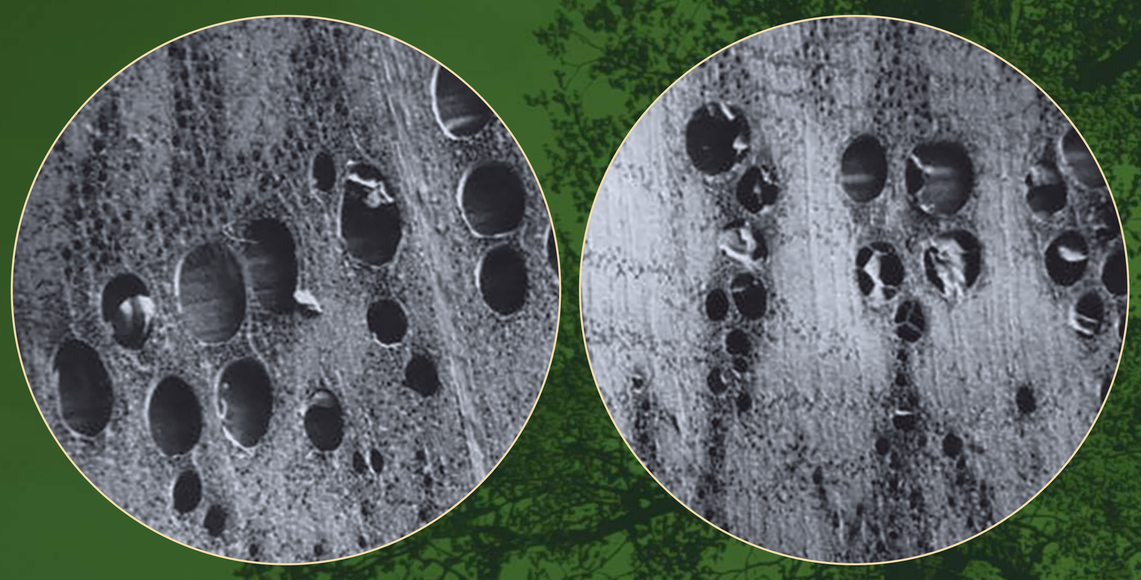
SHAKE IN OAK

The presence of star or ring shake can reduce the utility of oak to firewood and, unlike many other species, exemplary form or vigour is not an indication of sound wood inside. There are no tests or indicators to determine the presence of shake in a standing tree – it is a hidden defect.

Star shake 'has been found to be a very highly heritable characteristic' (*Forest Trees Trust*). Larger than average vessels are the key trait. Sound trees tend to have smaller vessels.

Ring shake is generally associated with moisture deficit – gravelly or sandy brown earths and acid brown earths (pH 4.5–6.5) should be avoided if wood production is a target. 40% of new broadleaf planting in Ireland is oak (q.p. & q.r.) Where there is an expectation of producing useful wood from new planting it is essential that parent stock carry the necessary traits.



Radial sections showing the wood of a star shaken tree (left), and an unshaken one (right).
The vessels of the shaken tree have larger cross-sectional areas, the biggest being about 0.3 mm

BLAME THE PARENTS

'This is where I had planted the first contingent of the Millennium oaks, all grown from acorns taken from Westmeath oaks in the autumn of 1999. Thirteen years ago they were 1,500 frail little seedlings no bigger than my hand. Today they are broad-chested, muscular creatures 20–30 feet high, broader than Westmeath bullocks and upright as guardsmen – in a word, magnificent.'

... 'Delighted with myself, I usually follow the track that winds up through the Millennium Wood past a gap in the whitethorn hedge and into the next compartment. This is the first of the six small compartments whose acorns were collected in the autumn of 2000 in all parts of Ireland. The list is a roll call of famous woodland names beginning with Killarney. I walk down the lines of this first compartment – and am appalled. These trees are only a year younger than the young giants from Westmeath. But they are stunted dwarfs by comparison.'

T. Pakenham, *The Company of Trees*

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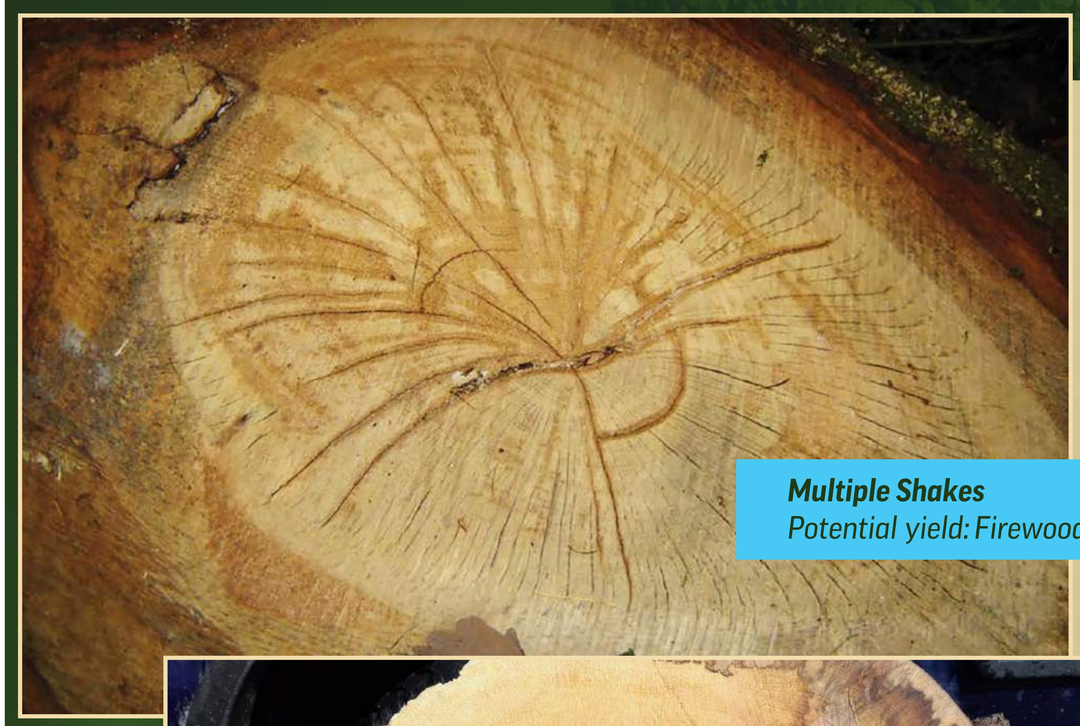
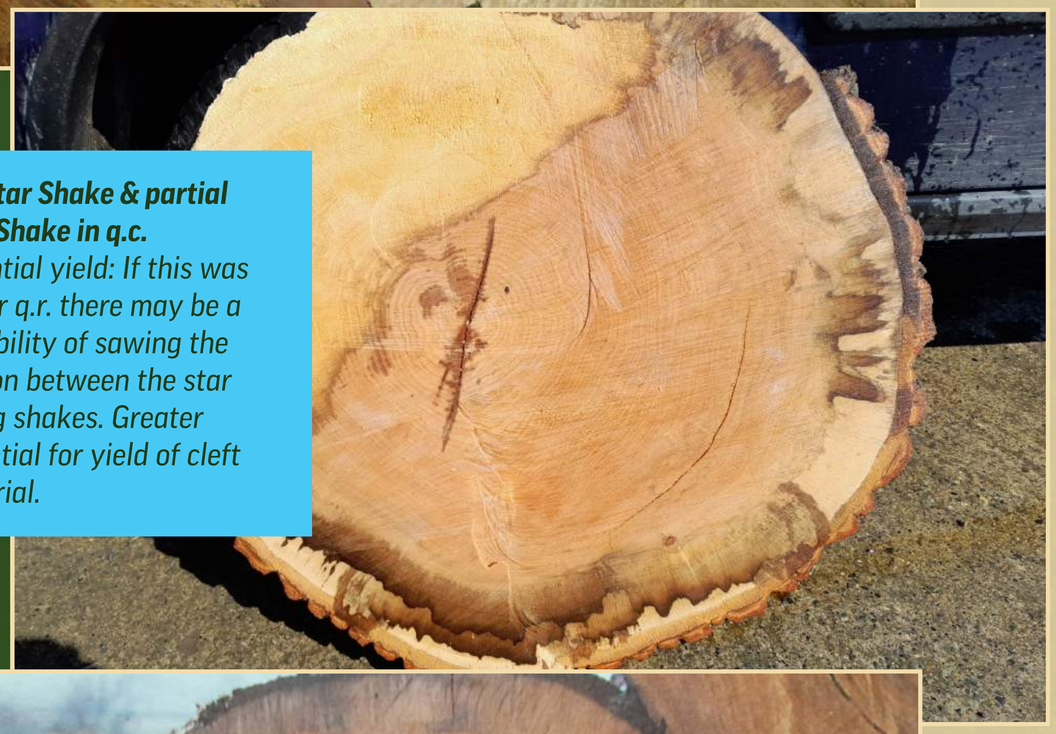
OAK SHAKE: WHAT IT LOOKS LIKE

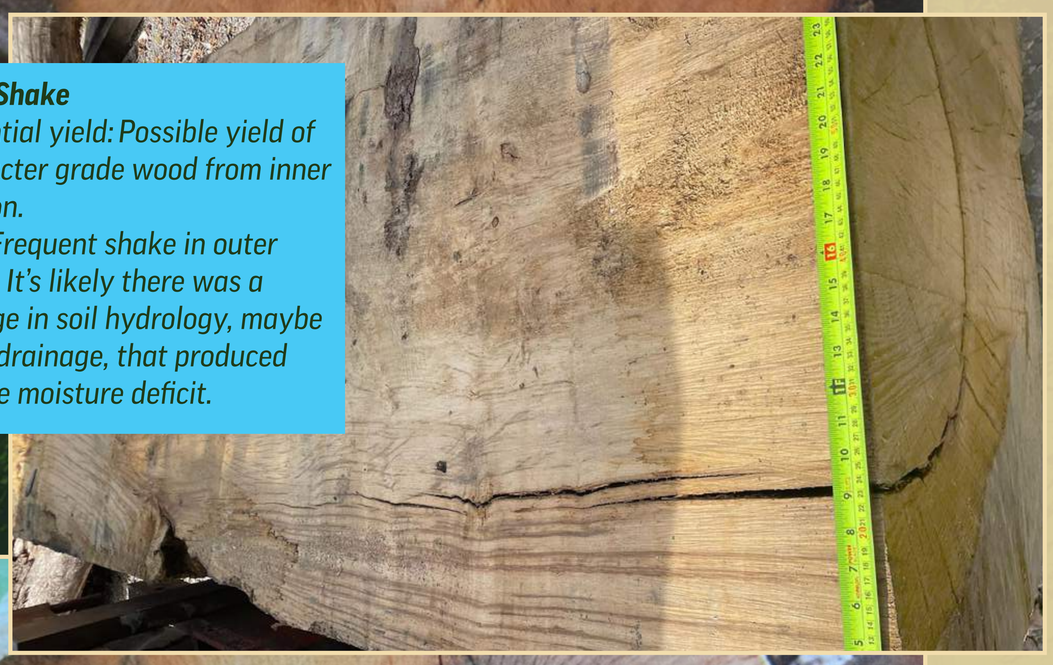


Multiple Shakes
Potential yield: Firewood



2pt Star Shake & partial Ring Shake in q.c.
Potential yield: If this was q.p. or q.r. there may be a possibility of sawing the section between the star & ring shakes. Greater potential for yield of cleft material.

Ring Shake
Potential yield: Under normal criteria this would be graded out to firewood. High potential for yield of cleft material.



Ring Shake
Potential yield: Possible yield of character grade wood from inner section.
N.B. Frequent shake in outer rings. It's likely there was a change in soil hydrology, maybe local drainage, that produced severe moisture deficit.

4 pt Star Shake
Potential yield: Limited but possible low stakewood yield. High potential for yield of cleft material.

The term 'shake' describes the longitudinal separations in the wood of standing oak trees that can severely reduce the conversion potential of stems. They occur either radially (star shake), or fully or partially around the circumference of an annual ring (ring shake). The separations, if not already large, tend to extend during timber processing.

Shake has been recognized as a serious problem to users of oak since at least the time of John Evelyn in 1664.
It occurs in nearly all Irish and U.K. oak plantations and quite often affects more than 50% of the trees in a stand, with cases recorded over 70%. The roadside value of shaken timber may be less than 10% of that of sound timber (vis-a-vis firewood and veneer grade wood). It has been estimated that over 21% of British oak is affected and the figure is likely to be significantly greater in Ireland.
A consequence of this is that the Timber Trade has low expectations of oak, which are reflected in low prices for standing sales.

Work on shake by the U.K. Forestry Commission has stressed that to avoid it, oak should not be grown on dry, stony or gravelly soils, and damage to trees should be avoided in harvesting. These can act as 'triggers' for shake.
The two native oaks and sweet chestnut are strongly ring-porous species. The earlywood produced each year has extremely large vessels, often up to 0.3 mm in diameter. They can be seen with the naked eye and are many times larger than the vessels of other species. Materials scientists who work on wood and other cellular materials have found that under tension (as in the heartwood of trees), flaws, cracks, or a few exceptionally large cells can cause cell walls to fracture locally. These fractures can spread and give rise to 'shakes'.

Investigations at Oxford University have indicated that a 'predisposition' to shake is present in all oaks, but especially those with larger-than-average vessels. Sound trees tend to have slightly smaller vessels. Like many of the properties of wood, vessel size, and hence a predisposition to shake, has been found to be a very highly heritable characteristic, and therefore amenable to genetic manipulation. It is for this reason that all the oak trees in the Future Trees Trust (FTT) breeding seedling orchards are progeny of mother trees with smaller-than-average vessels. FTT hopes to produce seed that will grow into both well formed trees as well as trees with much less predisposition to shake than the current populations in British and Irish woodlands.

It is possible to recognize trees with larger or smaller vessels easily in field from the time that they come into leaf in the spring. Within any stand of oaks, those that flush latest have the biggest vessels. Oak growers could therefore quite easily remove shake-prone trees i.e. those with large vessels, in thinnings over the course of a rotation if they are marked at flushing time in the spring.

Risk factor	Rating of potential impact*	Strength of evidence for judgement**	Inherited or acquired risk?	Are other associated factors important?	Does the evidence enable recommendations for management?	
					New planting	Existing crop
(a) Predispositions						
Large earlywood vessel diameter	High	Good – empirical	Inherited and/or acquired	Yes: Mechanical or growth stresses are required to trigger	Yes: Use improved planting stock when becomes available. Use tree shelters judiciously	Yes: Remove late flushing trees early in rotation, or those that drop their leaves early
Wounding and barrier zone formation	High	Good – empirical	Acquired (but inherited genetic qualities may also influence)	Yes: Initial cause of wounding required. If soil nutrient status is low then healing will be slower and less effective. Mechanical or growth stresses are required to trigger	Yes: Avoid exposed sites and those with low-calcium soils. Protect trees from damage	Yes: Protect trees from damage. Identify trees with obvious decay and remove when thinning
Wounding and bacterial wetwood formation	Medium–high	Good – empirical	Acquired (but inherited genetic qualities may also influence)	Yes: Initial cause of wounding required. Mechanical or growth stresses are required to trigger. (Note that roots are also vulnerable to damage from drought or waterlogging)	Yes: Protect trees from damage, especially during harvesting and extraction. Avoid frost hollows and waterlogged ground	Yes: Identify trees with frost cracks and obvious decay and remove when thinning
Abrupt changes in ring width	High	Good – empirical	Acquired	Yes: Drought, defoliation or close competition may reduce ring width; sudden and heavy thinning may increase ring width	Yes: Avoid drought-prone sites and frost hollows	Clean and weed in early years. Ensure that thinnings are carefully marked and are carried out in time to ensure regular, even growth
Tension wood and **possible** localised variation in wood density	Unknown – not previously studied	None currently – association is now being tested	Acquired	N/a	N/a	N/a
(b) Triggers						
Physiological stress – **soil nutrition**	High	Good – empirical	N/a	Yes: Existing predisposition required (any)	Yes: Low available calcium and/or high aluminium content indicate higher risk	No
Physiological stress – **soil type**	Low–medium	Poor–moderate (evidence is mainly **inferred** by reference to more empirical soil studies of texture, water and nutrients)	N/a	Yes: Existing predisposition required (any)	Yes: Although only brown earth sites would normally be considered for oak in plantation, acid brown earths (pH 4.5–6.5) and gravelly or sandy brown earths are likely to be at higher risk than are calcareous or forest brown earth types	Yes: On riskier soil types, individuals subject to other predisposing factors are at higher overall risk, so remove during thinning
Physiological stress – **soil pH**	Low–medium	Poor–moderate (most evidence is **inferred** from calcium studies)	N/a	Yes: Existing predisposition required (any)	Yes: Soil pH may give a broad indication of likely available calcium	No

Summary of evidence relating to factors influencing the development of shake in oak.

Price, A , *Shake in Oak: An Evidence Review*, Forestry Commission Research Report, 2015

REFERENCES

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Produced by: D. Brickenden, Timberline

SHAKY OAK: GO WITH THE FLOW

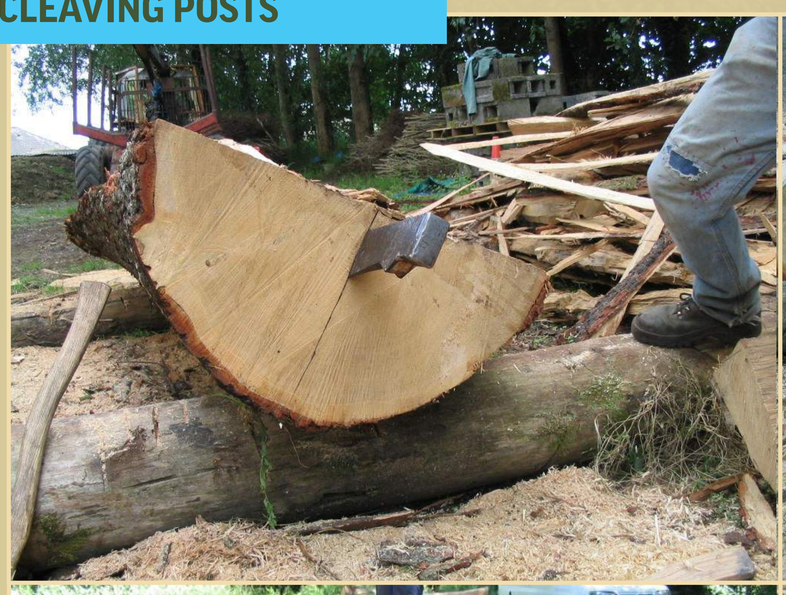
It is to be expected that the thrust of research is towards growing oak with a view to primary conversion through a sawmill. But for more than 100,000 years, and until less than 300 years ago, wherever on earth oak and man came together, cleaving was the method for primary conversion on the way to useful wood.

Our ancestors discovered that the species of oak that possessed the very desirable properties of strength and durability also had a weak point that could be readily exploited. They found naturally occurring lines of weakness or Cleaving Lines that radiate from the centre of the tree (like the spokes of a bicycle wheel) and run longitudinally up to the height where heartwood forms. These are the same lines along which Star Shake can develop.

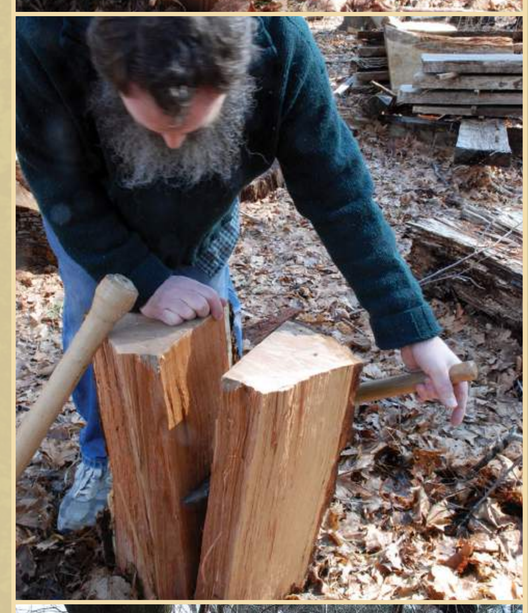
The sources of this weakness are the medullary rays, common to most tree species but, in the case of oak (and sweet chestnut) are far more pronounced. The cells have a weaker bond than the cells of the surrounding wood and facilitate cleaving by driving in wedges along the line of a ray and progressively wedging open the fracture that develops as the wedges penetrate further in.

PROCESSES

CLEAVING POSTS



USING A FROE



BARREL STAVE CLEAVING

IMAGE CREDITS

David Brickenden, Timberline
Fabbrica Botti Gamba
Mountain Oak Woodcraft
Mike Carswell
The Cleft Wood Company

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CLEFT OAK IN ACTION

While the practice of whole log oak cleaving has fallen off in the Western world, it has continued at a much reduced scale in some regions particularly for roofing shakes, riven plastering laths, barrell staves, fencing and gates.

The advantages of cleaving over sawing for primary conversion are known to most craftsmen who work in oak (and chestnut). In a way that sawing may not – it exposes the true direction of the grain, the coarseness of the grain, areas of bound fibre and other structural defects. As well as this it exposes the extent and nature of the medullary rays (a.k.a. silver rays, pith rays, figure) which are considered an important aesthetic feature, as well as proving that the wood has been radial processed and will be inherently more strong and stable than tangential processed wood.

In relation to a log that displays a degree of star shake that would otherwise condemn it to firewood or stake grade material – in the hands of a craftsman there is the potential to convert most of the wood to useful products.

PRODUCTS

ROOFING SHAKES

GATES

PLASTERING LATHS

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