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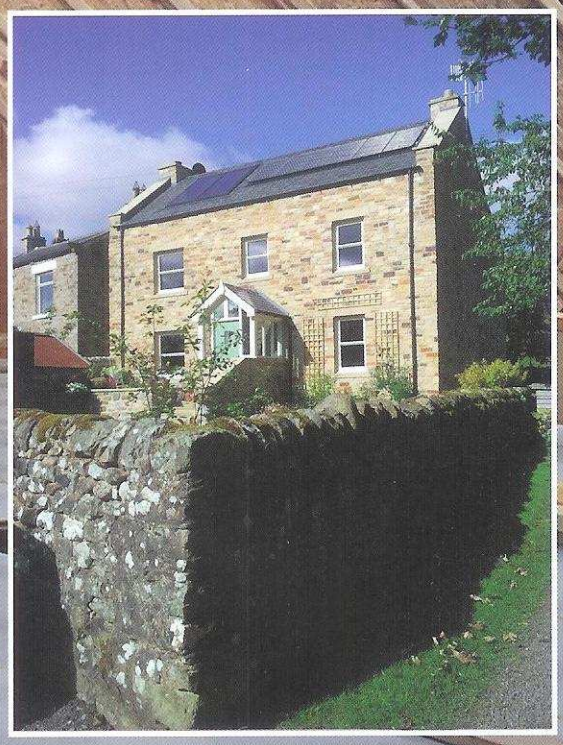

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OAK TREES AND CARPENTRY TRADITION

AND MUCH MORE ...

Oak trees, carpentry traditions and timber conversion

The potential inter-relationship between the two main species of oak and the carpentry traditions of timber-frame buildings within the British Isles is facinating. It is suggested that natural distributions pre-date the development of carpentry traditions and that subsequent woodland management and the ability to convert timber using water power might have perpetuated the distribution until relatively recent times. In addition a suggestion is made that there may also be a link between cruck frames and the development of the technology to produce appropriate sash-mounted saws and the ability to harness waterpower. Charles Hippisley-Cox reports...

Our relationship with the oak tree

No other tree features more prominently in the folk-lore and psyche of the inhabitants of Northern Europe. This respect for the oak is probably based on the strength and durability of the timber for construction and ship building, but the usefulness of the wood is compounded by the bark to be used for tanning leather and for smaller branches to be converted into charcoal. Domestic pigs, like their wild counterparts, didn't need much encouragement to forage for acorns. The longevity of the individual trees, and an association with fertility, give the oak a prominent place in folk-lore and legends such as the green man who is usually depicted with boughs of oak emerging from his mouth. There are many examples of oaks over 500 years old and some (often with a history of being pollarded and/or coppiced) may be twice that age and have a girth of up to 12 metres.

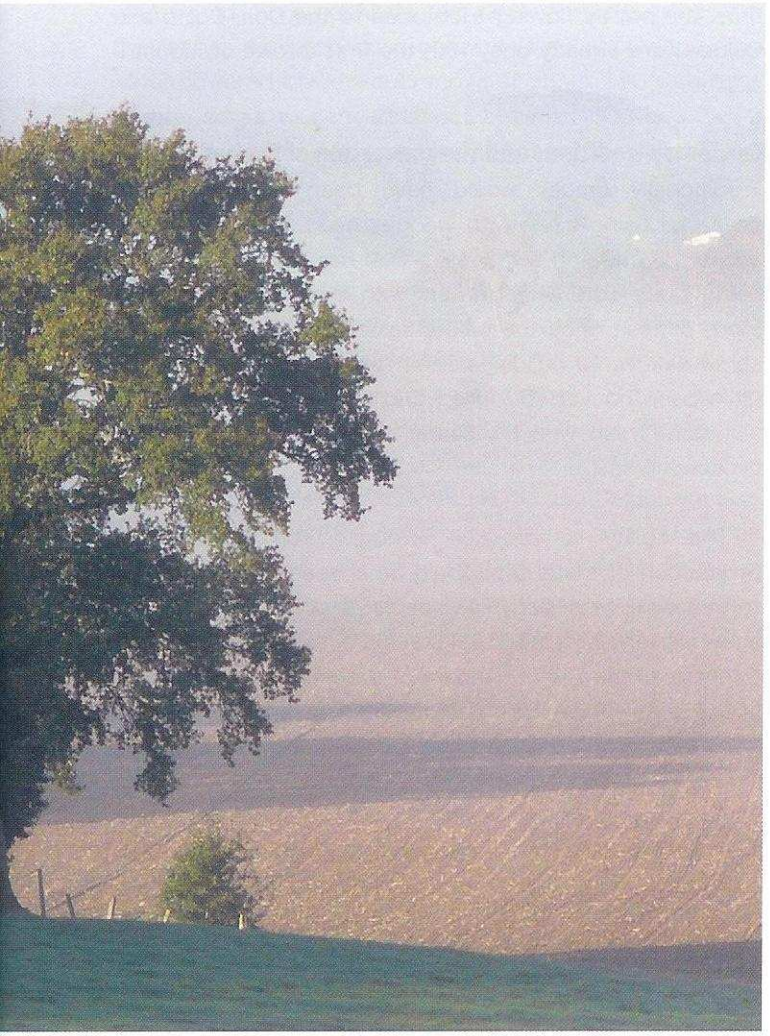
The two types of oak tree

There are two predominant types of oak tree in the British Isles and of the 25 European species, these two have dominated the temperate deciduous forests of Northern Europe since the end of the last ice age. Firstly there is the common 'robust' or 'pedunculate' oak, Quercus robur and secondly the 'sessile' (or durmast oak), Quercus petraea. The vast areas of forest dominated by these two trees once covered large areas of Europe but now only remains in small pockets within an agricultural landscape.

Physiological differences

Although hybrids occur, the two species demonstrate

Above: the acorns of the common robust (or pedunculate). Oak and, below; the leaf.



An icon of the British countryside, the oak tree.

distinctive traits. The terms 'sessile' and 'pedunculate' refer to the acorns with sessile referring to them being attached without a long stalk, and pedunculate to them hanging on stalks. The acorns of a sessile oak also tend to be rounder. The pattern is reversed when looking at the leaves with a shorter stalk (petiole) on the pedunculate oak. The pedunculate oak-leaf has small lobes (auricles) near the base, whilst the leaves of the sessile oak are more tapered from the stem, with more lobes and hairs at the base of the mid-rib. In addition the over-all tree shape differs with the pedunculate oaks tending to have twisted, gnarled branches and a rounded silhouette with a broad-domed crown above a relatively short, sturdy trunk. The sessile oaks tend to have a longer trunk with straighter branches and a narrower crown.

Climatic and soil-related preferences

Pedunculate oaks tend to prefer neutral or slightly lime-rich soils and can also thrive on loams and heavy clays. The sessile oak is more tolerant of acid soils and has the capacity to thrive on higher ground.

Woodland management

Despite much of the forests being cleared in advance of agricultural expansion, areas of oak woodland have been managed as a valuable resource, passed on from one generation to the next. The longevity of oak trees has required long term planning and an ability to forecast the demand of great grandchildren and beyond. Depending on circumstances, this management would have happened historically within family groups, or perhaps on a communal basis as part of the feudal system.

Apart from buildings and boats, the next most significant contribution of the oak is the production of charcoal. With pedunculate oak this has normally been achieved by pollarding with the bole or trunk being left at about four or five metres. The harvested poles/branches would then be converted to charcoal in what are known as clamps. The importance of charcoal lies in its contribution for the smelting and forging of iron, both on a local basis for smiths but also on a regional basis once industrialisation began.

Around the vicinity of the small proudly named village of Sept Forges, France, almost all the oaks older than 150 years show evidence of having been pollarded or coppiced. The regeneration and subsequent spread of the crowns suggest that the pollarding within this part of Normandy stopped about 100 years ago. The oaks are predominantly pedunculate and the traditional buildings

Above: acorns of the sessile (or durmast) oak and, below, the leaf.

(both timber-framed and stone built) have dimensions determined by the length of the timber from the trunks of these pollarded oaks and sweet chestnut managed in a similar fashion. The height of the pollarded oak is of considerable significance, especially when there is a need for the trunk to be converted into timber for construction, with lengths of three-to-four metres being particularly useful for both box and 'post and truss' frames. However, longer pieces of timber are required for cruck frames so the taller sessile oak is much more suitable.

With the sessile oak, management is usually different, especially if longer timbers are required. The ability of this type of oak to produce a long trunk needs relatively little attention apart from the occasional removal of unwanted side branches. Depending on the density of the planting within suitably managed woodland, a sessile oak can easily produce a useful trunk of between 10 and 15 metres. However, if a curved timber is required, another strategy can be adopted by tethering the young tree to control the growing habit of the main trunk. It is this practice which is particularly relevant to the production of timber for cruck frames.

The distribution of cruck frames and sessile oak populations on the eastern Pennine slopes

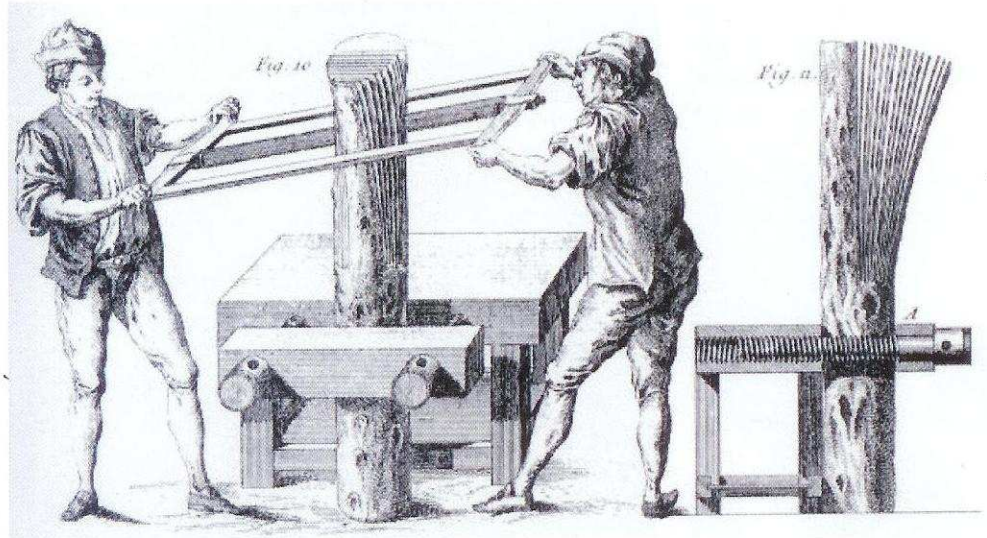
One of the type-areas for cruck-framed buildings are the slopes of the Pennines between Sheffield and Huddersfield and during survey work undertaken by the South Yorkshire County Archaeology Unit, a close relationship was observed between the distribution of cruck-frames and the natural occurrence of the sessile oak. On one level this could be a simple exploitation of a natural resource, as the sessile oak is known to be more tolerant of poor upland acid soils, but there could also be a conscious woodland management system with trees being planted and maintained across the generations. One of the other surprises that came from the work in South and West Yorkshire was the late dates associated with some of the cruck frames, confirmed either by date stones and/or dendrochronology with many examples being from the 17th and 18th centuries. By this time, the swiftly flowing tributaries to the Don, Colne and Calder were already busy with the first throws of industrialisation.

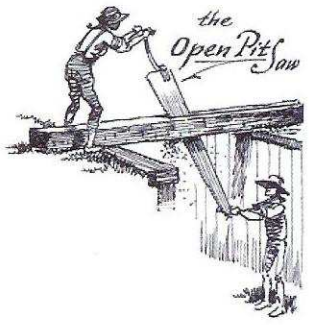
Carpentry traditions and the conversion of timber

Traditionally timber would have been cut down and prepared using axes, with wedges used for splitting and adzes for finishing surfaces. Oak has the advantage of being quite soft when 'green' with the task significantly more difficult once the oak is seasoned. This is the why some oak-frame buildings seem twisted. The oak would have been converted, drilled and pegged together whilst still quite 'fresh' with the timber completing the seasoning process 'in-situ'.

The ability to produce wrought iron enabled the production of metal that could be shaped and toothed to form saws. Most early saws depicted in early manuscripts show artisans working in pairs at either end of a long blade. Sometimes the least fortunate of the pair (presumably the young apprentice) being underneath in a pit as the rip saw works along the length of the prepared tree trunk. A rip-saw is specifically for cutting along the grain of a piece of timber with straight teeth that cut in a chisel-like action, whereas blades for cutting across the grain, are sharpened differently and have teeth twisted alternately.

Prior to the 1840s and the introduction of rotating 'circular' saws, saw mills exclusively used a vertical movement for converting the trees into timber. Saw mills were traditionally powered by water, with the rotary motion of the wheel being transferred via a crank shaft to a rip-saw blade mounted in a vertical wooden frame known as a sash. The introduction of steam power would have also contributed to the demise of water power for timber conversion in the UK. The sash-frame would be attached to a crank which pushed it up and down with a motion akin





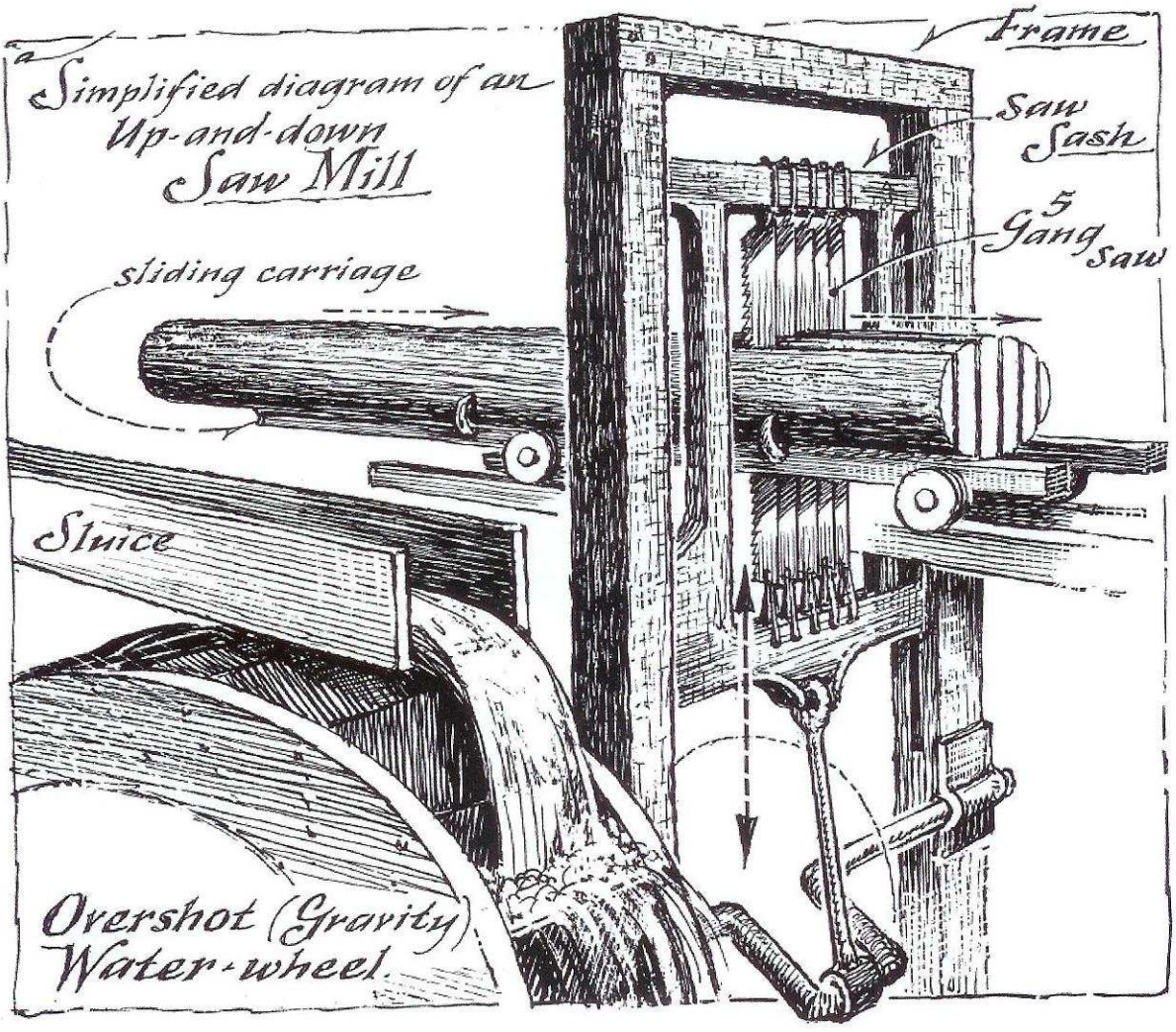
Above: an example of an open pit saw.
Left: a two man vertical saw.
Right next page: a water powered vertical saw with sash.

to the opening and closing of a window sash. Some mills used gravity driven weights to advance the timber whilst others had more sophisticated ratchet mechanisms with the timber mounted on a cogwheel-driven carriage. The water-powered blade would move at about 150 strokes a minute, so as to convert about between 500 and 3,000 feet of timber in a 12-hour day subject to the availability of sufficient water.

Sheffield, where six rivers and eight smaller brooks join the River Don, was an ideal (and early) place to harness water power. Associated essentially for the powering of tilt-hammers and grind-stones, the motion could easily be adapted for the conversion of timber. There is also an early association of water power with the mechanical pounding of wool as part of the fullering process. The earliest water mills on the rivers Holme and Calder are also likely to have been for processing fleeces with origins as part of the monastic grange system in the Middle Ages. For example in the Rivelin valley to the west of Sheffield, there was a mill run by the Hind family as early as 1581. Eventually there was a whole series of water driven mills on the Rivelin including the Wolf (c.1722) and the one with the largest wheel of all known as "Old Groggy" at Grogham's Mill at the confluence with the River Loxley. Saw blades

were produced in the Sheffield area from as early as the C17 and it reasonable to suggest that the local tees were converted into cruck blades using local technology and the familiar vertical motion associated with early tilt hammers.

The industrial revolution and the re-use /re-modelling of individual mill sites is likely to obscure their origins and the various uses to which the power was directed. Changes in methods of converting timber to steam power and circular saw blades combined with changing construction methods means that water mills ceased to produce cruck blades and reverted to more specialised industrial processes such as hammering and grinding. >>>

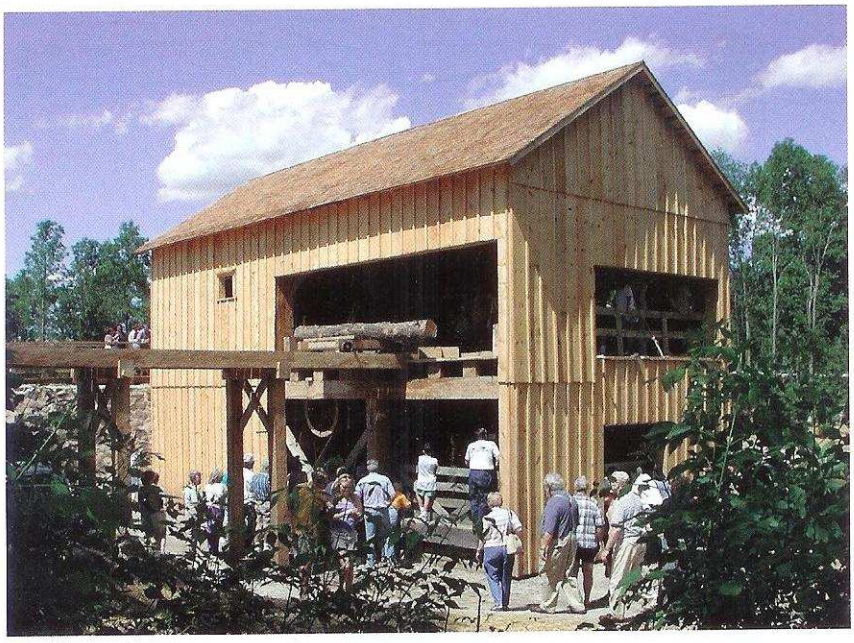


Examples of water driven saw mills and the American experience

The absence of surviving examples of saw mills within the industrial landscape of South and West Yorkshire is partly explained by poor documentation and the fact that mills often had more than one function and would (in the case of Sheffield) have defaulted to tilt hammers and/or mills for grinding and polishing.

However, there are some examples to be found in Europe and North America. Five water-powered saw mills survive in Norway, including the one located near Bjørkedalen. The waterfall turns a wheel to power a vertical frame that houses the rip-saw blade. The advancement of the log is also water powered. This type of saw mills is believed to have been introduced to Norway around the year 1520 by German migrants.

In North America, the technology of converting timber using water power was taken to the colonies by the very first settlers. There are surviving mills that continue to use the vertical motion of the sash-frame system. Restored examples, preserving the pioneering spirit, include the mill at Bertolet, Pennsylvania and the recently renovated complex at Herrling, Wisconsin (below).



A British example is Gayle Mill in Wensleydale, although originally a mill for spinning, now uses the water-powered turbines to operate belt-driven machinery for cutting timber.

Afterthought

Although climate and soil type still have a close geographical correlation to the distribution of the two main species of oak within the British Isles, woodland management, carpentry traditions and the technology of timber conversion have probably contributed to the perpetuation of the distribution.

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Further reading

Alcock, N. W. 1973; A Catalogue of Cruck Buildings, Phillimore for VAG.

Alcock N W, 1981; Cruck Construction. The Council for British Archaeology Research Report No 42. 37-9.

Airs M, 1995; The Tudor and Jacobean Country House. A Building History. Sutton Publishing, Stroud.

Alcock N, W, 1973; A Catalogue of Cruck Buildings. Vernacular Architecture Society.

Alcock N W, 1996; The meaning of Insethouse, Vernacular Architecture 27, 8-9.

Alcock N W, 1997; A Response to: Cruck Distribution: A Social Explanation by Eric Mercer',Vernacular Architecture 28 (1997), 92-3.

Alcock N W, 2002; The Distribution and Dating of Crucks and Base Crucks, Vernacular Architecture 33, 67-70.

Alcock N W, 2007; The Origins of Crucks. A Rejoinder, Vernacular Architecture 38, 11-14.

Brunskill R W, 1994; Timber Building in Britain. Victor Gollancz, London.

Hewett, Cecil A. 1980; English Historic Carpentry, Philimore, 231-233.

Hill N, 2005; On the Origins of Crucks: An Innocent Notion, Vernacular Architecture 36, 1-14.

Mason, R.T.(un-dated); Framed Buildings of England, Coach Publishing House, Horsham.

Mercer E, 1996; Cruck Distribution: A Social Explanation, Vernacular Architecture 27, 1-2.

Pearson S, 2001, The Chronological Distribution of Tree-Ring Dates, 1980-2001: An Update, Vernacular Architecture 32, 68-69.

Ross, P., Mettem, C. and Holloway, A. 2007; Green Oak in Construction, TRADA Technology.

Ryder, Peter 1982; Timber Framed Buildings in South Yorkshire, SYCC Archaeological Service.

Williams, Michael, 1992; Americans and Their Forests, Cambridge University Press.

Charles has worked as a historic building specialist since studying geology at Sheffield University in the 1970s. He returned to university in the 1990s to undertake formal architectural training after working in local government and for English Heritage. He is currently programme leader for Architectural Technology at Huddersfield University.