VETERAN TREES & CONSERVATION ARBORICULTURE

Paper presented for Dutch Tree Conference (Boominfodag June 2016)

Neville Fay[1]

Introduction

Twenty years ago I carried out an arboricultural assessment of a population of ancient *native oaks* (*Quercus robur*) in historic parkland. The trees were light-shaded by dense competing natural regeneration. Treatment included thinning of the competition to increase light to the oaks and to manage their stability. As a result a number of old trees declined, which told me I had intervened too intensely. I owe a curious debt to these trees that suffered despite my good intentions (see Fig 1). The experience opened my mind to the possibility that despite being extraordinary survivors ancient and other veteran trees are highly vulnerable to change and hopefully, I have begun to repay my debt by sharing lessons learnt.

Ancient and veteran trees are ecosystems, host-space to above- and below-ground colonising organisms within living and decaying tissues. Together with their trunk and crown systems, their root-soil system (including billions of micro-flora and -fauna) function as an integral living entity. Ancient trees standing sentinel on ancient soil by definition are survivors. In European landscapes great numbers have been assisted on their journey to ancientness by traditional husbandry 'cropping' as pollards. This 'vernacular arboriculture' that has influenced decay processes and hollowing has left a legacy of decomposing wood (saproxylic) habitats for generations of organisms to exploit over centuries.

As arborists we are a product of our time. For decades the value of saproxylic habitat has been overlooked. The influence of different disciplines on arboriculture many '...-logists' (myco-, entomo-, ornitho-, chiroptero-, lichen-) have stimulated a re-evaluation of tree management. Modern arboriculture, operating under a paradigm that confers best value at peak maturity when visual amenity and use-value is optimised, is challenged by these interests in ancient and other veteran trees. We cannot escape being sociologically embedded which determines our psychology and sensibilities, not least our concepts of time. Envisaging the tree's life-journey of trees spanning many

---

[1] Chartered Arboriculturist, Principal Consultant, Treework Environmental Practice, Bristol.

human generations contributes to a heighted a sense of 'tree-time' and influences management objectives and practices is a challenge that underpins conservation arboriculture

FIG. 1 Ancient English oak population, some trees over 500 years old: Intervention to maintain structure and increase light was too rapid and resulting in stress and decline.

Conversations with nature conservation and landscape ecologists have helped illuminate the inter-relationship between trees and wildlife as a complex ecosystem to create a 'knowledge community' for further awareness in the science and good practice for ancient trees and for conservation management of trees in general. The formation of the Ancient Tree Forum in the UK has influenced national policy, guidance standards for veteran tree surveying (Fay & de Berker 1997) and for good management (Read (ed.) 2000, Lonsdale (ed.) 2013).

Dead wood crawling with life

"*Life and death are one thread, two faces of the same sinew*." Lao Tzu

Sometimes the modern world has to re-invent before we can believe underlying truths that earlier times were taken for granted. Since agriculture has added fertilisers and pesticides for over a century, the recent organic movement has had to explain its 'new' alternative method, despite once having been the only available system, such that it did not even warrant a name. The same can be said of our relationship with dead and decaying wood.

Our ancestors supported the tree through its life's journey by pollarding for produce. They intuitively, sustainably managed the tree's water-relations; specifically the transportation distances from root to shoot and in so doing they benefitted the micro-organism ecology that flourished as passengers on the tree-journey through time.

Britain's ancient trees support 2,000 invertebrate species needing dead and decaying woody habitat for some stage of their life cycle (Alexander 2012). Unless we understand trees *as* ecosystems functioning *within* ecosystems, as a mother (or 'ark') carrying dependent wildlife, through inappropriate management we run the risk of not only causing the loss of old trees but also threaten colonising species some of which may be exceptionally rare. Despite 300 million years of co-evolution between trees and fungi (and the relatively recent arrival of man) 20th century arboricultural practice has assumed that it is self-evident that *dead wood removal* is beneficial for the health of the tree (Shigo 1989) and that dead wood is a food source for harmful invasive fungi.

s

A great influence on arboriculture comes from the life's work of Shigo who with a concept of 'compartmentalization of decay in trees' (CODIT) and brought about a respect for the way trees had evolved a special capacity to accommodate and restrict the spread of decay (Shigo 1986). Technical approaches to pruning aimed to respect natural boundaries and the pattern of branching.

The presence of great numbers of ancient trees on old growth and wood pasture landscapes challenges assumptions as to how thousand-year-old trees have survived with decaying and advanced-rotting wood. Certain mycologists have helped to explain by exploring tree-fungi relationships, nutrient recycling and decomposition (Cooke and Rayner 1984; Rayner and Boddy 1988). Today there is wide appreciation of the role of mutualistic, co-evolved mycorrhizal associations that confer health and survival benefits. However as there has been limited study of *endophytic* fungi residing, mostly benignly, within living tissue their understanding is inevitably poorly appreciated. Endophytes that function latently within live tissue challenges concepts of decaying wood and fungi (Rayner 1993) and raises questions about the nature of fungal colonisation and how they get to inhabit living and dead woody tissues.

The tree is *a fountain of the forest* (Rayner 1998) moving ground water to the clouds. As energy is required to move columns of water great distances a strategy is needed to maintain it intact on its journey through vascular columns while maintaining 'pipe integrity' to leaves, departing under evapotranspiration through the stomata. The mystery of this process is described by the cohesion-tension *theory*; for the hydraulic system to work the model that requires air to be excluded.

The present of endophytic fungi within hydrated vessels suggests there is a sophisticated relationship between the tree, fungi, water and air and why endophytic fungi *already present* in the tree may not be inherently hostile, but rather existing quiescent in hydrated vessels. When through bark damage, pruning or other wounding circumstances change, vessel hydration is reduced and results in air ingress; in turn reducing cohesion and causing the chain of vessel-borne water molecules to 'snap'. The resulting in 'air embolism' allows microscopic endophytes to benefit from the oxygen and to flourish and forage. Their changed lifestyle can be observed when the endophytes express their presence through fruiting bodies on exposed wood.

This 'hydrodynamic' model of the tree and its colonising fungal communities suggest the tree may have evolved not so much to defend itself against fungal invasion but rather both fungi and trees being mutually 'plumbed' together have evolved to manage water and exclude air (Cooke and Rayner 1984; Rayner and Boddy 1988; Rayner 1993; Rayner 1998). Freed from dormancy, endophytes expand their territory and are antagonistic to other fungal communities, including those that may seek to enter the tree from outside. Endophytes are inter-competitive and compete against opportunistic ingress-colonisation. Where endophytic species expand their territory against external fungi these circumstances might suggest a tree-endophyte relationship is something akin to an immune system.

Human-time and tree-time

"*Three centuries he grows, and three he stays supreme in state and in three more decays*" (Dryden 1700). Referring to the oak, the poet seems to have well understood how tree-time compares with human-time, recognising that for 300 years the oak tree is in the *developmental phase*, for the next 300 it is in the *mature phase*, after which it enter its prolonged *ancient phase*. We learn that trees have a natural life cycle – from seed through senescence to death (Fig 3).

The human life span is so short by comparison. It is not surprising therefore that we have come to focus on functionality and amenity rather than values associated with the tree's potential lifespan, and where we do this we inevitably cut short the aging process, removing trees at highest mature 'use value', before their veteran qualities begin to flourish.

Developing the faculty to comprehend tree time and imagine how trees may respond to influences requires observation of natural processes. Appreciating that when we intervene (as with pruning) tree responses are slow and gradual *and seldom how we would imagine*. We are not able to witness the effects of our actions over tree-time and are not fortune teller, so probably are wrong in our assumptions.

The sequence of a rare 100-year photographic record of a tree (Fig 2) illustrates rejuvenation, self-pruning and -shaping as the tree interacts with its environment over tree-time. Few tree specialists would foresee these responses.

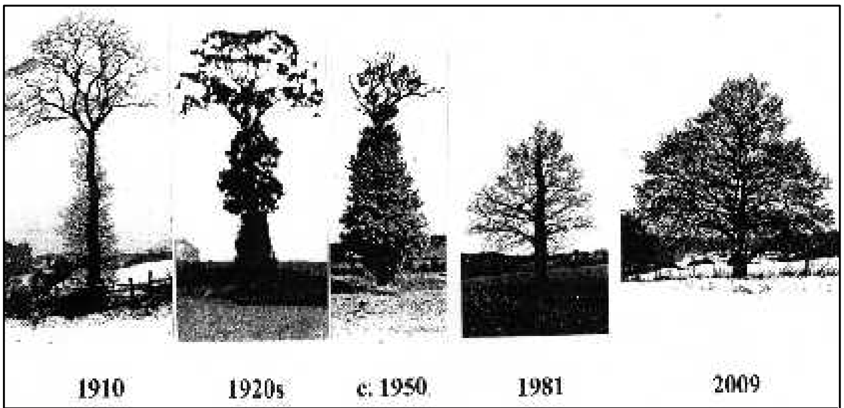

Fig 2: **The Arthur Clough Oak Boars Hill, Nr. Oxford**
A hundred years of aging, sequence shows limitations in our ability to foresee tree's growth natural responses to its environment and events. Photos courtesy of Philip Stewart)

Getting a sense of time is a difficult and yet vital trick. The brevity of our human-time compared to that of trees affords a mere glimpse of the tree developmental processes. Such awareness however is needed to support making management decisions.

The life cycle is key to understanding the aging process, and moreover, what is meant by 'veteran' and 'ancient'.

Fig 3: Ancient oak tree just reaching full-mature state after six human generations (Savernake Forest, England)

The term *ancient* describes an *age class* where the chronological age of the individual is considered in light of the species' life cycle within the scale of typical life expectancy. Ancient trees being true survivors communicate their physiological encounters with history through their body language morphology. The term *veteran* describes the saproxylic habitat quality of the tree from its history of wounding in the aging process as it increasingly becomes host-space for wildlife. A veteran suggests a 'battle scarred survivor' whose body language describes life-experiences and wounding from the effects of shading, drought and storms. Veteran habitat may be initiated 'pre-maturely', i.e. in a non-ancient tree. *Whereas all ancient trees are veterans, not all veterans are ancient.*

A crucial stage of the aging process is just beyond peak maturity. The crown begins to contract (*retrench*), naturally prompted when the roots are unable to finance new peripheral crown extension due to the canopy reaching the maximum potential within growing conditions (Fig 4). *Crown retrenchment defines the onset of the ancient phase* which may be the longest phase (Fay 2002).

Fig 4a (LHS) and 4B (RHS)
Natural crown retrenchment as trees enter the ancient phase beyond peak maturity

The influence of traditional husbandry on the understanding of the aging process

In Europe 'vernacular arboriculture' has taken place for millennia.

There is no model for how one can trade in rot. Modern conventional arboriculture concerns itself largely with how trees and people coexist and has been inevitably influenced by utilitarian models with a somewhat narrow aesthetic range. This has led to trees being assessed for their retention suitability, often considered in terms of their 'safe useful life expectancy'. In this sense arboriculture has also been influenced by forestry in that, at the stage when a tree begins to decay, it declines in commercial value.

Modern arboriculture is different from traditional husbandry methods of pollarding. The latter does not take account of natural branch attachment and might involve cutting between nodes. Observing the way ancient trees have survived through natural branch shedding suggests the 'defence' system may be more complicated through the perspective of tree-time. Conservation arboriculture may go even further in considering artificially mimicking natural pruning; and in special circumstance where ancient tree loss is unsustainably high and habitat creation is becomes a wildlife management strategy and may determine to initiate decay processes in younger trees through wounding sacrificial candidates.

From ancient times works of art reveal the shaping of the European landscape by man and beast with pollard depictions from over three thousand years in pottery and paintings dating from ancient Greece through the Renaissance and beyond (Hæggström 1994). Pollarding created a system combining cutting trees for produce together with using land for grazing, creating landscapes with grassland, scrub and open grown trees (Rackham 1990; Vera 2000). Humans pollarding together with the grazing animals influenced the 'design' of the European cultural landscape. The Enlightenment influenced the way pollarding and hard-pruning were used in ornamental contexts, reflecting aesthetic and pragmatic approaches to tree management in alleyways, boulevards and squares - included pleaching, 'curtain pruning' and topiary (Clair-Maczulajtys *et al* 1999). In Britain since the growth of the Romantic landscape design, municipal trees began to be managed by pruning as urban pollards while in traditional pollarding slowly went out of fashion in the wider landscape (Petit and Watkins 2003).

Ancient pollards teach us that decay has little to do with disease and often much to do with longevity. The oldest trees in European landscapes, particularly in lowland Britain, many in old growth savannah-type wood-pasture, have been lost or harmed through wars as well as 'civilising' influences associated with landscape design, ornamental gardening, intensive modern agriculture and new development and, in recent years, from 'tidiness' and efficient, mechanised working. The pollard tradition had sustained local economies but did not persist into the New World. Without seeing pollards as common features, connecting growth responses to aging is inevitably limited as is the relationship to the aesthetics of decay.

Modern and conservation arboriculture – a synthesis?

Failure to comprehend our relatively short-lived existence compared to that of trees can push in the direction of, though ingenious, mechanistic intervention rather than patient observation. On the other hand drawing on traditional tree husbandry helps to lay a foundation for conservation arboriculture. In the post-war period tree managers played a part in cleansing environments of dead wood and unwittingly deconstructing the next practitioner generation's experience of life processes and in Britain as elsewhere ancient trees have been lost over recent decades from arboricultural management for safety risk-aversion, management for amenity and 'use-value' and sheer ignorance.

This has led to a reappraisal of philosophy, tree science and practice. The tree is clearly far more complex than can be understood through an over-simplified biological model. Veteran trees in their own right are iconic natural heritage due age, history and place in the landscape – and their veteran qualities, *wounds* and *decaying wood*, endow them with intrinsic value as colonising host-space. If the ancient and aging woody structure is an expression of the web of life, observing the trees in general through this 'lens' points to an integrated approach to management and stewardship spun over time. This then is the challenge for conservation arboriculture, to observe through the perspective of the ancient tree, and share and apply this knowledge with conventional arboriculture to arrive at a new synthesis.

References

Alexander, K.N.A. (2012) *What do saproxylic (wood-decay) beetles really want? Conservation should be based on practical observation rather than unstable theory***,** Trees beyond the wood conference proceedings, September 2012

Clair-Maczulajtys, D., Le Disquet, I. and Bory, G (1999) *Pruning trees: changes in the tree physiology and other effects on tree health*. Proc. Int. Symp. On Urban Tree Health. Acta Horticulturae, 496, 317-324

Cooke, R.C. and Rayner, A.D.M. (1984) *Ecology of Saprotrophic Fungi* Longman, London.

Dryden, J. (1700) Palamon and Arcite in *Fables, Ancient and Modern*, Book. 3, Volume l.

Fay, N. and de Berker, N. (1997) *The Specialist Survey Method* Veteran Trees Initiative: Natural England, Peterborough.

Fay, N. (2002), Environmental Arboriculture, Tree Ecology & Veteran Tree Management. *The Arboricultural Journal* **26** (3), 213 – 238.

Green, E.E. Coppicing Like a Beaver *British Wildlife* **11**, 239 – 241.

Gilpin, W. (1791), *Remarks on Forest Scenery and Other Woodland Views', Volume I*, Smith, Elder & Co, London.

Hæggström, C-A. (1994). Pollards in Art, *Botanical Journal of Scotland* **46**, 682-687.

Irving, W. (1835) *Abbotsford and Newstead Abbey* John Murray, London.

Johns, Rev. C.A. (1882) *The Forest Trees of Britain* SPCK, London.

Petit, S. and Watkins, C. (2003) Pollarding Trees: Changing Attitudes to a Traditional Land Management Practice in Britain 1600-1900, *Rural History* **14**(2), 157-176, Cambridge University Press.

Rackham, O. (1990) *Trees and woodland in the British landscape* Dent & Sons Ltd, London.

Rayner, A.D.M. and Boddy, L. (1988) *Fungal Decomposition of Wood – Its Biology and Ecology* Wiley, Chichester.

Rayner, A.D.M. (1993) New Avenues for Understanding Processes of Tree Decay. *The Arboricultural Journal* **17** (2), 171 – 189.

Rayner ADM (1998) Fountains of the forest: the interconnectedness between trees and fungi. *Mycol. Res.* **102**, 1441-1449.

Read, H. (ed) (2000) *Veteran trees: A guide to good management*. Natural England, Peterborough.

Shigo, A.L. (1986) *A New Tree Biology* Shigo and Trees Associates, Durham, New Hampshire.

Shigo, A. (1989) *A New Tree Biology* Shigo and Trees, Associates, USA.

Vera, F.W.M. (2000) *Grazing Ecology and Forest History* CABI, Oxford.

Note: This paper develops ideas presented at the International Society of Arboriculture 87th Annual Conference, Parramatta, Australia, July 2011 (http://www.isa-arbor.com/). I acknowledge Philip Stewart for the images of the "The Arthur Clough Oak" and friends and colleagues at Treework Environmental Practice (http://www.treeworks.co.uk) and Ancient Tree Forum (http://www.woodland-trust.org.uk/ancient-tree-forum) for challenging philosophies and for life changing opportunities to experience ancient trees.