-the-way trees using newly developed stone axes[2]. The Early Neolithic was not only concerned with direct removal of native trees, however. During this period, agricultural weeds such as stinging nettles were reintroduced to the UK and, around 4 000 BCE, an elm disease was introduced which caused a great decline in the number of elm trees present[1]. After this, trees were re-planted in areas not required for human civilisation. The Early Neolithic, therefore, is a complicated story of initial destruction and introduction of non-native species combined with later re-afforestation, producing a landscape comprising mostly of primary and secondary woodland interspersed with clearings larger than in the Mesolithic but still relatively small compared to modern standards[6].

4.2. Late Neolithic (3 500 – 2 500 BCE):

After the environmental change of the Early Neolithic, the Late Neolithic was relatively stable, possibly due to the discovery of sustainable woodland management methods such as coppicing[1].

Coppicing is the technique of regularly felling trees and leaving the stumps to allow regrowth, hence producing a constant supply of underwood and timber and retaining the composition of the woodland. Furthermore, the introduction of cattle and sheep for agriculture, combined with the native large mammal species, maintained the clearings created in the Early Neolithic through grazing, meaning that human intervention was not necessary[2]. Monuments such as Stonehenge began to be built towards the end of the period[1] and although their building shows that parts of the landscape were large open clearings, there is evidence of woodland regeneration around the monuments[6], suggesting that the wildwood was healthy and able to reestablish itself in areas where it was previously removed.

Ultimately, the Neolithic period was a time of increased environmental change with the increasing human population requiring more land to establish their civilisations. Although initially destructive, it appears that Neolithic people learnt to live alongside the wildwood instead of taking it over entirely, and the evidence of both natural and human-mediated regeneration of the woodland suggests that they were appreciative of the importance of trees and their value not just to humans but many species.

5. Bronze Age (2 500 – 750 BCE):

To support the increasing population through the Bronze Age (2 500 – 750 BCE), woodland clearance increased once again[6], greatly aided by the development of bronze axes. Although coppicing was still important to produce timber for building and underwood for fuel[2], agricultural land was in greater demand, so largescale deforestation occurred, especially in previously untouched areas such as mountains. This destruction of wildwood led to the local extinction of the aurochs and contributed to the declines of many other native animal species[3]. By the end of the Bronze Age, the British landscape looked very different to the beginning of the period with an increase in heathland and reduction in woodland cover[7], and a change in the relationship between the woodland and humans, with woodlands now seen not as an essential habitat for many species but as a resource to be harvested[2]. The continued management of the remaining woodland through coppicing would have been advantageous for shade-intolerant ground flora species such as bluebells and primroses which would have greatly benefited from the open canopy produced by woodland management[8].

6. Iron Age (750 BCE – 40 CE):

Woodland clearance is thought to have peaked in the early Iron Age (750 BCE – 40 CE)[1] due to development of iron axes and saws. Interestingly, the development of iron agricultural tools

increased the efficiency of farming[2] likely lowering the amount of land required for the growing of crops. This would have reduced the need to destroy woodland and more emphasis could have been put on the importance of sustainable woodland management to support the growing population of approximately 1 million people[9]. Nevertheless, as we enter the common era, only half of England is estimated to have been wildwood[1] and this is only going to decrease in the following centuries.

7. Roman (40 – 410 CE):

The Roman invasion of England around 40 CE brought with it the introduction of the sweet chestnut tree and a new relationship to trees. Woodland became privately owned and named suggesting that trees were increasingly seen as assets to be exploited for economic gain rather than natural entities, and that the woodlands had become isolated to such an extent that differentiating between different woods and between woodland and non-woodland areas became appropriate[1]. By the fall of the Roman empire in England in 410 CE, the population had increased to approximately 5 million people[10] meaning that, throughout the period, the demand for fuel and timber would have been greater than previous periods and so coppicing and other woodland management methods became even more important and widely used[1]. Previous trends suggest that with an increasing population comes a need for more agricultural land and so woodland clearance also needs to increase. However, the agricultural land created by previous people, especially those of the Metal Ages, was extensive[7] and, combined with the more modern and efficient farming techniques introduced by the Roman invaders, may have been great enough to support the burgeoning population without the need for much further destruction. It is likely that some woodland was destroyed to make space for larger settlements[11], creating a landscape that, although still contained extensively managed woodland, also contained large amounts of non-wooded open spaces primarily used for settlements and agriculture[3].

8. Anglo-Saxon (410 – 1066 CE):

In the early Anglo-Saxon Period (410 – 710 CE), England was likely hit by a plague that decreased the approximately 5 million strong population to just 1.5 million[10]. This reduced demand for timber, fuel, and space meant that woodlands may have regenerated with records stating that about 25% of England was woodland by the end of these Dark Ages[11]. As the population started to increase through the late Anglo-Saxon period (710-1066 CE), woodland management in the form of coppicing continued, mostly for timber and domestic fuel instead of industry[10], but farming on mountain slopes fell out of favour with some areas seeing continued grazing by sheep and others seeing a

regeneration of beech woodland[12]. Ultimately, the Anglo-Saxon period was a time of relative stability in terms of woodland cover and composition as well as continued woodland management. By the time of the Norman invasion in 1066, people of the UK had a relatively sustainable if exploitative relationship with their woodlands which, although it had led to the local extinction of species including bears[3] and beavers[1], was beneficial for a range of woodland species.

9. Middle Ages (1066 – 1536 CE):

The Middle Ages or Medieval period (1066 – 1536 CE) can be separated into Early (1066 – 1349 CE) and Late (1349 – 1536 CE) periods with the Early period characterised by increased woodland clearance and the Late period being an era of relative stability after a population crash.

9.1. Early Middle Ages (1066 – 1349 CE):

The most comprehensive census of land use and ownership up until this point occurred 20 years after the Norman Invasion of Britain – the 1086 Doomsday Book. From this record it is known that, by the Early Middle Ages, most of the England (65%) was now used for agriculture or animal rearing with only 15% considered woodland or wood-pasture, with the latter usage likely being more common[1]. Throughout the period, the population doubled leading to an increased food demand, but coppiced woodland was still important for both domestic use and international trade[10]. By the end of the period, woodland cover was approximately 7-10%[3,11] so, although important for the economy and domestic life, the woodland continued to be cleared. Woodland cover reduction led to a decline in the abundance of several species that had been present in the UK since the early post-glacial period such as the red and roe deer. Wild swine and wolves also declined to extinction throughout the period due to a combination of hunting and woodland destruction. The Middle Ages were not simply marked by species reduction, however, as it is likely that the Normans did introduce fallow deer[3] and rabbits[1] into the country, species that continues to thrive today.

9.2. Late Middle Ages (1349 – 1536 CE):

The Late Middle Ages began with a dramatic crash in the population due to the 1349 Black Death[1]. As occurred after the 5th century plague-induced population decrease, this heralded in a time of reasonable stability as the population struggled to recover and began to value woodland over arable land[3]. The continued management for industry and trade and reduced clearance of the remaining woodland meant that these woods were likely to survive through the Medieval and Early Modern

periods until the 1800s, and the increase in abandoned agricultural land led to a rise in secondary woodland[1].

10. Early Modern (1536 – 1800 CE):

As suggested in the previous section, the Early Modern period (1536 – 1800 CE) was a time of general stability for woodlands with most of the woods named in Medieval records still present in the 18th century and even later. This was mostly due to the economic value of woodland which prioritised continued management of woodland, and therefore sustainable supply of wood and timber, over clearance for agricultural land[3]. That is not to say that all woodland was safe, however, as woodland neglect was not unusual when land fell into the ownership of the Crown after the dissolution of the monasteries at the beginning of the period, and woodland clearance to make space for agricultural land to support the recovering population was also seen[11]. In general, however, the requirement for woodland products such as underwood for powering factories[8], oak bark for leather tanning, and oak timber for trade and ship building[11] meant that woodlands, especially oak-dominated woodlands, became protected. This protection would not last, however.

11. Modern (1800 CE -):

The Modern era extends from the beginning of the 19th century to the present day and is characterised by increased woodland clearance, reduced woodland management, and a change in the relationship between the woodland and humanity.

11.1. 19th Century (1800 – 1899 CE):

The first half of the 19th century appeared to continue the work of the previous few centuries with the shipbuilding and leather-tanning industries continuing to flourish and therefore requiring a continuous supply of oak wood and bark, respectively. By the 1850s, however, both industries collapsed leading to a decline in the management of these oak-dominated woodlands. When large trees such as oaks are not felled on a regular basis, they continue to grow and cause increased canopy cover in the woodland. This reduces the survival of shade-intolerant ground flora and underwood which ultimately destabilises the woodland ecosystem[3]. Long-standing industries may have collapsed but the new coal industry required timber to construct mines. This led to felling of trees for timber but the devaluing of underwood as fuel due to the ability to transport coal via the railways[11]. Furthermore, with the woodlands losing their economic value, agriculture started to

become popular once again, leading to the clearance of large amounts of woodland[3]. This 'Agricultural Boom' was short lived, however, and plantations of non-native conifers began to be constructed[3]. This immense reduction in woodland cover and management led to the declination of several woodland species such as the roe and fallow deer, polecat, and marten. Additionally, increased air and rain pollution because of industry caused lichens and mosses that ordinarily colonised trees to decline, a trend that would continue throughout the next century. Several non-native species were introduced during this period including the grey squirrel, and rhododendron and willowherb plants[3]. By 1900, woodland cover was estimated at 6.1%[13], 5.3%[4], and 4.25%[14], in England, Scotland, and Wales respectively, with Great Britain estimated to be approximately 5% woodland[11].

11.2. 20th Century (1900 – 1999 CE):

The first half of the 20th century continued the reduction in woodland management such as coppicing and increased conifer plantation creation[10] to supply timber for the war effort[11]. Nevertheless, this was a short time of relative stability in a period of intense change with most of the ancient woodlands (woodlands dating back to at least 1600 in England and 1750 in Scotland) present in 1890 also recorded by the end of the Second World War in 1945. This stability would not last, however, as the 1950s heralded in an era of woodland destruction unseen in history[3]. Native broadleaf woodlands were cleared at unprecedented levels between 1950 and 1970 to make space for agricultural land and conifer plantations[3]. Interestingly, apart from a 'War dip' in the 1930s, woodland cover increased through the 20th century in all areas of Great Britain[4, 13, 14] indicating that most of the woodland that was destroyed was replaced, but as ancient woodlands were replaced with non-native conifer plantations, species diversity and richness as well as the general health of the woodland ecosystem likely decreased over this time. By the end of the century, the plantation forestry industry declined, agriculture increased in efficiency, and public interest in woodlands increased, all leading to a shift from destruction to a concerted attempt to repopulate the landscape with native broadleaf woodland and prevent further destruction[11]. Woodland cover now stood at approximately 12% for Great Britain[10] with increases in broadleaved woodland from 1990 to 1998, especially in lowland regions[15]. This increase in native woodland cover may explain the population recovery seen for the roe and fallow deer, polecat, and marten[3].

11.3. 21st century (2000 CE -):

Over the past 20 to 30 years a greater emphasis has been placed on protecting and preserving our woodland, especially our ancient woodland. By 2021, woodland cover had increased from 12% in 1998 to over 13% of the UK (10%, 18.8%, and 14.9% of England, Scotland, and Wales respectively) but only 2.5% of the UK is considered ancient woodland. Ancient woodlands are the most important types of woodland as they usually contain the most species rich and productive ecosystems which cannot be recreated in more recent woodlands, so great effort is being put into protecting these unique woodlands from further destruction and increasing their presence through the reestablishment of native broadleaf woodland on ancient sites[16]. At the beginning of the century, the proportion of woodlands that were actively managed through coppicing was below 1%[4, 13, 14], and lack of management continues to be the number one cause of poor woodland condition in England[16]. This lack of management combined with climate warming, nitrogen and sulphur deposition, herbivory, and tree disease has led to a large change in the frequency of woodland species. Shade intolerant species that are palatable to herbivores such as dog violet and sweet chestnut have decreased while those that more easily survive in the shade, warmer climates, and more fertile soil such as holly have increased. Ultimately, woodlands are currently dominated by large, older trees with few younger trees or shade-intolerant ground flora. This may change if the canopy gaps created by the death of ash trees by ash dieback continue to be managed through felling so that light can reach the woodland floor and if deer can be more effectively controlled to reduce the destruction of samplings[17]. Although the number of deer have increased substantially in recent times, the 0.36 million red deer and 0.5 million roe deer that are estimated to currently roam the UK is less than the 1.2 and 0.8 million estimated to have existed in the Mesolithic period. Indeed, the current total number of non-human mammals is thought to be just 53% of Mesolithic numbers[5]. Although woodland cover is increasing, it is clearly not having the desired effect of increasing woodland species such as birds, butterflies, and invertebrates[18], and the condition of the woodland may be too poor to be home to a diverse array of plant and animal species as it once was[17]. The UK has placed a goal of 17% woodland cover by 2050[18] however it is incredibly doubtful whether, at the current rate of reafforestation, this target will be reached and, even if it is, whether it will have the effect of increasing the biodiversity of our landscape[17].

12. Conclusion:

Since trees recolonised the UK after the last Ice Age 14 000 years ago, our woodlands have been under constant change and management. From Stone Age people living side-by-side with the plant and animal species housed within the woodlands to Metal Age people more greatly

managing and clearing the woodland for resources and agricultural land, from Roman and Norman settlers introducing non-native species to Modern-day people exploiting and neglecting the landscape, the story of British Woodlands is vast, varied, and informative. We can only learn from the mistakes of the past if we acknowledge them. The introduction of non-native species like the rhododendron or grey squirrel, the replacing of ancient broadleaf woodland with conifer plantations, and the recent neglect of the woodland are just some of the events that have led to less-extensive and less-healthy woodlands in the UK. We live in a time of extreme environmental crisis both in the UK and on a more global level, including diminishing biodiversity and increasing atmospheric carbon due to the use of fossil fuels. Trees, and especially woodlands, may be key to solving at least some of our environmental problems[19]. If there is a chance that we could live alongside nature, as our ancestors did, sustainably using the woodland for fuel and timber without destroying the irreplaceable habitat of countless organisms, shouldn't we at least try?

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