4-2010

Veteran Tree Management Strategies at the Morris Arboretum

Daniel Patrick Church

Veteran Tree Management Strategies at the Morris Arboretum

Title: **Veteran Tree Management Strategies at the Morris Arboretum**

Author: **Daniel Patrick Church**
The Walter W. Root Endowed Arborist Intern

Date: **April 2010**

Abstract:

The purpose of this paper is to consolidate and synthesize the modern arboricultural views and practices regarding Veteran Tree management in an attempt to create a dynamic management structure for the veteran trees at the Morris Arboretum of the University of Pennsylvania.

INTRODUCTION

Veteran trees are a vital part of our cultural landscape. They provide aesthetic beauty, historical context, and perhaps most importantly, serve as a vessel for the continuation and evolution of a myriad

of wildlife habitats. These old and revered trees are found anywhere from public gardens, to parks and private homes. They are an intrinsic link to our past both as a society and an ecosystem and a conscientious approach to their management is essential for their survival.

Fortunately, there has been a resurgence of awareness concerning veteran trees in recent years, and as a result of efforts such as the Ancient Tree Forum in the UK, more informed decisions are being made within the arboricultural and extended community. It is my goal to extend this line of thought to embrace the Morris Arboretum and its collection of magnificent veteran trees.

As opposed to much of the surrounding urban forest, here at the garden we have a unique opportunity for experimentation. We have the capacity to aid these veterans along in their life as well as help to perpetuate the intricate communities of organisms that have co-evolved with them. If we are to do our best to fully understand the complexities of veteran trees, a longitudinal collection of data and observations concerning individual veteran trees needs to be accumulated to provide future arborists and horticulturalists with a dynamic management structure that is able to grow and evolve with the Morris Arboretum.

UNDERSTANDING THE AGING PROCESS

As with all other plants, the longevity of trees is attained through a relationship between genetic potential and environmental conditions. This connection between the effects of the physical environment and tree morphology was described by Patrick Raimbault during the second European Congress of Arboriculture, where he identified a morphological progression for a "standard" tree. Using this as a basis, Raimbault could apply a diagnostic procedure to "identify and interpret variations from the standard progression in order to indicate physiological disturbances in the state of the tree" (Fay, 2007).

The life of a tree then, as Raimbault points out, is separated into ten stages. The first grouping (stages 1-5) concern the development of the tree from seedling to early maturity where increased branching complexity takes place. Apical dominance is observed as well as proliferation of the root system to accommodate the above ground growth and crown structure.

In the next phase of development (stages 6-8) the crown continues to fill out and begins to exhibit a loss of peripheral vitality, some loss of under-branch growth, and the beginning of reiterative growth within the inner crown. With the initiation of inner crown growth and its vascular connection to the root system, the outer crown begins to die back. During these middle stages, root death begins to develop along with increased fungal colonization consequently leading to internal trunk decay.

The final phase of tree morphology (stages 9-10) exhibits the reduction of the crown as resource transfer between the root system and the canopy is shifted to lower regions of the trunk and crown. New shoots arising from dormant or adventitious buds on the trunk and branch system maintain foliar function as the outer crown continues to condense. At this point the longevity of the tree is largely dependent on the mechanical stability of the crown along with the anchoring potential of the root system. The success of the remaining vascular and cambial columns within the trunk to serve the tree is also crucial to its ability to rejuvenate and continue through a cycle of some or all of the stages 1 through 10 (Fay, 2007).

While in reality, the aging process of a tree can be a great deal more complex; this outline of morphology offered by Raimbault provides the investigative arborist with a framework to interpret individual trees.

PROBLEMS WITH DEFINITION

One of the major difficulties concerning veteran trees is how to go about defining them. According to Neville Fay, a managing director and arboricultural consultant with Treework Environmental Practice, the term "veteran tree" gained widespread acceptance upon the inception of the Veteran Trees Initiative, a four year collaboration led by English Nature. This initiative, spearheaded by the Ancient Tree Forum (ATF), intended to "raise awareness, provide training, clarify best practice, and harmonize survey methodology" (Fay, 2007).

As a result, the ATF defined a veteran tree as one "that is of interest biologically, aesthetically, or culturally because of its age, size or condition" (Read, 2000). It is important to note that while this is not necessarily a precise definition, there are three guiding principles that aid in interpretation:

- Trees of interest biologically, aesthetically, or culturally because of their age
- Trees in the ancient stage of their life
- Trees that are old relative to others of the same species.

In much of the literature concerning veteran trees, the terms veteran, old, and ancient, are often used interchangeably. While this does not pose a serious problem, the nomenclature is constantly the topic of debate and it is necessary to differentiate the three.

When the term "old" is used, it generally refers to the chronological age of the tree. "Veteran" on the other hand depicts a tree that has been through traumatic events in its life and has survived. It therefore may have had an "accelerated passage through the ageing process through abiotically induced, physiological stress and wounding" (Fay, 2007). If a tree is termed as "ancient", it "implies inherent stature" (Read, 2000), and has taken a more gradual path down the ageing process. One must display caution when using these terms however as girth and age alone are not reliable indicators due to the fact that different species and individuals have markedly different life spans and grow at different rates (Read, 2000). Despite the discrepancies between the different definitions and terminology concerning veteran trees, it is still possible to identify and recognize true veterans through an understanding of the aging process of trees as well as specific characteristic features found on them.

IDENTIFYING A VETERAN

With an improved understanding of the aging process of trees, it is necessary to consider what features are associated with the later stages of life and hence veteran trees. Outlined below are some of the major features that are used to qualify a veteran tree:

Hollowing

Established trunk hollowing within a complete circumference is a most important indicator of a true veteran and is very closely linked to the aging process. Any hollowing in the trunk or major limbs is important though extensive trunk hollowing is indicative of a tree of great age for its species. Following the normal aging process fungal decay may progress through the root system in the heart of the trunk and may form large cavities or become continuous creating an entire or partially enclosed cylinder. Such sites are extremely rare when in an advanced state and the changing quality of the woody substrate amalgamates into ever finer and 'soil-like' material (typically in ancient pollards). This latter stage indicates trees of great age and habitat of high conservation significance.

Rot sites

Rot sites associated with wounds that are decaying

Following bark loss, wounding or limb loss wood may be colonized by fungi and other microorganisms. Rot is typically visible on the surface of the tree following bark disruption or damage. Rot sites may be apparent within the stem or branches or where a stem or branch has fractured and the wood become colonized by fungi. Such sites can then become important for a range of saproxylic species.

Holes & Water pockets

Holes and Water pockets in the trunk and mature crown

Rot holes can develop through limb loss and bark wounds, and are expanded by digestive activity of microorganisms (particularly wood decay fungi) and invertebrates, and when inundated can form water pools. They can become occupied by invertebrates, mammals, reptiles, birds and bats.

Dead wood

Dead branches or stems

Dead wood may be fallen or remain attached. It is typically colonized by decay fungi and depending on its hydration, exposure, and elevation may support different suites of species. Extensive (Larger than 20cm in diameter) standing or fallen dead wood is of value. Note: Dieback alone is not sufficient for inclusion in this survey as an indication of the presence
of dead wood.

Tears, Scars, Lightning strikes

Tears, scars, lightning strikes result in exposed woody tissue

Exposed woody tissue from bark loss associated with shedding limbs or lightning strikes may be veritably compartmentalized. Tissue quality may be variable depending on extent, fungal decay activity, exposure and elevation on the tree.

Live stubs

Naturally fractured, truncated live stems or branches

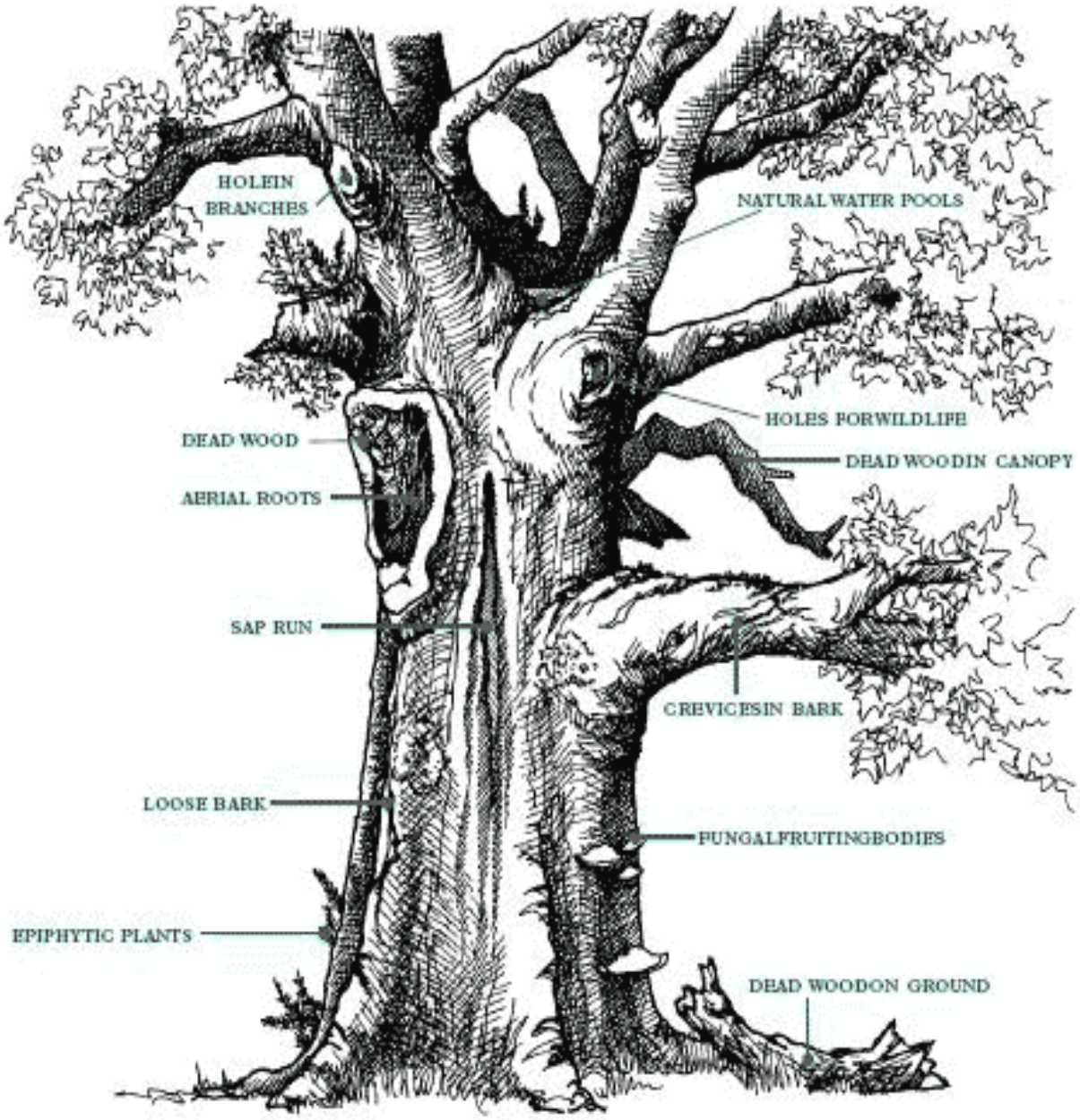
Live growth associated with fracture ends and shattered tissue creates a large surface area for microorganism colonization. Such wound can be very variable in the type of habitat they offer for colonization and can develop in hollow branches.

Fungal fruit bodies

Fruit bodies of fungi typically associated with wood decay.

(Fay, 2007)

The characteristic features associated with veteran trees can be observed within a veteran tree in the diagram below:



(Read, 2000)

MANAGEMENT

Why are veteran trees important?

…those grey old men of Moccas, those grey, gnarled, low-browed , knock-kneed, bent, huge, strange, long-armed, deformed, hunchbacked misshapen oak men that stand awaiting and watching century after century biding God's time with both feet in the grave and yet tiring down and seeing out generation after generation.

The Reverend Francis Kilvert, 1876.

Veteran trees, like the ones described above, have served to inspire artists and writers for centuries, as well as people in all walks of life. Noteworthy specimens such as the Major oak at Sherwood and the Fortingall yew have become key tourist destinations, and through their individuality possess high intrinsic appeal and character. As a survivor from the past, each tree serves as a relic of a previous landscape. They are living documents that tell us of former management practices both to the individual tree itself as well as its place in the surrounding land.

Why manage veteran trees?

Management of trees and woodlands has changed significantly over the years. From managing pollards and coppices for firewood and leaf fodder for animals, to public parklands for recreation, each generation has helped to change and shape the way we view the trees of our landscape.

In general, the objectives of veteran tree management include:

- Promote longevity
- Avoid rapid depletion of the trees stored energy reserves causing stress
- Encourage growth in the lower regions of the tree
- Promote habitat
- Manage succession
- Public Safety

MANAGEMENT OF VETERAN TREES FOR HABITAT

One objective of management that I would like to highlight is habitat. When managing a veteran tree for its habitat value, one needs to keep in mind that while veteran trees are highly individualistic, they are not a single organism. Instead, veteran trees are a complex, highly interconnected community of organisms, all of which are crucial to the habitat.

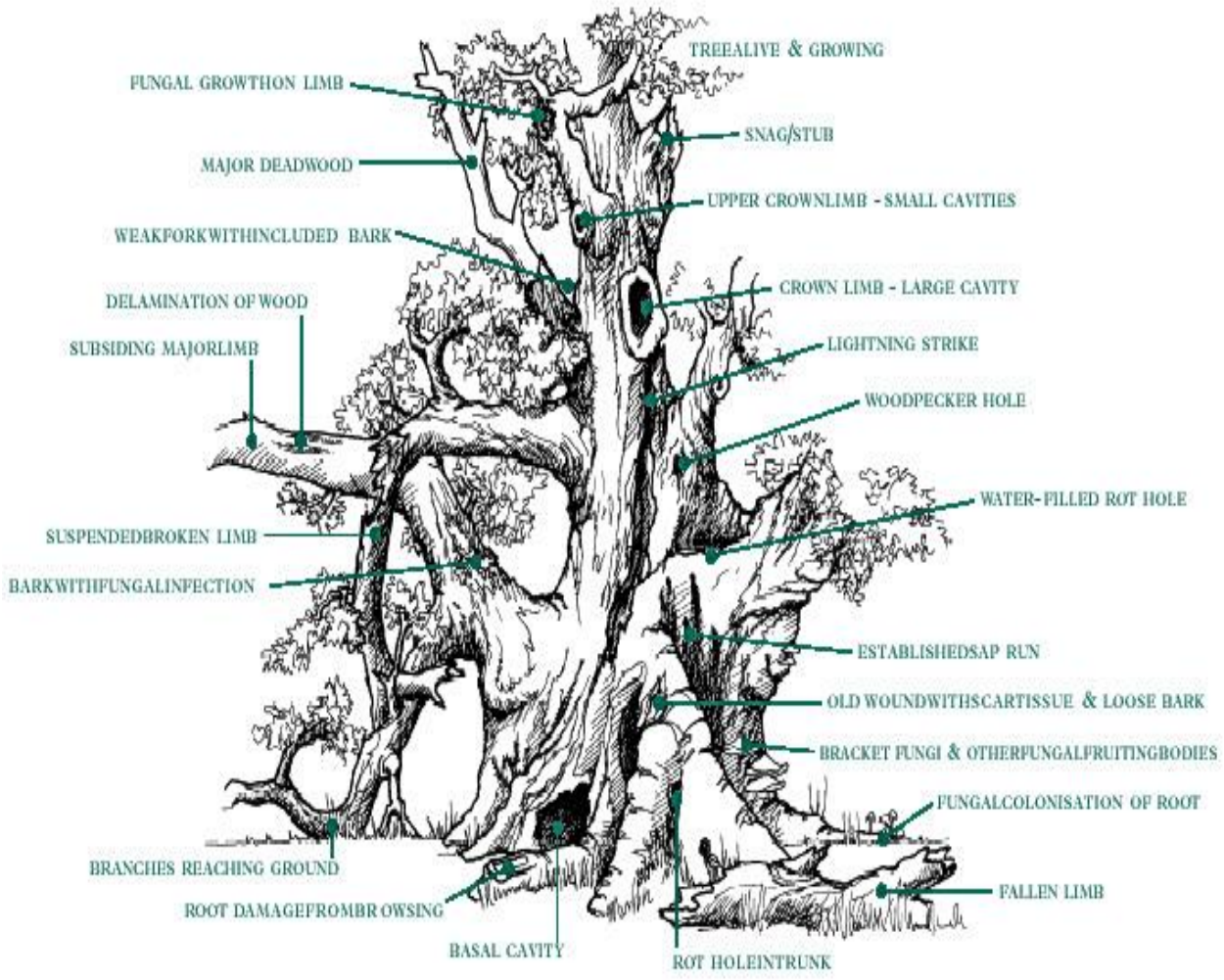
The basis of the habitat that a veteran tree provides is almost entirely dependent on the amount and diversity of dead and decaying wood. While these two descriptions are often used interchangeably, it is necessary to differentiate between them as dead wood is simply a physical state that the wood is in, whereas decaying wood is a process that the wood is going through which involves numerous stages.

The crucial distinction in relation to habitat is that there needs to be a wide range and diversity of dead and decaying wood in the veteran tree as the multitude of species residing in veteran trees require specific conditions to thrive. An example of this includes decaying wood both in the canopy as well as on the ground. In the canopy, the crevices and cavities often associated with deadwood play host to a wide range of vertebrate species such as birds, squirrels, and bats. Some species of bird can excavate their own holes to live in, but most require the naturally occurring cavities. Bats on the other hand prefer tighter crevices or cracks instead of cavities. Deadwood on the ground conversely allows fungi and insects an opportunity to cycle nutrients back into the soil through decomposition.

Ideally, there should be deadwood present encompassing different sizes, moisture levels, stages of decay, amounts of sunlight, and temperatures to ensure the most diverse community of species. On the following page is a diagram highlighting the ideal characteristics of a veteran tree for wildlife habitat:

(Read, 2000)

An 'ideal' veteran tree for wildlife.



In terms of the continuation and co-evolution of the species that are associated with ancient trees, careful consideration should be taken when choosing the next generation of trees to plant on the site. Many species of flora, fungi, and invertebrates are highly specific to certain tree species and if it is desired to perpetuate these species on a site, retain the same species for the future plantings to provide a host to these organisms in years to come.

Proximity of veteran tree habitat must also be taken seriously on a site. If veteran trees are spaced to far apart or are clustered in one area leaving others completely void, the organisms will not be able to spread. An example of this is how bats require specifics lines of flight between their nesting sites, inhibiting their spread if there is not adequate habitat close by. (Read, 2000)

MANAGING FOR RISK

In an ideal situation, a tree would be allowed to progress through the aging process in the most natural way possible and be able to dismantle without human intervention. This is feasible in some settings such as farmland or woodland where there is very low risk of injury to people or property. At the Morris Arboretum however this is not the case. Inherent with being a public garden, there is a great deal of pedestrian traffic as well as important infrastructure. Therefore if it is desired to maintain our veteran trees within this setting, it is essential that risk is taken into account.

Within the law, the owner of any tree has a duty, known as the duty of care, to take reasonable care to avoid acts or omissions that he or she can reasonably foresee would be likely to cause harm. It must be noted that it is impossible to eliminate risk one hundred percent. The only method of doing this would be to cut down every tree and that is obviously not the desired outcome. This duty of care then simply means that any owner of a tree must do all that is within the scope of their power and knowledge to prevent harm to others. (Read, 2000)

As a result of an increased understanding of the aging process of trees and natural growth responses to wounding and mechanical stress, there are improved methods of predicting how and why trees fail (Shigo, 1994). Examples such as heavily included bark in the branch unions, signs of root decay, or severe end weight on branches illustrate hazards associated with tree failure. By identifying those hazards that pose unacceptable levels of risk and managing for them, it is possible to conserve the cultural, landscape, and habitat values of veteran trees without compromising public safety.

It is also necessary to identify specific targets on a veteran tree site that would be compromised if a tree were to fail. Due to the historic value of many of the buildings on the Arboretum grounds, different approaches to veteran tree management might be necessary for those trees in close proximity to buildings. Regardless of whether it is people or property that are at risk, the main focus is the need to identify those specific targets which are at risk and adequately manage for them to avoid legal implications. (Read, 2000)

As stewards, it is necessary to determine which of these specific reasons pertain to our site and the outcome that is desired. A plan serves to make all those associated with the site aware of what is being done and why as there may be several different ideal management options depending on the point of view taken by an advisor.

Because of this, it is important to recognize that there is no single “right” way of managing and all aspects need to be considered to make an informed judgment. Regardless of

which option is chosen however, if the tree is not saved, all the values associated with it are lost (Read, 2000).Taking this into consideration, a management for a specific site can aim to:

- Ensure continuity of management over time
- Bring together people involved in the management of the site and achieve consensus
- Manage multiple uses and potentially conflicting interests on the site
- Relate the site to the wider ecological and social context
- Attract resources or visitors
- Ensure that management can be achieved within the resources available
- Promote and publicize the site

(Read, 2000)

MANAGEMENT STRATEGIES

Individual Tree Management Plans (ITMP):

When creating a plan, it is crucial that every tree is treated as an individual, as different management options and prescriptions are needed for different trees. Certain species respond better to tree surgery work and others may have a higher tolerance to environmental factors such as exposure to high winds. Consequently, each individual plan should contain separate sections which:

- **Record the existing attributes of the tree/site:** Are there particular wildlife and surrounding historical features that are of high importance? Does the tree species typically respond well to pruning?

- **Give information about the site:** Does standing water continually gather around the roots? Is the tree exposed to a higher intensity of sunlight due to loss of neighboring trees? It is most often the case that there are a number of factors affecting the health of a veteran tree and not just one.

- **Identify the site's value and significance:** Is it an area where people often congregate? Is there potential for visitor interaction and education?

- **Explain what management is intended to achieve:** Not merely for the plan to be a means to an end but what continued contribution will a plan provide to the specific site and surrounding environs. This can include, but is not limited to managing for habitat continuity, reducing soil compaction, or solely intrinsic value.

- **Say who will do what, when, and what resources are required:** This allows future site managers to contact specific personnel and inquire about management decisions, work done, or financial requirements. This information is not only intended for stewards of said specific site, and can be incredibly useful as case studies for people trying to manage other sites entirely.

- **Provide a way of checking the effectiveness of the site management:** Determine a timeline of treatment. Typically large old trees respond slowly to changes and a systematic cycle of return assessments are necessary to monitor and record observations. (Read, 2000)

One important clarification pertains to the synonymous use of site and individual veteran tree. When taking into account a specific veteran tree, the tree and its immediate surroundings become the "site". This allows the manager to consider each individual site as its own micro-ecosystem and then apply that knowledge to the greater surrounding area. Therefore, there can be multiple different veteran tree sites within one single property.

An ITMP is rooted in the understanding that while trees in their later stages of development tend to show low tolerance to major disturbances of their growing conditions and environment, they

frequently respond and adapt well to minor changes phased over an extended period. Based on an analysis of the viability assessment outlined above, if it is feared that a tree is likely to be lost from a decline in vitality and/or from structural collapse, an ITMP is created involving the following:

- An assessment of the risk of mechanical failure within a period of thirty years
- An assessment of the tree's tolerance to disturbance by assessing the tree's vigor (vital capacity of the tree [inherited characteristics]) and Vitality (current vital signs particularly the form of the tree and how it has responded to past and current growth conditions).
- Based on the above assessment, if it is considered that the tree is compromised from structural failure it is important to assess whether it is possible to reduce the crown height and the branch end-weight (or branch length) to improve structural stability.
- If the answer to the above is yes then it is necessary to decide what the ultimate/optimum height and branch-weight (or length) that is estimated could be tolerated by the tree.

(Fay, 2005)

TREATMENT PHASE & CYCLE

An Individual Management Treatment Plan is inherently a long term process as old trees respond and adapt at a much different pace than younger vibrant specimens. A Treatment Phase is the total duration that the plan extends through. It serves as an estimate of the period of time that is necessary to stretch the arboricultural treatment and achieve the objectives set forth in the IMTP. Treatment cycles are the total number of treatments and the period of time between each treatment (Fay, 2005).

To formulate an appropriate Phase (duration) and Cycle, it is first necessary to estimate the final reduced height and/or branch length that the tree can withstand based on its observed vitality. It is also important to keep in mind the ultimate size of the wounds that will result from the reduction.

While treatment cycles generally involve a number of operations, the first operation or Intervention Treatment can sometimes be the most crucial. If vitality is moderate to high and the tree can withstand the reduction in foliar mass, this intervention begins the retrenchment pruning regime and is the first step toward the modified crown. This first step will often be a more finely tuned rejuvenation treatment of *known* extent, usually starting with the outermost crown margin, with later stages being *predictive*. This predictive aspect is important when considering the ITMP as both the Treatment Phase and Cycle should be viewed as dynamic processes where changes can be made in accordance with the newest observations and analysis (Fay, 2007)

RETRENCHMENT PRUNING

Perhaps the most important rule in determining whether or not to prune a veteran tree is that THERE SHOULD BE NOTHING DONE TO IT UNLESS THERE IS A CLEAR DEMONSTRATEABLE NEED. Remember that the focus is to keep the trees alive and generally speaking, seek to do as little cutting as possible. That being said, it is usually the case that crown modification is necessary in the form of pruning.

"Retrenchment Pruning is the staged reduction of a tree's crown intended to mimic the natural ageing process" (Fay, 2005). During the transition from the mature stage of growth to ancient status, the trees hormone regulation mechanisms begin to modify in the canopy leading to die-back and the proliferation of growth in lower internal portions of the crown. The appropriateness of retrenchment pruning will be in accordance with the assessment of the trees tolerance to disturbance (Vigor and Vitality). Some guidelines that are useful in helping to see if a tree is likely to respond well to pruning are listed below:

- How has the tree responded in the past to minor tree surgery work?
- How have other trees of the same species on the same site (or close by) responded to cutting?
- How do trees on the same site respond to accidental damage not associated with planned tree surgery?
- Is it a species with a good reputation (like willow) or a bad one (such as beech)?
- Is it a suitable shape, i.e. is it relatively easy to leave small branches close to the bolling after cutting?
- Has it been pruned before? If so, how long is it since the tree was last cut (the shorter the time the more likely the response is to be good)

Keep in mind the importance of returning to monitor and evaluate the pruning cuts for many years after the initial trials as there are numerous examples of circumstances where a tree has responded well initially but died years down the line, almost certainly as a direct response to the cutting (Read, 2000).

NATURAL FRACTURE PRUNING AND CORONET CUT

Two techniques often used today in modern arboriculture are natural fracture pruning and coronet cuts. These are both methods aimed at mimicking the way tears and fractured branches naturally occur on branches and trunks. Coronet cuts in particular are a type of natural fracture technique that is particularly focused on imitating the jagged edges routinely seen on broken branches resulting from storm damage.

Natural fracture techniques are preferred to traditional chainsaw cuts by many environmental arborists, as the "eye" produced by a traditional cut is an unnatural flat plane surface that is never found in nature. The myriad of nooks and crannies produced by fiber separation and splintering along numerous planes not only opens up much more surface area for dormant buds to grow, but it also provides ecological niches that are colonized by microorganisms and succession species (Fay, 2003).

INDIVIDUAL VETERAN TREE MANAGAGEMENT INVENTORY SHEETS AND VISUAL AID

Taking into account all of the aspects of an ITMP that Neville Fay discusses, I thought that it was necessary to create a longitudinal collection of data for each tree that is determined to be managed as a veteran here at the Arboretum. Aside from the actual decisions concerning which trees to treat as veterans, I thought that the next most critical tool in managing these trees was a way to pass on their information and management strategies to future generations of arborists or horticulturalists at the Morris Arboretum.

To accomplish this I thought that a veteran tree inventory sheet would be an ideal method of documenting each tree and would serve as a way for future managers to examine the progression of management techniques and provide an opportunity to look into the minds of past managers and examine trends. As an ever evolving volume that is constantly being amended and added to as the tree undergoes work, storm damage, or changing environmental conditions, these inventory sheets provide a context and human connection between those involved in veteran tree management.

My inspiration to create a veteran tree inventory sheet came from working on a daily basis with a similar sheet created by Alena Klimesova, a previous intern at the Arboretum. After performing work on any tree, one of these sheets would be filled out to record various information such as diameter at breast height, canopy spread, hazards within the tree, or the presence and condition of cables and braces. The information would then be used to create a database of the trees at the Arboretum and their condition.

The one problem that I had with these sheets however was the impersonality of the information exchange between the arborist who had worked on and observed the tree and anyone who might follow up on the tree at a later date. While this did not so much pose a problem for monitoring healthy adolescent or mature trees, due to their highly individualistic nature and inherent risk of failure, I thought that there needed to be a more elaborate and precise form of communication concerning veteran trees. It was my goal in creating the new inventory sheets to build upon the framework that Alena had provided to create a venue where a manager can specifically and in great detail describe the condition of the tree and the subsequent management decisions that are necessary.

Along with the sheets I thought that it was necessary to have the accompaniment of a visual aid. To do this, with the help of Imogen Anderson, we created illustrations of veteran tree candidates. These illustrations, adapted from photographs of the trees, allow the background “noise” of the surrounding landscape to be eliminated, allowing a very detailed view of the tree. Individual branches, cavities, or other defects can be precisely highlighted on the illustration and are very helpful for future examination.

It is my hope that the inventory sheets along with the veteran tree visual aids will provide a tangible tool for managers of the veteran trees at the Arboretum to better communicate and document their thought processes in the greater goal of creating a dynamic veteran tree management structure that will grow with the Morris Arboretum.

BIBLIOGRAPHY

Davies, Caroline, Neville Fay, and Charles Mynors. *Veteran Trees: A Guide to Risk and Responsibility*. Working paper. English Nature, 2000. Print.

Fay, Neville. *Defining Age and Surveying Veteran and Ancient Trees*. Working paper. March 2007. Treework Environmental Practice. Web. <www.treeworks.co.uk>.

Fay, Neville. *Individual Tree Management Plans (ITMP'S) and Retrenchment Pruning*. Working paper. Treework Environmental Practice, August 2005. Print.

Fay, Neville. *Natural Fracture Pruning Techniques and Coronet Cuts*. Working paper. Treework Environmental Practice, 2003. Web. <www.treeworks.co.uk>.

Fay, Neville. *Notes on Arboricultural Techniques for Veteran Trees*. Working paper. Treework Environmental Practice, 2002. Web. <www.treeworks.co.uk>.

Fay, Neville. "Towards Reasonable Tree Risk Decision Making?" *The Arboricultural Journal* 2 (2007): 143-61. Web.

Mattheck, C., D. Lonsdale, and Helge Breloer. *The Body Language of Trees: a Handbook for Failure Analysis*. London: H.M.S.O., 1994. Print.

Read, Helen. *Veteran Trees: A Guide to Good Management*. Natural England, 2000. *Natural England*. Web. <www.naturalengland.org.uk>.

Shigo, Alex L. *Modern Arboriculture*. Durham, N.H.: Shigo and Trees, Associates, 1994. Print.

Shigo, Alex. *New Tree Biology*. [S.l.], 1986. Print.

Individual Veteran Tree Management Plan (ITMP)

Date: DBH:

Accession Number: Crown Diameter:

Scientific Name: Tree Height:

Risk of Mechanical Failure:

Defects:

Changes/Notes in Surrounding Environment:

Significant Events:

Tolerance to Disturbance:

Vigor:

Vitality:

Wildlife/Habitat:

Treatment Phase:

Treatment Cycle:

Work Record:

Date:	Personnel:	Work Done:

Considerations: