Conservation Arboriculture

Learning from old trees, artists and dead poets

Neville Fay MA (Hons), MICFor, MArborA, FLS, FRGS, FRSA

Introduction

Conservation Arboriculture, while being informed by the natural sciences, also draws from cultural traditions, the humanities, arts and other sciences, to develop a holistic approach to tree management.

Fifteen years ago I was asked to carry out a conventional arboricultural assessment of an ancient population of English oak trees in a thousand acre historic parkland. This led to a salutary lesson. Intervention was intended to improve the light reaching important old trees and to manage their stability. By intervening too intensely, a small, though significant number of the veteran trees declined. Strangely I owe a debt of gratitude to those trees who suffered despite my good intentions.

The experience unexpectedly led to a new development between arborists and specialists involved in invertebrate, lichen and fungal communities associated with dead wood (saproxylic) habitat. These conversations opened up the inter-relationships between trees and wildlife as a complex ecosystem – they also served to consolidate the formation of the Ancient Tree Forum (ATF) as a ‘knowledge community’ engaged in furthering awareness, science and good conservation practice for ancient trees. The ATF collaboration has always punched above its weight, influencing national policy, publishing standards for veteran tree surveying (Fay & de Berker, 1997) and guidance on good management (Read, 2000).

Ancient English oak population in a well-visited historic deer park: some specimens over 500 years old, mostly with extensive trunk decay and vertically drawn from overtopping young vigorous trees. Intervention was needed to maintain structure and increase light. Too rapid, intensive intervention risks inducing tree decline or loss.
Ancient and veteran – tree time

I had been taught that trees have a natural life cycle, they set seed, grow old.

From these early beginnings, the arboricultural paradigm began shifting from the planning, planting and maintaining of trees in safe and amenable condition, to considering trees as ecosystems operating within ecosystems, as keystone species for dependent wildlife. Britain’s ancient trees support 2,000 invertebrate species dependent on their dead wood habitat for some stage of their life cycle. When an old tree is lost, so are the colonising species.

These events and exchanges were consciousness changing experiences. I had been taught about pests and diseases, to protect trees from biological harm. The perspective now rather focused on health, what might constitute a functioning above- and below-ground ecosystem, and about what might tip the balance towards disease. Theoretically, given favourable circumstances, trees through their vegetative capacity, could live forever. Given that ancient trees are by definition natural survivors living for hundreds and even thousands of years, immersed and infused with microorganisms, the question arises - what creates the grounds for pathogenicity or a spiral of decline? To integrate these implications, theorists and practitioners need a conceptual framework that draws on an understanding of natural processes as a basis for developing mature tree management strategies and enhancing ancient tree longevity.

Sometimes the modern world has to re-invent things before we can believe in their veracity, which in times past had been taken for granted. After a century of adding fertilisers to the soil to increase agricultural productivity, the organic movement emerged to explain an alternative - as if this was something new, when before the chemical processing of fossil fuels it was all anyone knew and therefore at that time it did not even need a name.

Washington Irving, a nineteenth century American author, was moved by the trees of Sherwood Forest (England) to describe “…mighty trunks of veteran oaks, the patriarchs of Sherwood Forest…shattered, hollow and moss grown…noble and picturesque in their decay…ruins of their ancient grandeur” (Irving, 1835).

Had the ATF existed when Irving visited Sherwood, he would without doubt have been a member. His colloquial observations should not be lightly dismissed. They show arboricultural and ecological imagination, aware that trunk diameter (mighty trunks) reflects age, shattered broken branches, decay and hollowness suggest veteran qualities, and that these being associated with moss grown (having colonising epiphytes) are all pointers to the trees’ ancientness.

Travel and the comments of travellers open our eyes to things we may take for granted. 175 years ago Irving clearly found ancient trees of Sherwood remarkable for their antiquity, referring to ‘veteran’ and ‘ancient’ as descriptive terms. In describing the features of decay and age, he applies terms more recently used to understand the trees habitat qualities.

Getting a sense of time is a difficult trick and a key aspect of the ‘arboricultural imagination’. Observing trees through their life cycle allows a glimpse of evolutionary time and natural processes to support the arborist in everyday management decisions. The life cycle is key to understanding the aging process, and what is meant by ‘veteran’ and ‘ancient’.
Neville Fay, Chartered Arboriculturist, Principal Consultant, Treework Environmental Practice, Bristol, UK
Chair of Ancient Tree Forum (1998 – 2011)

An ancient tree is one that is old for its species. The term ancient describes an age class where chronological age of the individual is considered in light of the species’ life cycle and typical life expectancy. A veteran tree has woody (saprophylic) habitat derived from wounding and the aging process, through which the tree becomes host to wildlife. In this sense a veteran might be thought of as a ‘battle scarred survivor’, who having been through the wars has tales of experiences and wounding. The physiological effects of damage, shading, drought and storms initiate veteran habitat and can occur ‘pre-maturely’ in a non-ancient tree. Whereas all ancient trees are veterans, not all veterans are ancient.

We seldom witness the long term effects of our actions. Developing the faculty to comprehend tree-time, to imagine how a tree will respond to influences requires close observation of natural processes to appreciate that when we intervene, (e.g. pruning), growth responses occur slowly and probably not how we would have imagined. The Arthur Clough Oak (below) is a rare 100-year photographic record sequence of a tree, illustrating how, most tree specialists would not have imagined the rejuvenation responses or the long term self-pruning and shaping by the tree.

Crown retrenchment and retrenchment pruning

We think of an ancient as having the wisdom of the ancestors. So it is with ancient trees, who, being true survivors, communicate through their body language (morphology) their physiological encounters with history. It is for us to develop the skills necessary to interpret their form to understand how we can enhance their longevity and support today’s trees becoming tomorrow’s ancients.
A crucial stage of aging is when the crown of a fully mature tree begins to *retrench* (when nutrient and water supply lines from root to crown periphery start to reduce). This is naturally prompted when the roots are unable to finance new peripheral extension, being limited by the canopy having developed to its maximum capacity. *Crown retrenchment* defines the onset of the ancient phase - often the longest phase. Retrenchment can occur many times in the tree’s lifespan (Fay, 2002).

Observing crown retrenchment gives a pointer to ways the arborist can mimic this natural process for conservation management of important heritage trees.

The poet John Dryden touched on how tree-time compares with human-time, describing the oak as patriarch of trees with “shoots rising up and spreads by slow degrees”…

> “Three centuries he grows  
> And three he stays supreme in state  
> And in three more decays (Dryden, c. 1700)”

So Dryden had an arboricultural imagination, perceiving the English oak as having a natural longevity greater than 13 human life spans, of 900 plus years. He understood natural ageing, that oak was in its *developmental phase* for 300 years, in the *mature phase* from 300 – 600 years, beyond which was the prolonged *ancient phase* (these phases are tree age classes).

Given that the human life span is so short by comparison, it is not surprising that we home in on functionality and amenity rather than values associated with the tree’s potential lifespan, and in so doing this inevitably leads to cutting short the aging process, removing trees at highest mature use-value, before their veteran qualities begin to flourish.

The Arthur Clough Oak – a hundred years of aging: It is hard to imagine this is one and the same tree. Without harnessing our arboricultural imagination we are limited in interpreting how trees will respond over ‘tree time’, naturally and with intervention. Probably most of us would not have imagined even the next stage of growth and the trees rejuvenation response. By developing this faculty, working with the principles of conservation arboriculture, observing natural processes, we can build up techniques for reversing the age clock, when attempting to enhance tree longevity. (Thanks are due to Philip Stewart, Boars Hill for these images.)

Neville Fay,  
Chartered Arboriculturist, Principal Consultant, Treework Environmental Practice, Bristol, UK  
Chair of Ancient Tree Forum (1998 – 2011)
Working towards a holistic approach

The British landscape holds a large proportion of Northern Europe’s ancient trees, many being pollards, (trees that are cut for wood products while being out of the reach of grazing animals). These ancient pollards in savannah-type wood-pasture have taught us that decay has little to do with disease and often much to do longevity. The oldest trees in many European landscapes have been lost or harmed through wars and ‘civilising’ influences, and in recent years from tidiness and efficient, mechanised working. Failing to comprehend our own relatively short-lived existence compared to the trees, pushes us in the direction of mechanistic, ingenious intervention rather than patient observation.

Britain has also lost many ancient trees in recent decades, when no longer considered ‘safe’ or ‘useful’ – this has raised passionate discourse between tree people, nature conservationists and owners, increasing the momentum of Conservation Arboriculture. Neither have tree professionals escaped a modernising tendency to a safer, more sanitised environment, free from the risks of aging trees. Tree managers have played their part in cleansing environments of dead wood, impoverishing biodiversity and unwittingly deconstructing the younger generation’s experience of living processes - all suggesting a responsibility to reassess arboricultural principles, to review assumptions that in some instances may be considered unchallengeable.

The dead wood – the hidden resource

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

Despite 300 million years of co-evolution between trees and fungi (and the late arrival of man on the scene) the view that “dead wood removal is good for the health of the tree” (Shigo, 1989), as a scientifically valid and intuitively self-evident principle, has in large measure driven arboricultural practice to the present time, based on an assumption that dead and decaying wood are food sources for ‘invasive’ harmful fungi.

Neville Fay,
Chartered Arboriculturist, Principal Consultant, Treework Environmental Practice, Bristol, UK
Chair of Ancient Tree Forum (1998 – 2011)
Inspired by Shigo’s dictum that “education starts when you doubt something (1989)”, seeing trees in their later stages of life, prompts questions about how thousand-year-old trees survive with copious dead, decaying and advanced-rotting wood. The view that dead wood is harmful is challenged by mycologists exploring tree-fungi interrelationships, fungal colonisation, nutrient recycling and decomposition (Cooke and Rayner, 1984; Rayner and Boddy, 1988). Despite wide acceptance of mutualistic mycorrhizal associations between fungi and tree roots, a new emerging appreciation of endophytic fungi as latent organisms within live tissue has challenged accepted wisdom and practice about dead wood and fungi (Rayner, 1993), demanding reconsideration of the view that fungi operate inherently as invasive pathogenic organisms (Shigo, 1989).

Guidance on retrenchment pruning based on Individual Tree Management Plans (ITMPs) for high value trees - this takes account of likelihood of losing the tree from structural failure and/or declining vitality within a management plan period, typically of 30-years. The diagram shows staged, fine peripheral pruning, and is not to be confused with functional ‘roundover pruning’. The technique is used to good advantage in restoring old and mature trees under stress. The timing of year for pruning is important.
The tree–fungi–water system

Modern research highlights the significance of tree hydrology. Investigations into endophytes demonstrate that tree-related fungi are capable of several modes of behaviour and that the macroscopic expression (i.e. when fruiting) arises under fairly uncommon conditions, influenced by the tree’s hydrology—a ‘hydrodynamic’ model of the tree and its fungal communities.

Crown retrenchment pruning to ancient pedunculate oak pollard at Richmond Park, England - carried out on a declining tree with hollow, fragmenting trunk (one of 830 ancient pollards being studied). Pruning is designed to promote rejuvenated external and lower internal crown growth.

600 year old ancient pollard beech (*Fagus sylvatica*) in southern England cut for its produce: the tree shows high vitality, is completely hollow and has been for the past century. The pollard regrowth (now multiple small trees) at one time would have been cut on a cycle depending on the type of use, for which the wood was required. Such rejuvenation cutting has contributed to the tree longevity.

Neville Fay,
Chartered Arboriculturist, Principal Consultant, Treework Environmental Practice, Bristol, UK
Chair of Ancient Tree Forum (1998 – 2011)
The tree, having evolved to move water great vertical distances, requires a strategy to maintain water conducting ‘pipe integrity’. This ‘cohesion-tension theory’ requires the exclusion of air for the hydraulic system to function. Endophytic fungi are already present in this system in quiescent form in hydrated vessels (circumstances that prevail for many years). When sapwood hydration significantly reduces (through pruning and wounding) water molecule cohesion is disrupted, causing the chain of vessel-borne water to ‘snap’ (air embolism). Under these circumstances endophytes flourish and forage, benefitting from available oxygen, changing their mode of behaviour, eventually expressing their macroscopic presence emerging as fruiting bodies on exposed wood.

Rayner shows that, once freed from dormancy, fungi are greedy for territory, and highly antagonistic to other fungal communities. Given that endophytes compete strongly between one another and against opportunistic colonisation from other outside fungi, there is a case for characterising the relationship between endophytes and the tree as an immune system.

Conclusion

The tree is clearly a far more complex organism than can be understood by an over-simplified biological model. Conservation Arboriculture explores the tree as an ecosystem and through the lens of co-evolution develops holistic-approaches to management. The internal topography of an aging woody structure, infused with a network of fungal hyphae, progressively hosting communities of invertebrates and other organisms, together expresses the web of life that is the ancient tree – a web that is certainly worth conserving.

Acknowledgement

I am grateful to Nigel de Berker for discussing these ideas with me.

Treework Environmental Practice may be contacted on their website www.treeworks.co.uk

The Ancient Tree Forum may be contacted on their website www.woodland-trust.org.uk/ancient-tree-forum

References