Ageing the Yew- no core, no curve?

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The distribution zone of *Taxus baccata* extends from Finno-Scandia to Asia Minor and the Caucasus and southward into north Africa, but mainland Britain contains the greatest concentration of truly ancient trees. The range of this species is defined by climatic extremes in central and western Europe; it is ideally suited to the mild oceanic climate of the UK where limiting growth factors are rainfall and growth season thermo period. In keeping with its climatic preferences, it is often a component of montane forest to the south of its zone and of lower altitudes to the north. About 45 specimens of exceptional girth have been gazetted by the Conservation Foundation in London, some of which have achieved girths of up to 10.75m. Tentative age assessments have been made using current guidelines, arriving at a possible age for these trees of 2000 years. Some 8000 cuttings have been propagated from these "methuselahs" and planted in the churchyards of England and Wales.

Such gargantuan specimens as have survived these modern times are set apart from the forest herd, treated with reverence and accorded mythic status. These are refuges from beyond the age of reason. A spirit of positive ageism is engendered by the lobby of wishful thinkers and romantics who have made it their totem tree. We cannot test for immortality whilst the trees are still standing, since common decency prevents us from counting their annual rings. Radioisotope dating is imprecise for the time span involved and is defeated by core decay in older trees. Conventional ring count techniques are in any case complicated by the yew's enigmatic propensity for anomalous growth. The typically fluted trunk results from discontinuous growth in different sections of the tree, leading to eccentric lobes which make it hard to locate the core. Dendrochronological analysis relies on core sampling by increment borer. Ideally, sample deviation is minimised by transects from four cardinal points in the stem.

After several centuries, older specimens appear to attain an optimum crown volume whereafter growth waxes and wanes across the tree, increasing sporadically after the collapse of a major component or ceasing altogether for long periods. Until this time, growth rate seems to be quite rapid and a simple formula relates girth to age. Alan Mitchell's rule of thumb remains a better guide than most, and is consistent for trees below a girth of 4.5m. It also reads well in imperial units. This is summarised as 1ft (30cm) in 30 years, give or take 5ft (1.5m) in trees exceeding 22ft (7m). This formula accounts well for a girth of 30ft (10m) in at least 750 years.

John White's system includes adjustments to account for distinct changes in the tree's growth pattern, characterised as formative, mature and senescent phases. After a period of rapid early growth the mature state is reached between 30 and 60 years of age according to site conditions, such as: woodland interior, exposed site, churchyard or parkland. A steady state of 3mm ring width marks the mature phase. Recent dendrochronological analysis of a group of 15 trees

Yew at Ankerwycke in Middlessex c.1840. Was it associated with the Magna Carta?
It is favoured by optimum growing conditions in the Thames floodplain.

at Norbury Park in Surrey, found girths ranging from 1.92 to 7.92m. According to John White's methodology, the oldest of these could be expected to exceed 2000 years of age, since a test fragment demonstrated extremely low growth rate in the "senescent" phase. The assessed minimum ages on this basis were 2536 years (7.27m), 2806 years (7.65m) and 2917 years (7.92m).

Despite its durability, *Taxus* is susceptible to the heart-rotting fungi *Ganoderma lucidum* below a height of 1m and *Laetiporus sulphureus* above. As a result, the core is often decayed in trees exceeding 4.5m girth, confounding attempts to establish a reference curve beyond about 400 years.   Consistent results have however been obtained by extrapolating 'partial' core samples using data from younger trees on the same site.

A reference series has been constructed using data from 12 yews planted around 1700 at Hampton Court Palace, with mean annual growth increment of 1.08mm. Indicator years cross-matched significantly with figures for rainfall and extent of summer growth season recorded at RBG Kew. The unusually high growth rate of these trees supports theories regarding the "heat island" effect of urban environment and underlines the variability of growth. On the

The Ankerwycke yew in 2001: its girth measured 9.43m. Was this a 12th century tree?

other hand, current findings among "wild" northerly yews show an increased ring density compared with southerly "churchyard" trees. A special study of cliff-top specimens indicates that the upper age limit is governed only by the rate of rock mass wasting. These trees are likely to be older still than their complacent churchyard counterparts. Recent studies have also shown a correlation between ring width series in yew and those of oak and lime.

Annual rings of equal width will progressively increase in area as the stem expands over the first 60 years or so. Until optimum crown size is attained, the annual increment of new wood remains constant at about 1.6mm.

John White refers to CAI (optimal cross-sectional area increase), a stage reached in middle age. After this growth stage, growth rings of CAI are maintained at a constant rate (in other words, the rings become progressively narrower). Unfortunately for our growth formula, yew seems able to return to "formative" growth rate at almost any stage of its life. Fortunately for the dendrochronologist, there are indications that despite climate change, core growth in some species of old trees has not varied for centuries. Furthermore, core samples demonstrate a dramatic decrease in growth rates of the largest

trees, implying an age greatly exceeding conservative estimates.

We rely on anecdotal and archaeological data to establish planting dates and supplement this knowledge with intermittent girth measurements. Comparison can often be made where larger trees have been recorded in photographs and engravings. No individual trees were ever recorded in the Domesday Book, but a curious trend might tell us more about the situation of our oldest trees. The current distribution of veteran yews from Kent through the southern counties and along the Welsh borders follows the demarcation line of the Danegeld, and might imply an ethnic cleansing by our Viking invaders. The ancient yew is certainly conspicuous in its absence from East-Anglia. If this prejudice were to be confirmed it would give us another historic baseline.

Stratographic archaeology does provide additional clues in cases where trees form part of a configuration or overlie old earthworks, but even these can be misleading. A celebrated example is at Tandridge in Surrey, where a tree measuring 12m in girth is established close to the foundations of a twelfth century church. An apocryphal story arose regarding the discovery of Saxon vaulting constructed to span an existing root. Had this been so it would certainly have confirmed suppositions of great age. Root material contains clearly legible growth rings and can frequently survive and regenerate following destruction of the tree itself. Unfortunately this evidence has wizened on close inspection.

Clues can be gathered as to the maximum possible age of trees established on earthworks or burial mounds, in association with churchyards or as marker trees near routes of pilgrimage or holy shrines. It does appear that some association exists with the activities of early Christian missionaries, such as the sixth century St Afan at Discoed in Powys. This may be a case of sanctity by association, but does not necessarily imply that such trees were particularly valued or preserved by earlier pagan cults. That they may have been marker trees would make sense in view of their conspicuous character. They certainly seem to have served as meeting places for the hundredal courts or moots, which declined in the twelfth century. Such groups of trees as those at Knowlton in Dorset could possibly have arisen since the last use of the site for saxon burials in the seventh century, but their girths indicate that they could be older still. Churchyard trees could be conveniently dated according to the transition from circular *llan* or *rath* to rectangular yard, if only the timing of this change had been sufficiently clear-cut. Examples such as the ring of 13 veteran yews at Llanelly in Brecon (6m girth at breast height) and those at Llanfihangell nant Melan (7m girth at breast height) were certainly established prior to the thirteenth century.

The National Tree Register lists measurements between 1952 and 1992 and incorporating earlier records. These have been further extended by TROBI.

Records from trees of known planting date include:

- Dryburgh Abbey, Selkirk. A tree planted by the monks in 1136 measured

Propped yew at Crom Castle, Fermanagh. 1902. No longer extant. Very few old yews of any size are to be found in Ireland. Revisionist extirpation?

11ft 4in. in 1896 and 12ft 2in. in 1984. This represents 10in. girth increase in 90 years and 136in. in 758 years, arriving at 12ft in 858 years (John Lowe, 1896).

Some seventeenth century trees have achieved 2.5cm per two to three years for the first 300 years:

- Hughenden, Bucks (1613) measured 10ft (1980).
- Waltham St Lawrence (1655) measured 12ft 11in. (1966).
- Sutton, Surrey (1660) measured 12ft 3in. (1966).

The growth rate of older trees seems to slow, averaging 2.5cm girth over four to 10 years.

Paul Tabbush at Alice Holt has devised a shortcut to yew age estimation based upon extensive sampling of churchyard yews. This maintains the assumption that girth is a function of age, on the simple premise that a plant's

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A yew tree growing from the rubble of Waverley Abbey in Surrey: its gbh is 6.4m. Does it pre-date the Abbey (1128) or the dissolution of the monasteries (1540)?

cells must divide for it to survive. This simplifies the mathematics of John White's formula: Age = girth² ÷ 300cm.

The dating and of yew remains a fuzzy science despite the arsenal of special effects brought to bear by archaeologists and dendrochronologists. Whatever the facts, no upper age limit has been established for this species- there is clearly a case for the ageist lobby as the debate continues.

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