

Chestnut in the United Kingdom: Forest area, management and utilisation as timber

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Abstract [Review article]

A review of the area and distribution, management and utilisation of chestnut is presented. Chestnut is an introduced species in the UK, grown predominantly in Southern England as intensive coppice and as high forest. The forest area is decreasing and the forest type changing from predominately coppice to high forest. As traditional agricultural and horticultural markets are declining, finger jointing and pioneering wet gluing technology has developed to produce new products. This paper also gives structural data for chestnut as a construction timber in the UK, obtained for the first time.

Keywords: chestnut, timber, distribution, management, utilisation

1 Background

Chestnut (*Castanea sativa*) has been grown in the UK for two thousand years and is thought to have been introduced by the Romans (WHITE 1995). Ancient trees include the Tortworth Chestnut in Gloucestershire estimated to be 1200 years old (MILLS 1999). The distribution area for chestnut is mainly Southern England. In the counties of Kent and East Sussex in southern England, extensive areas of chestnut coppice grow on non-calcareous soils, either as a pure crop or with oak standards, and have been common landscape features for centuries, closely associated with hop growing (WHITE 1995). In the UK, chestnut is grown solely for its timber as nut production is not economically viable under UK growing conditions; however, its fruit is collected by many people when available.

2 Distribution and area

The UK National Inventory for Woodland and Trees (NIWT), compiled by the Forestry Commission (Anonymous 2000a), records there are 18 788 ha of chestnut within the UK. Of these, 10 875 ha are classed as high forest and 7913 ha as coppice. The vast majority of chestnut occurs within England (96%), of which approximately 60% are to be found in the south-eastern counties of Kent, and East and West Sussex. Much smaller areas of high forest are located in Wales (544 ha), Scotland (77 ha) and Northern Ireland (2 ha). The only coppice (45 ha) outside of England is located in Wales. The chestnut in Scotland may qualify as the most northerly occurrence in Europe. Table 1 provides details of the type and location of chestnut in England in 2000.

Table 1. Sweet Chestnut growing areas in England. Source: Forestry Commission – National Inventory of Woodland and Trees 2000. Note on data: Forest areas and woods below 2 ha in area are not included.

Region	High forest ha	Coppice and coppice with standards ha	TOTAL ha	% of total chestnut growing area in England %
South-east England. (Kent, East and West Sussex)	3228	7195	10 423	57.52
Southern and Central England (Norfolk to Shropshire, South excluding the SE counties)	6074	668	6742	37.21
Northern England	950	5	955	5.27
Total	10 252	7868	18 120	100

The NIWT, based on the analysis of aerial photographs together with plot sampling on-site, seems to indicate a substantial reduction (35%) in the chestnut-growing area of the UK in comparison with the 1979–82 national census (Anonymous 1983) when a total of 28 991 ha of chestnut were recorded in the UK. In 2000 only 18 788 ha were registered. It should be noted, however, that the previous census included woodland down to 0.25 ha in area and also included SC (sweet chestnut) coppice grown under standards of a different species (principally Oak), whereas the 2000 census excluded woodlands smaller than two hectares. These differences could explain some of the apparent reduction in the area where chestnut is grown between 1983 and 2000.

The figures do indicate that there has been a major reversion of coppice to high forest. This is partly due to coppice being left unmanaged and thus reverting to high forest, and partly due to the practice of reducing the number of stems per stools to “store” chestnut and create high forest. Also, the decline in markets for traditional chestnut coppice, such as hop poles and fencing, combined with a shortage of coppice working skills and high labour costs have contributed to a decrease in the coppice management of chestnut.

Pure chestnut high forest resulting from maiden trees rather than coppice is quite rare. Some former chestnut coppice with oak standards may now have been reclassified as oak high forest or mixed high forest. The last major chestnut coppice area is in south-east England, where there are still large areas of coppiced woodlands being actively managed (Anonymous 2000b, RUSSELL in press). The vast majority of chestnut is privately owned with only 216 hectares owned by the state (Forestry Commission, pers. comm.).

The UK does not have a tradition of growing chestnut for fruit production, however, chestnut fruit varieties are being trialled on a very limited basis (Crawford, pers. comm.). The fruit may be collected from forest trees, but the size and quality is generally poor and harvesting infrequent.

3 Management

The silvicultural management of coppice and of standard trees is rather different, and is described by Anonymous (2000b), CRAWFORD (1995), EVANS (1982), ROLLINSON and EVANS (1987). Both types are often managed by small specialist companies and estates with experience gained over several generations. The rotation time depends on local growing conditions and on the end product desired. For example, it is normally two to three years for walking sticks, five to seven years for bean poles, 15 to 20 years for fencing posts, and 50 to 70 years for veneer and planking timber.

For coppice, a typically rotation is 14 to 20 years, by which time the coppice is usually about 12 metres in height. Usually small areas of chestnut coppice up to 0.5 ha, known as cants, are felled in successive winters. Re-growth from the stools is rapid (up to 2.5 metres in the first year). On average, 110 to 130 tonnes of wood per hectare is harvested when cut at about 14 years (Anonymous 2000b), equivalent to an annual yield of seven to nine tonnes per hectare per year. Unlike the coppicing practice in many continental systems, the shoots from the stools are not thinned out unless the coppice is being converted to high forest. In this case, one stem per stool is selected for growing on and all others are removed.

Mature, standard trees are highly valued for their timber (EVERARD and CHRISTIE 1995). As timber defects, such as spiral grain or star and ring shakes, are common in chestnut in the UK, trees are rarely allowed to grow on to become large standards. The standard trees are normally felled at a maximum of about 70 years of age (or even earlier if the site has a history of producing trees with timber defects) to reduce the risk of such defects occurring. The average yield class for chestnut is considered to be 8+, with a rotation time of 45 to 55 years (EVERARD and CHRISTIE 1995). There are some excellent examples of mature, standard chestnut trees in the Forest of Dean, Gloucestershire and the Mereworth Estate, Kent.

Seedlings are used to establish new plantings of coppice and high forest and for re-stocking existing areas. Currently, most of the seed is from the continent, but occasionally local provenances were used if sufficient seed were available. The use of local seed provenances is increasingly being encouraged by government grants for woodlands. Young seedlings and trees need to be protected from damage by mammals, particularly browsing deer and rabbits.

The stocking densities to establish new coppice, described by CRAWFORD (1995), are determined by the length of rotation and the desired product. For the most common rotation period of twelve to sixteen years, an optimum of 800 to 1000 stools per hectare stocking density at a spacing of 2.6 to 2.9 m is required. In the UK, chestnut does not naturally regenerate. Gaps within existing coppice are usually filled by layering from adjoining stools, bending growing stems and pegging to the ground to promote rooting where the new stool is required.

A major problem in growing chestnut to large diameter saw logs is the tendency for trees over 40 years of age to develop ring shake. Observations of felled logs with the defect suggest that visible patterns on the bark may indicate shake within the tree. A research project is currently being carried out at the Imperial College at Wye to correlate these bark indicators and measure their reliability by firstly predicting the incidence of shake and then felling the trees to see if shake is present. The measurement of the length of fissures between the bark plates seems to be a possible indicator.

The main disease problem in chestnut in the UK is the fungal root rot "Ink Disease" (*Phytophthora cinnamomi* and *P. cambivora*) (STROUTS 1981). Chestnut Blight (*Cryphonectria parasitica*), which is the major disease of chestnut in continental Europe, is not present in UK. Ink disease is widespread but tends to be localised to poorly drained sites such as heavy clays and alongside extraction routes where soil has been compacted. Where ink disease occurs, trees are typically felled. The main bacterial disease, Anthracnose (*Mycosphaerella maculiformis*), which causes brown spotting on the leaves sometimes leading to early leaf fall, is not considered a major problem.

4 Utilisation

Chestnut is a versatile and naturally durable timber, with a low movement potential for tangential and radial shrinkage/ expansion when seasoned (Anonymous 1972). Traditionally, chestnut timber from standard trees is used in building construction, furniture, joinery and coffin boards. Coppice is used to produce small diameter logs for the production of traditional fencing stakes, paling and hop poles. Minor uses for coppiced chestnut include turnery, cask staves, walking sticks, charcoal and firewood. In the past, the bark was used for tanning leather. In recent years it has been fashionable for cleaved chestnut coppice to be used to produce rustic garden furniture and climbing frames for plants and children. Areas of coppice are valued on hunting estates, especially for pheasant shoots, as they provide cover and nuts for the birds.

Chestnut coppices are traditionally grown intensively as pure stands and chestnut is regarded as the UK's most successful and profitable coppice crop (CRAWFORD 1995). The value of the coppice is largely determined by the quality of the stems. Straight tall stems with minimal knots are particularly sought after for ease of cleaving and for minimising waste. The density of the stand and ease of access also determine the value. Low quality and poorly stocked stands often fail to be sold for any other purpose than for pulpwood.

There is an active market for good quality planking and veneer grade logs with over-bark diameters greater than 350 mm. These are mainly exported to southern Europe. Because quality logs tend to be found in small parcels mixed with other species, log merchants combine logs from several locations to make full lorry loads. Chestnut grown for large diameter logs would yield good returns to the grower if the timber quality could be improved and the incidence of shake could be minimised. New markets for smaller diameter logs grown from existing coppice stands need developing.

Until recently no structural data was available for the use of chestnut as construction timber in the UK. A joint Timber Trade, Forestry Commission and South East England Local Authorities initiative commissioned a research project at the Building Research Establishment to develop grading and structural standards for the use of chestnut for construction.

As part of the project, sawn timber samples, sourced from Southern England and the Forest of Dean, were tested mechanically on a large scale to determine the strength properties of the timber. A visual grading specification was applied in accordance with British Standard (BS) 5756:1997 "Specification for visual strength grading of hardwood" and the mechanical data will be published as a revision to BS 5268: 1996 "Part 2 Structural use of timber". BRE have produced a digest of the data (Anonymous 2000b). The results indicate that chestnut is generally available in TH1 grade to BS 5756 with density and strength slightly lower than oak.

Chestnut timber grown in coppices was characterised by fast growth. An increased proportion of denser summer wood fibre to the spring wood vessels gives it greater timber strength. Optimum strength values appear to be achieved with five to seven annual growth rings per 25 mm. Chestnut sawn from logs with mid diameters of 150 to 225 mm, aged between 15 and 30 years, are most suitable and few show signs of ring shake.

The development of finger jointing and the pioneering of modern wet gluing technology has created exciting possibilities for the structural utilisation of small diameter chestnut timber. This is demonstrated in the development of the showcase Woodland Enterprise Centre at Flimwell in East Sussex (BRADEN in press) where a 12 m span exhibition and

office building with a curved gridshell roof has been constructed using 10 m lengths of finger-jointed timber bolted together at 600 mm node points. The grids were prepared from lengths of 15 to 20 year old coppice-grown chestnut, specially sawn to produce straight-grained timber of high strength, which could be bent to the roof shape required. The building also demonstrates the use of finger-jointed chestnut for external cladding and glue-laminated chestnut joinery for the external windows and doors to the building.

The potential use of chestnut as an energy crop (Anonymous 2000c) has been explored, and could encourage the productive management of chestnut coppice in regions where the demand for traditional products has declined. The distance for transporting the timber would, however, affect its economic viability.

Interaction between the industry and research sectors has developed considerably over the last five years. However, as results are currently still limited, they are not presented here. WARWICK (1999) gives brief descriptions of the work in progress by the British and Irish Hardwoods Improvement Programme's chestnut group and BRADEN (1999) describes work being undertaken with regard to timber utilisation.

5 Conclusions

The area of chestnut in the UK and the type of forest it grows in appear to have changed considerably in recent years. This may, however, be in part due to different sampling techniques used for the National Inventories in 1983 and 2000 and to changes in the classification of forest type. Intensive chestnut coppice production using traditional management practices in the UK still continues. The decline in the demand for traditional products, such as chestnut paling, means that its economic viability is dependent on new products being developed, such as new timber glue lamination and finger-jointing technology. The practice of converting coppice to high forest by reducing stools to single stems is becoming more common.

The development of a European code for the use of chestnut in construction and glue lamination would be desirable. Research is also needed to define the durability qualities of the timber, taking into consideration the effects of the season of felling, drying processes, and any appropriate treatments (e.g. natural oils or synthetic compounds) to maximise natural durability.

Co-ordinated promotion of chestnut as an important, naturally durable hardwood species, which can be used as timber in construction and joinery, is needed. This should, together with the development of modern timber engineering techniques, increase the demand for chestnut as a timber and help halt the decline in chestnut growing in the UK.

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