Conservation arboriculture: Maintaining old trees in the human landscape

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FOR MANY PEOPLE, TREES are just another part of daily life. While everyone relies on, and many even take for granted, the ecological benefits trees provide every day, people's interactions with trees are often limited. From time-to-time they might rake up leaves or prune a few branches, and even fewer may at some point in their lives plant a tree. But few people realize that trees, like works of art, stories, or historic buildings, can also be part of a shared cultural, spiritual, and natural heritage. Trees, therefore, deserve the same care and attention that is devoted to maintaining other heritage artifacts, especially as they enter into old age. This article explores how trees can become important heritage artifacts, why maintaining heritage trees is important, and what strategies can be implemented to assess and maintain such trees for the benefit of current and future generations. (**Fig. 1**)

In recent years, several groups and individuals have proposed definitions of what a 'heritage tree' might be. Some relation to a historic person, event or period, outstanding specimen characteristics, significant landmark function, or a number of other attributes may contribute to the heritage value of an individual tree or group of trees. Recently, Dr. Cecil Konijnendijk noted that trees in urban forests may help groups and individuals form a sense of identity, particularly in relation to a place they call home. Heritage trees also provide tangible linkages to places people once called home, or where others may call home in the future. (**Fig. 2**)

Trees and humans have shared the same landscapes for millennia. Over time, people learned to use trees for the direct benefits that they could provide. Through management systems such as pollarding and coppicing, they developed 'working trees' (a term coined by researcher Ted Green) and used them for products

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Figure 1. (Left) A very large and old valley oak in Kenwood, CA. A progressing failure in a large scaffold could have resulted in removal. The defect was mitigated by pruning and the level of risk was greatly reduced. ***Photo: B. Hagen***

Figure 2. (Right) Trees like these 300 year-old Southern Live Oaks (*Quercus virginiana*) on the grounds of the historic Oak Alley Plantation are a good example Heritage trees. ***Photo: B. Hagen***

Figure 3. (Left) Pollarded London Planes (*Plantanus* x *hispanica*) like these, are common place throughout France. *Photo: B. Hagen*

Figure 4. (Right) A very old veteran oak in England. A large portion of the upper crown has failed in the past, but has since been replaced by newer growth. *Photo: provided by Neville Fay*

such as fuelwood, building materials, and even food. For thousands of years, such trees provided rural peoples with a livelihood and a reliable means to sustainably harvest everyday products and materials.

As times changed, people increasingly moved from the countryside into towns and cities, and in some locations the old management systems became impractical or unnecessary. The Industrial Revolution required coal to feed its steam engines and so the traditional coppiced forests were largely abandoned. Pollarding, once a key means of preventing browsing by domestic animals, became largely reserved for formal gardens and street trees in industrializing areas. However, in many parts of Europe, pollarding still goes on or in some places has recently been re-started. (**Fig. 3**)

Arborists, foresters and tree advocates in the United Kingdom eventually began to rediscover the ancient working trees that dotted the landscape. Many were "escaped pollards" (also coined by Ted Green) or coppices, far too large to be workable but reminiscent of the shape and low spreading growth form which once made them so valuable to rural people. Many of these trees were found in former royal preserves, while others could be found in hedgerows or regenerating forests. Many are very old for their species, with some exceptional individual trees exceeding 1000 years of age. Such longevity was often made possible through past pollarding, which encouraged canopy rejuvenation and reduced static loading on trunks and branches. Such management also enabled pollarded veteran populations, often found as collections of open-grown trees, to become rich reserves of biological diversity for invertebrates and other saproxylic organisms (those dependent on decaying wood habitats).

Wherever they were found, these trees stood as monuments of times past. In 1993 a group called the Ancient Tree Forum (ATF) began to come together to discuss these trees. By 1996, the group had launched the Veteran Tree Initiative (VTI), a collaborative effort with government agencies and nature conservation groups, to develop a standard for the identification, assessment, management and protection of these 'veteran' heritage trees in the United Kingdom. The VTI identified thousands of such trees across the UK and in Europe, and perhaps more importantly, articulated the cultural and ecological importance of these trees in towns, cities and the countryside. (**Figs. 4-5**)

Through their own work and that of other European researchers, veteran tree advocates began to increase their knowledge of tree life stages. Many foresters and arborists still lack knowledge about how trees age and progress to their old or ancient life stages. In fact, many trees in the urban forest labelled as 'over-mature' or 'senescent' (**Fig. 6**) are routinely removed just as they begin reaching true middle age, at the time when their habitat value is just beginning to increase. What causes these removals is a lack of understanding about the natural changes in tree physiology that take place as trees grow older. As part of these natural processes, larger limbs are shed, cavities develop, and many trees naturally begin a phase described as 'canopy reiteration' or 'retrenchment', whereby they become shorter and wider as they economize on energy allocation and transport distances. As such, they may begin to slowly decline in scale, from the top down, and lower sections may continue living for many more years. Effective management of veteran and heritage trees requires an understanding of these processes as natural survival strategies.

Figure 5. (Left) Many veteran trees are hollow, yet they remain standing because their crowns are usually significantly smaller than others of similar age. Note the adaptive growth that has helped strengthen the stem. *Photo: provided by Neville Fay*

Figure 6. (Right) An example of a senescing oak. With a proper pruning strategy, and regular monitoring, this tree can be maintained for many years. *Photo: B. Hagen*

This knowledge of tree life phases is no longer new and uncertain; all arborists and urban foresters should become aware of the specific traits associated with aging trees, and begin to manage the human landscape in ways which protect and promote the many benefits such old trees provide. For instance, Mats Jonsell, researcher at the Swedish University of Agricultural Sciences, has found that veteran lindens in urban Swedish parks contain levels of biodiversity comparable to or greater than their counterparts in natural forests. In North America, work by Professor Steve Sillet at Humboldt University has shown that the oldest trees in redwood forests contain the greatest amount of biodiversity, precisely because of the many microhabitats found, characteristically in features correlating to those most often considered by arborists as structural 'defects'. Such research highlights the importance of saproxylic (dead wood) habitats for a variety of species, and the role of old trees as 'arks of biodiversity' throughout long periods of time. Apart from their role in providing habitat, the greatest proportion of benefits such as air quality improvement, stormwater retention, shading and energy conservation are typically provided by the largest trees in urban settings, as they have the greatest leaf area. (**Fig. 7**)

The challenge for responsible arborists is to sufficiently understand the structural tree features conventionally termed 'defects' and to be able to make balanced judgements about their significance as habitat. In this way tree owners can be appropriately informed about these attributes together with their associated risks. This requires an evidence-based approach that avoids risk-aversion, so that management decisions can be based on real risks and also account for tree decay response strategies such as compartmentalization or compensatory adaptive growth. Inappropriate judgements about the body language of trees will likely result in substantial intervention, including major limb pruning or whole-tree removal, possibly at the unnecessary expense of habitat and biodiversity values. (**Fig. 8**)

Figure 7. Large Sierra redwoods (*Sequoiadendron giganteum*), like this one provide extensive habitat in its crown and in the slowly decaying wood of its lower stem. *Photo: B. Hagen*

British arboricultural consultant and veteran tree specialist Neville Fay identified twenty commonly found characteristics of veteran trees which many urban foresters and arborists would typically consider 'hazardous', and also identified important ecological interactions of floral and faunal species dependent on each of these common defect characteristics. Considered alongside the work of Jonsell, Sillett and many others, this suggests a responsibility for arborists to carefully consider the quality of habitat when assessing trees. The Specialist Survey Method (SSM), devised by Fay and the VTI, is an effective means to record and analyze these features at a tree population level.

Figure 8. (Left) An example of adaptive growth that must be considered when assessing tree risk. ***Photo: B. Hagen***

Figure 9. (Right) Sonic tomography allows arborists to detect internal decay noninvasively. ***Photo: Frank Rinn***

The appreciation of the ecological interactions between characteristics of a defect and its habitat potential contributes to a more holistic perspective of tree inspection and management. This approach takes into account the risk and condition of trees without undue reliance on defect-oriented methodologies. While the identification and assessment of the significance of defects is integral to tree risk assessment, it should not drive the entire tree management process at the expense of heritage and ecological values. Finding ways to assess these positive characteristics will lead to a more balanced and proportionate tree management approach that accounts for risk while appropriately identifying important ecological and heritage values.

Fortunately, modern arboriculture has progressed greatly – especially in the field of tree risk assessment. Today, advanced assessment methodologies such as tree radar, thermal imaging, sonic and electric impedance tomography, static-load testing and others are available to experienced and progressive practitioners. These tools contribute to evidence-based tree risk assessment and can help arborists determine whether to, and how to, invest in the retention of veteran trees in the human landscape. They are also supported by an ever-growing body of research and knowledge which allows new insights into tree biomechanics – particularly the effects of internal decay on strength loss and stability. In doing so, these methods can help support arboricultural prescriptions designed to maintain mature, veteran and heritage trees in reasonably safe condition, or provide real justification when removal is deemed necessary. (**Fig. 9**)

A number of time-honored methods applied by arborists to reduce risk or promote tree longevity can also be applied to veteran trees, albeit sometimes in creative and novel ways. Dynamic cabling is one successful method of risk reduction, reducing the likelihood of stem failure while allowing the cabled tree to maintain some of the flexibility necessary to stimulate the growth of reaction wood. Strong dynamic or static cables can also act as fail-safe devices for failure-prone limbs, catching them should they fracture. The likelihood of introducing decay is also significantly reduced, as dynamic cabling systems do not require drilling to install fixed anchoring points such as eye bolts. Another method is propping, which is used extensively in many parts of the world but has not yet gained much traction in North America. Props are not appropriate in all circumstances, but can be designed to carefully balance the needs of the tree with other important considerations such as aesthetics. (**Fig. 10**)

Perhaps the most effective method of risk mitigation and veteran tree maintenance, promoted by many veteran tree advocates, is the practice of 'retrenchment pruning.' This method seeks to replicate the natural ageing process and involves directed pruning of the outer canopy to stimulate internal growth, sometimes even employing internodal heading cuts. Such pruning also reduces the wind sail area of a tree's crown and long lever arms, thereby reducing the overall risks associated with failure during significant loading events such as wind or ice storms. Opponents of this methodology point out the commonly-accepted consequences

Figure 10. An example of a prop being used on a a Oregon white oak. ***Photo: B. Hagen***

associated with topping: weak branch attachments, vigorous sprouting and poor decay compartmentalization. Its proponents maintain the view that the judicious application of such pruning methods forms just one part of a long-term commitment to the tree, which must include a regular maintenance and monitoring regime. The overall objective of such a maintenance program, which may be somewhat reminiscent of historical pollarding and coppicing techniques, is to maintain a reduced size and enable the long-term retention of the tree. Proponents of this methodology also contend that such measures cannot be applied across the board, but may be applicable for special cases, particularly among trees of high landscape, biodiversity and heritage value, when determined appropriate by arborists or others experienced in veteran tree management techniques. (**Fig. 11**)

The latter point highlights a simple truth that underlies the entirety of conservation arboriculture and veteran tree management: it is still an evolving discipline, and the key to its success will be experience, innovation, experimentation, knowledge transfer and adaptation. Those involved are playing a part in a new knowledge community. Veteran trees are, by nature, survivors, and can considerably outlive our professional life spans. However, as mistakes can lead to irreplaceable loss, it is important that practitioner experience, and contributions from other disciplines are shared. While some attempts to maintain veteran trees on the human landscape may fail, the benefits derived from the successes will far outweigh the costs. As arborists and urban foresters move towards a greater understanding of the life stages of ageing trees, the benefits associated with their retention, and the tools and techniques for their management, future generations will reap the rewards of these living monuments to cultural and natural heritage.

Figure 11. An example of 'retrenchement' pruning on this old oak. ***Photo: B. Hagen***

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