Assets and Liabilities of Large Old Trees in Urban Landscapes

Tuesday, August 11, 2015; 8:30 to 11:00 am; Osceola Ballroom D; A, M, Bm

Symposium abstract: Urban trees generally live a shorter life than their forest counterparts. Yet in many cities, a small number of trees reach great size and age. These trees may be pre-settlement trees left in place during a city's growth, or trees planted early in the life of a city. Although not common, large old trees are significant assets and sometimes significant liabilities to cities. The symposium will begin with two case studies of ancient tree management in urban landscapes and then address risks and benefits and risk management of large urban trees. The symposium will conclude with a panel discussion on emerging guidelines for management of large trees in urban environments. This symposium is sponsored by the Urban Tree Growth & Longevity Working Group of AREA and ISA.

Opening Remarks [8:30-8:35 am]

Moderator: Bryant Scharenbroch; Chair of Urban Tree Growth & Longevity Working Group; University of Wisconsin – Stevens Point and The Morton Arboretum

Elderly Trees are Quite Different From Young Trees [8:35-9:05 am]

Presenter: Norm Easey; Chief Executive Officer of Florida Chapter ISA

Abstract: Their appearance, physiology, needs, cultural tolerances, and other aspects require unique attention. As arborists it is essential that we understand these differences and change the way we interact with elderly trees. This session will discuss, in very simple basic terms, how to identify elderly trees, discuss the contrasts from younger trees, and discuss how as arborists our treatments of elderly trees need to adapt.

Managing Mature Trees Under Limited Water/Drought Conditions [9:05-9:35 am]

Presenter: Lara Schuman; Program Manager of Urban Forestry Program Parks and Recreation Department; City of Austin, Texas

Abstract: The City of Austin, Texas has an estimated 200,000 trees in managed park lands. Of this population, roughly half are considered to be established trees, and about 7% are mature trees. In 2011, Texas experienced one of the worst drought years in history, resulting in a loss of an estimated 5.6 million urban trees. Drought has persisted in the state, leaving the lake system which supplies water to the City of Austin at extremely low levels. The City has had watering restrictions in place for several years now, and without significant rainfall, is expected to further restrict water usage. This has made protecting the mature trees in our parks even more challenging. This presentation will outline the steps that we are taking to manage our mature trees through this time of drought and water restrictions, and how we are attempting to engage the community to help.

Longevity and Management in Ancient Urban Trees of the Bluegrass [9:35-10:05 am]

Presenter: Tom Kimmerer; Chief Scientist at Venerable Trees, Inc.

Abstract: When the Bluegrass region of Kentucky was settled in the 1770s, there were extensive woodland pastures consisting of very large, open-grown trees shading grass and cane. This habitat was created by bison and drought. Farmers had little reason to cut down the trees, and today there are still thousands of acres of ancient woodland pastures. As urban areas grew, many of these trees were lost. Fayette County, Kentucky, lost 90% of its bur oaks in the last 60 years. Many trees remain in urban areas. These trees are slowly disappearing due to development, poor management and lightning strikes. The Old Schoolhouse Oak is a case study in careful management of an ancient bur oak in a new housing development. A clear understanding of physiologic condition and root distribution, removal of competing vegetation, avoidance of damage by construction equipment and lightning protection are contributing to the preservation of this iconic tree

Preservation of Large Trees at the University of Pennsylvania [10:05-10:35]

Presenter: Jason Lubar, Associate Director of Urban Forestry; The Morris Arboretum of the University of Pennsylvania

While all trees within our urban landscapes are valuable, large trees play a particularly vital role as the most important green infrastructure element. Large trees provide the greatest environmental, economic, and social benefits, and fundamentally contribute to the health and welfare of almost 80 per cent of the US population and over half the world population living in urban areas. However, as a tree grows and tree-related benefits increase, tree-related risk concurrently increases, since large, mature specimens are more likely to shed increasingly larger branches or develop conditions predisposing the whole tree to failure. This presentation will discuss how tree-related risks and benefits are assessed and evaluated, and how tree owners and managers strive to balance their risk tolerance with the many benefits trees contribute to our urban communities.

Panel Discussion: Developing Guidelines for Management of Large, Old Trees [10:35-11 am]

Moderators: Jake Miesbauer; The Morton Arboretum and Bryant Scharenbroch; Chair of Urban Tree Growth & Longevity Working Group; University of Wisconsin – Stevens Point and The Morton Arboretum

Longevity and Management of Ancient Urban Trees in the Bluegrass

Tom Kimmerer
Chief Scientist
Venerable Trees, Inc.

Background. When the Bluegrass Region of Kentucky was settled in the 1770s, settlers found extensive woodland pastures of very large, open-grown trees shading grass and cane. This habitat was created by bison and drought. Farmers had little reason to cut down the trees, and today there are still thousands of acres of ancient woodland pastures. The woodland pasture habitat exists only in two places in North America, the Bluegrass and the Nashville Basin of Tennessee. Woodland pastures are also found in the United Kingdom, Romania and Russia. E. Lucy Braun referred to this habitat as "the most anomalous vegetation in North America."[1]

The trees of the woodland pastures that have survived for 300-500 years or more include three oaks – bur oak, chinkapin oak and Shumard oak – blue ash, and kingnut, also known as shellbark hickory. These are long-lived, drought-tolerant trees with the typical form of very old open-grown trees.

As cities in the Bluegrass and Nashville Basin grew, many of the woodland pastures were cleared for development. Since 1950, Fayette County, the most urbanized part of the Bluegrass, has lost 90% of its bur oaks based on repeated sampling. We assume that there has been proportional loss of the other ancient tree species.

Despite the loss of woodland pastures, many ancient trees remain today in city parks, yards, school grounds, corporate and college campuses and industrial areas. A few are even street trees.

This history makes Lexington and other cities in the Bluegrass, and perhaps in the Nashville Basin, unique in having a large population of urban trees that are much older than the city.

Current Condtions. The ancient urban trees of Lexington are scattered all over the city. A few are isolated individual trees, but many more are in groups. For example in one city park, there are six very large, very old blue ash trees, but an exploration of nearby neighborhoods shows that there are at least a dozen more in front and back yards, including not only blue ash, but the other four species as well. One chinkapin oak that had to be removed was 435 years old at 14 feet above ground.

These trees typically show the signs of great age: smooth bark or smooth patches; low stem taper; high stem sinuosity; crowns of few, thick and twisting limbs; low crown volume; a low leaf area to trunk volume ratio.[2] To these criteria described by Neil Pederson, we would add that leaves of our ancient trees are often tufted at the ends of branches, and in deep-furrowed bark like bur oak, we may not see the smoothing or smooth patches seen in the other species.

It is conventional wisdom that old trees like these must be growing very slowly. Recent research has shown that very old trees do not slow down, but actually accumulate carbon faster than younger trees.[3] We see this in our old Bluegrass trees. Although we do not yet have diameter growth data, measurement of shoot growth shows that the ancient trees are growing as fast as or faster than other urban trees.

Nevertheless, our ancient urban trees show signs of canopy retrenchment, the natural process of reduced height growth and greater canopy breadth seen in very old, open-grown trees. Most have significant wounds, stem cracks and other defects that come naturally with age.

Threats. The greatest threat to the continued existence of our ancient trees is urban development. Many trees have been felled as land was cleared for housing, industry or commercial development. Efforts to preserve trees in urban developments have mostly been half-hearted, with little attention paid to adequate root protection, lax enforcement of construction preservation rules, or post-development neglect.

Another source of mortality is modern lawn care. Heavy mowing equipment damages stems and surface roots and compacts soil. Heavy use of fertilizer and pesticides to maintain pristine lawns is anathema to the health of large, old trees.

A third source of mortality is lightning. The majority of our ancient trees, both in urban areas and in woodland pastures have been hit by lightning. A lightning strike sometimes causes immediate mortality, with a tree dying within days or weeks of a lightning strike. This is probably due to complete death of the vascular cambium when current passes through the entire cambial layer. Lightning can also cause a cryptic form of death, when a strike kills the roots system, but the stem and crown survive for a few more months. Trees sometimes lose all or part of the crown but are able to build a new crown from epicormic branching. The most common effect of lightning is the death of a strip of cambium and phloem and cracking of the xylem.

One interesting difference in tree longevity between woodland pastures of Europe and those of the Bluegrass is that trees in Europe seem to achieve greater age. Woodland pasture trees in Great Britain often live longer than a thousand years, while we have no known trees that old in the Bluegrass. Part of this difference may be due to shorter periods of record keeping in North America and the difficulty in aging very old and often hollow trees. Another difference may be in lightning frequency. Lightning strikes on trees in the Bluegrass are about fifty times more likely than in England, based on the spatial and temporal patterns of lightning strikes in the two places.

One important problem of these old trees is how best to manage them so that they can live out their full life span even under the stressful life of a city tree. A case study of one tree may provide some guidance.

The Old Schoolhouse Tree. A large bur oak stands on a hill top overlooking a large area of houses, apartments, churches and schools on the south side of Lexington. This tree has a history of controversy: there have been more articles written about this tree in the local paper, the Lexington Herald-Leader, than any other tree. On fourteen occasions, the tree has been considered newsworthy. In almost every case, the news was that there was some existential threat to the tree due to development. The tree is called the Old Schoolhouse Oak, as it sits a few hundred feet from one of the early schoolhouses in the area.

Until recently, the tree occupied one of the few operating farms in the urban part of Fayette County. The County has very strict land use regulations to protect our valuable horse farms that form an emerald ring around the city. The setting of an urban service boundary, with development encouraged inside the boundary and discouraged or prohibited outside has left only a few hundred acres of farm land in the city proper.

In 2008, a developer attempted to get a permit to remove the Old Schoolhouse Oak, but opposition from local residents blocked this effort. Further development efforts were stymied by opposition to the loss of the tree until one developer, Ball Homes, made a commitment to preservation of the tree. Ball Homes, in collaboration with Venerable Trees, Inc and Big Beaver Tree Service jointly developed a tree preservation plan which was approved by the city planning commission. The plan did not entirely win over opponents of the development, but eventually the city provided the necessary permits to move the project forward.

The tree preservation plan began with a careful, noninvasive inspection of the tree. The inspection showed that the tree was growing rapidly, with no signs of decline. Tap tests indicated that decay was not excessive. Later inspection with a borescope through a woodchuck burrow showed that, while the tree was hollow there was a substantial amount of solid wood.

The tree had lost its top in the past but remaining branches were sound. We removed a few lower branches that were damaged. No upper crown pruning was necessary. We installed a 6-point lightning protection system to ANSI standards.

The most critical part of the protection plan with the creation of a 0.75 acre tree protection zone, with a minimum distance to a road cut of 75 feet. The protection zone was surrounded with a six foot chain-link fence clearly labeled as a tree protection zone. Building contractors were forbidden to enter the protection zone for any reason. We removed all vegetation, including other trees, from within the protection zone using hand tools with no entry by vehicles. We used no herbicide.

As soon as the vegetation was cleared, we covered the protection zone in a layer of kraft or bogus paper and covered the entire area with six inches of coarse hardwood mulch. In the two growing seasons since the protection zone was cleared, few plants have come up in the zone, and most were on top of the paper and easily removed.

As part of the site evaluation, a cultural anthropology consultant dug soil pits looking for signs of old human habitation and found none. We extended the depth of these pits and sampled roots and soil to four feet. The soil was Maury silt loam at least to the four foot depth of our sample. In spite of this deep rich soil, we found no significant (>1 cm) bur oak roots in any of the 35 pits. Black walnut, hackberry, and honeysuckle roots were abundant. This indicated that bur oak was deeply rooted in karst rock with limited contact with the surface. We believe this to be a common root distribution pattern in ancient Bluegrass trees.

Further evidence to support the absence of surface roots came in 2015, when we used an air tool to create a 3 foot deep trench 65 feet east of the tree stem. The purpose of this inspection was to see if it would be safe to alter the slope leading down to the nearest road and thus avoid the need for a retaining wall. In a trench 96 feet long at a radius of 65 ft from the stem, we found abundant dead walnut and hackberry roots and live honeysuckle roots but no bur oak roots > 1 cm in diameter.

The lower stem of the tree had about 60 holes that appeared to be exit holes of cerambycid beetles. Passing a wire into the holes indicated that they did not go deeper than the outer bark, which was >15cm thick. To determine whether these holes represented a current problem, we mapped every hole on the surface of the bole from the base of the tree to a height of 7 inches, and marked each hole with tree paint. In two subsequent growing seasons, we have seen no new exit holes. We believe the holes are a result of past infestation, not an ongoing problem.

As construction of the housing development nears completion, we are preparing for the next stage of the protection plan. The intent of the plan is to create a low-impact recreation area within and adjacent to the protection zone. An area of mulch to about the drip line will be maintained, with the remainder of the area planted in grass or ornamental perennials and shrubs. No herbicides will be used in the recreation area and there will be no structures or solid-pavement sidewalks. The mulched area will accumulate leaf litter to maintain nutrient cycles. Fertilizer will not be applied unless there appears to be a slow-down in growth.

This tree is very prominent. It sits atop an embankment about 30 feet above busy roads below. It is exposed to fetching winds from the west, and this is a major consideration in the stability of the tree. The protection zone is large enough that the tree would not pose a threat to any structures if it were to fail.

I am often asked "how long will the tree last?" To which, of course, there is no answer I can give except to say somewhere between one day and five hundred years. I believe, based on several lines of evidence, that this tree is at least 450 years old, but we will never know for sure. My hope is that this tree will be there for many generations of people to enjoy. By taking a minimalist approach to protecting this tree, without aggressive pruning, cabling, fertilizer or pesticide use, we believe that we have provided this tree with the best opportunity for its continue existence. Regular inspection will guide any future treatment.[4]

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[1] Braun, E. Lucy. 2001. *Deciduous Forests of Eastern North America*. Blackburn Press.

[2] Pederson, Neil. 2010. "External Characteristics of Old Trees in the Eastern Deciduous Forest." *Natural Areas Journal* 30 (4): 396–407.

[3] Stephenson, N. L., A. J. Das, R. Condit, S. E. Russo, P. J. Baker, N. G. Beckman, D. A. Coomes, et al. 2014. "Rate of Tree Carbon Accumulation Increases Continuously with Tree Size." *Nature* (January). doi:10.1038/nature12914.

4 This article is based on Kimmerer, T.W. 2015 Venerable Trees: History, Conservation and Biology in the Bluegrass. University Press of Kentucky.