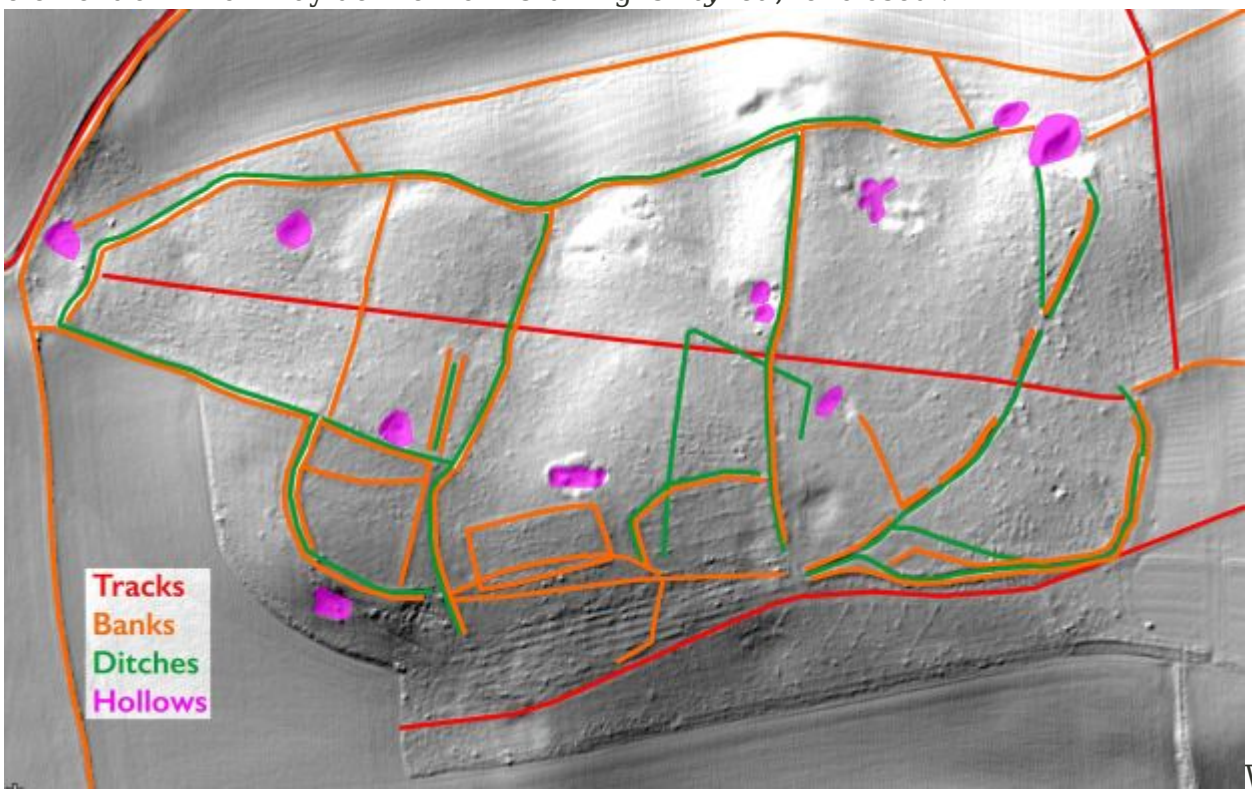
Sometimes, maps and placenames hint at past activities that are not immediately visible. Often the places are on private land but, as we've seen in previous Archaeology Tuesdays, aerial (or satellite) photography can reveal details. But how do we cope with woodland, such as at Tingley Wood in Pirton, just north of the B655 Hexton Road to the west of Hitchin? The name Tingley, while obscure, is first recorded in the thirteenth century as *Tinele*, the first element of which may derive from Old English *tȳned*, 'enclosed'.



What might have been enclosed? Was it the wood (although the second element *leah* implies a clearing within woodland) of something already there when the wood got its name? Here, we can use a technique known as Lidar to help us see through the tree canopy to what lies on the ground surface below. Lidar has been around for more than 60 years, yet its applications in archaeology only go back twenty-five years or so. Its great advantage is that it enables us to see subtle earthworks and, remarkably, those under woodland. When first developed for satellite tracking in 1961, during the space race, it was known as Colidar (Coherent Light Detecting And Radar).

Like any such new technology, the military soon spotted that it might be useful, and the US army began using it for long-distance targeting from 1963. Around the same time, the name Lidar was first used. In 1971, astronauts in the Apollo 15 mission used it to map the moon's surface, at it provides a very accurate altimeter (height measuring system). Altimetry is the aspect of Lidar that archaeologists find so useful.

Lidar works by sending a narrow laser beam (which can be in ultraviolet, visible or near infrared light) in pulses towards a target, measuring the time it takes to reflect. It gives a very precise measurement of the distance between the laser source and the thing being measured. Micropulse Lidar uses low energy lasers that cannot cause damage to eyesight,

while high energy systems used in atmospheric studies point away from the ground into the sky. Surveys can be done from an aircraft or can be ground based; in the latter type, the scanners can be stationary or attached to moving vehicles.

From an aircraft, Lidar can give a spatial resolution – the distance between individual measurement points – of less than 30 cm. Global Position Systems record the precise location of each pulse, including the altitude of the aircraft (which is not available to sufficient resolution in everyday GPS devices). The data is returned in the form of a 'point cloud', a set of measurements located in three dimensions: latitude, longitude and elevation. As raw data, point clouds are not easily 'read', so they have to be processed. They are excellent for producing contour maps more accurately than any human surveyor could achieve, but their most familiar applications are to make Digital Surface Models (which include buildings and trees) and Digital Terrain Models (which 'remove' buildings and trees).

There are numerous uses for the data produced by Lidar surveys, from agriculture (such as monitoring crop growth) through conservation (such as measuring the biomass of an area), to geology (such as identifying uplift after earthquakes) and atmospheric studies (including measuring wind speed and cloud structure). More controversially, hand-held 'speed guns' used by traffic control are based on Lidar, while self-driving vehicles rely on it to avoid obstacles.

Archaeological uses have become one of the most widely-publicised applications of the technique. There have been numerous press stories about the rediscovery of 'lost' cities and even entire civilisations beneath the jungle canopies of central America and the Amazon basin. In England and Wales, the Environment Agency has been the main force behind Lidar surveys, although other organisations (such as the Chilterns Conservation Board) also commission them.

During 2022, the Environment Agency made all its data, covering most of England and parts of Wales, available free of charge. All of North Hertfordshire can now be viewed through portals such as lidarfinder.com or the National Library of Scotland's very useful georeferenced historic maps website (which also covers Scotland and includes a Lidar Digital Terrain Model at 50 cm resolution as one of the background layers).

Tingley Wood, in the southwestern corner of Pirton parish, just to the west of High Down, appears on maps as a simple block of woodland. Large scale maps show a track running through it from east to west, aligned roughly on High Down. Three other tracks cross it, two more-or-less straight, the third curving. Another track leads through a lobe in the southwest of the wood, while a sixth runs from the axial east-west track to the south, where it joins a track that follows the southern boundary.

The maps do not begin to hint at what the Lidar shows. The main east-west track is clear enough, including an extension at the western end, where the mapped track diverts to the south. The track south of the wood also shows, as do others outside the woodland. More significant are a series of banks and ditches around, inside and outside the wood. On the western edge of the photograph is a bank without associated ditch: this marks the line of

the county boundary. The origins of Hertfordshire probably lie in the wars between King Eadweard the Elder (AD 899-924), who established fortified towns at Hertford in 912 and Bedford in 914 (and probably also Hitchin and Ashwell, about 913). The shires provided men to staff these *burhs*, as they were known. The boundary between Hertfordshire and Bedfordshire cut through the earlier folk territory of the Hicce, who gave their name to Hitchin. Because these new shires were artificial creations whose boundaries did not follow those that were long established, banks often mark their course, as here. The bank between Pirton and Pegsdon probably dated from the 910s.

The next thing to notice in the Lidar is a boundary bank for Tingley Wood itself. It encompasses the whole wood apart from a stretch in the south, where it is obliterated by very straight ridge-and-furrow probably created by steam ploughing in the nineteenth century, and at the north-eastern corner, where it also seems to have been ploughed away in recent centuries. A ditch follows outside the bank around the northern side of the wood, but to the southwest, the ditch is inside the bank. To the southeast, the ditch has a bank both inside and outside the wood.

The differences in the relationship between the bank and ditch hint at a complex history. Although it was usual to enclose medieval woodland, the nature of the enclosure depended on its purpose. In woodland used as part of a deer park, the ditch is always inside the bank as it makes it more difficult for the animals to jump across the boundary. For woods that were coppiced to provide timber, the ditch would be outside, as it was intended to keep animals out. We seem to have both systems here, in different parts of Tingley Wood.

Next, we seem to have subdivisions inside the woodland, marked by three banks, two with ditches, running north to south. Those with ditches both have the ditches to the west. The westernmost, which does not have a ditch, lines us with the inner bank of the southwestern lobe of the wood. Does it perhaps mark the original western edge of Tingley Wood? At the eastern end, there is a ditch with only slight traces of an internal bank running from about the middle of the southern edge up to the northeastern corner. Is this perhaps the original eastern edge of the wood? The current eastern part of Tingley Wood disrupts a pattern of ridge-and-furrow cultivation, suggesting that it has expanded over formerly arable land. These details perhaps show the growth of the wood. If this suggestion is correct, then it was originally about 70% of its current size (11.4 ha as opposed to its current 16.0 ha). The two other north to south internal banks and ditches then divide the original woodland into three zones of unequal area. These separate parts of the wood hint at its original purpose: one of the areas would be coppices, while the other two continued to grow and provide pannage (foraging) for pigs. Perhaps the wood expanded as the demand for timber increased in the later Middle Ages, both for building work and as fuel.

There are also hollows visible both inside and outside the woodland. Most of these are irregular and surrounded by spoil. The area still had several chalk and gravel pits marked on the early Ordnance Survey maps, and this suggests an origin for those in Tingley Wood. At least one of them has partly destroyed the boundary bank and ditch, showing that this activity took place once the wood was no longer being used as a source of timber. However,

one hollow to the southwest of the centre is very rectangular and may have been a saw pit, used for cutting timber when the woodland was still in use.

The story does not even end there. As well as the banks and ditches associated with boundaries and the quarry pits, there are other embanked and ditched areas that bear no relation to the woodland. All three lie south of the centre of the wood and all are disrupted by the woodland banks. The southwestern of the tree is very rectangular and lies between the proposed saw pit and the denuded original southern bank of the wood. Could this have been a penned off area used for storing wood processed in the storage pit while it seasoned?

The two other groups of ditches, only one of which is associated with banks, are more enigmatic. One overlies the other (that with banks seems to overlie the purely ditched part enclosure) and both seem to be earlier than any of the woodland management banks and ditches. What they are is unclear. The very straight edges of the ditched trapezoidal part enclosure look to be Romano-British rather than prehistoric or early medieval. Its western ditch appears to continue into the southern extension of the wood as a bank, perhaps showing that its bank within the early phase of Tingley Wood was deliberately levelled.

The bank and ditch of the northern and western edges of a perhaps polygonal (certainly not curved) enclosure overlie the southern end of the possibly Romano-British ditched enclosure. The relationship with the subdivision of the woodland seems to make this enclosure earlier, as it is cut by it and its southern and eastern edges are not visible beyond it, suggesting that they have been obliterated by the woodland. The most reasonable explanation sould be that it is intermediate in date between the underlying putatively Romano-British enclosure and earlier than the woodland. Less easy to characterise, some have identified similar enclosures as early medieval sheepcotes, areas where sheep could be penned. This high ground in the southwest of Pirton could well have been an area used for keeping sheep before being brought into arable cultivation. Other origins are, of course, possible. Might the first element of the name Tingley be not Old English *týned*, ‘enclosed’, but another derivative of *týnan*, ‘to fence or close’, perhaps an unattested but plausible **týne*, ‘an enclosure’, referring to the possible sheepcote?

The Lidar results for just a small patch of land, only sixteen hectares in extent, give us a complex picture with much to digest and attempt to interpret. As a relatively new technique in archaeology, its potential is only just beginning to be tapped.

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