

Tree Inventory and Analysis



Treefull Communities, LLC



Why is this Inventory Needed?

- 💧 Evaluate the Village's trees
- 💧 Maximize benefits and minimize problems



What are the advantages of the Tree Inventory ?

- 💧 Increased awareness
- 💧 The data establishes the baseline for tree information



Practical goals that can be realized are:

- Improved response
- Efficient scheduling
- Realistic budget requests
- Improved relations



Data Collection and Inventory Methods

Location (GPS)

Identification

Tree Size (DBH)

Condition Rating

Tree Problems

Maintenance Actions

Pruning/Removal Priority Rating

General Notes



The Village of Pinehurst Urban Forest



Results

- ◆ Number of trees
- ◆ Species diversity
- ◆ Tree condition
- ◆ Tree size
- ◆ Tree problems
- ◆ Maintenance actions



Recommendations

- ◆ Removal and pruning
- ◆ Retention and maintenance of larger trees
- ◆ Structurally prune young trees
- ◆ Increase species diversity



Tree Problems

<i>Problem</i>	<i>Number of Trees</i>
Deadwood (Minor)	28
Codominant Stems	19
Cavity in Trunk	16
Damage to Trunk	9
Deadwood (Major)	8
Decay in Trunk	6
Cavity in Crown	3
Structural Issues	2
Topped	2
Decay in Crown	1
Dieback	1
Leaning	1
Pests/Diseases	1

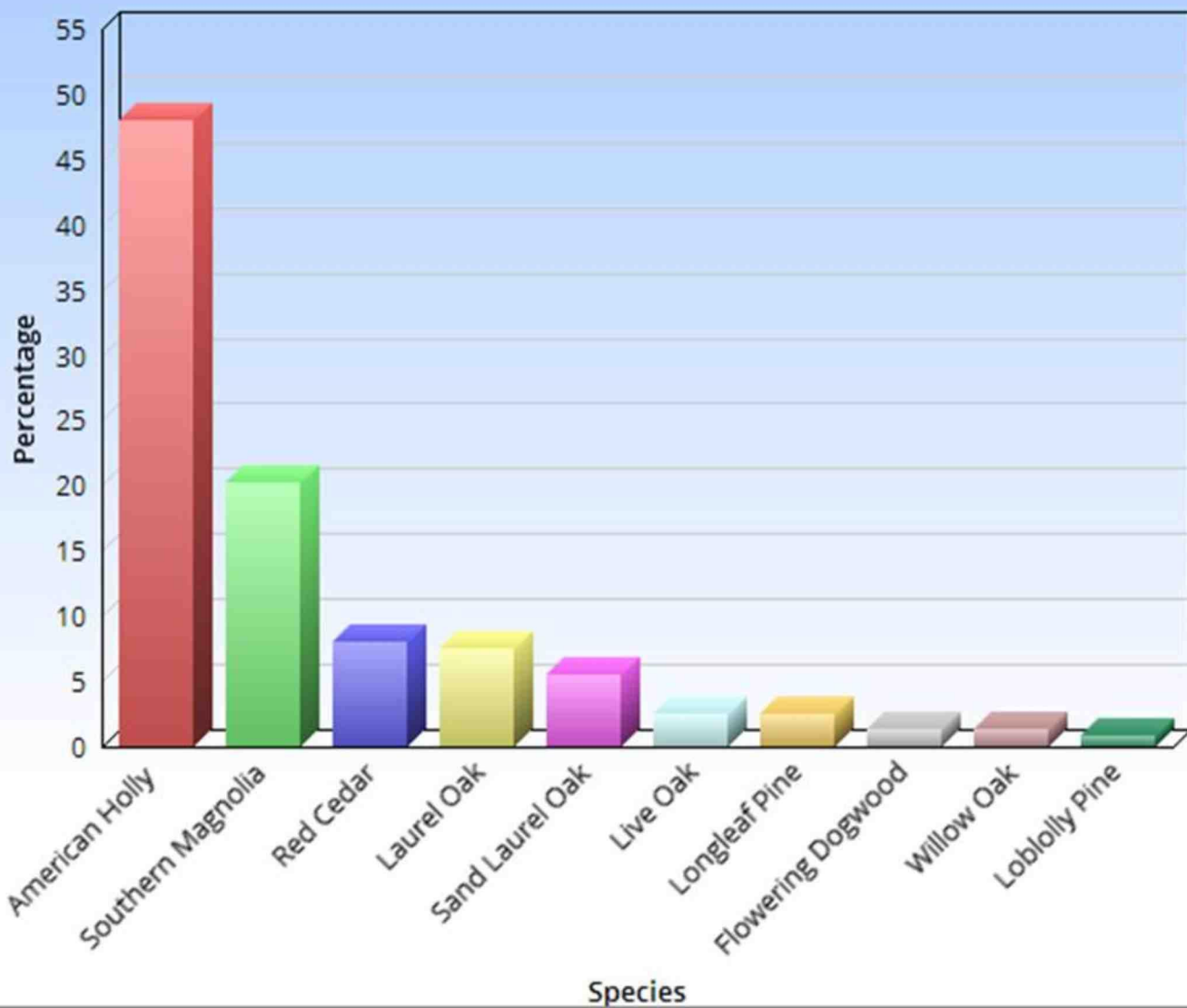


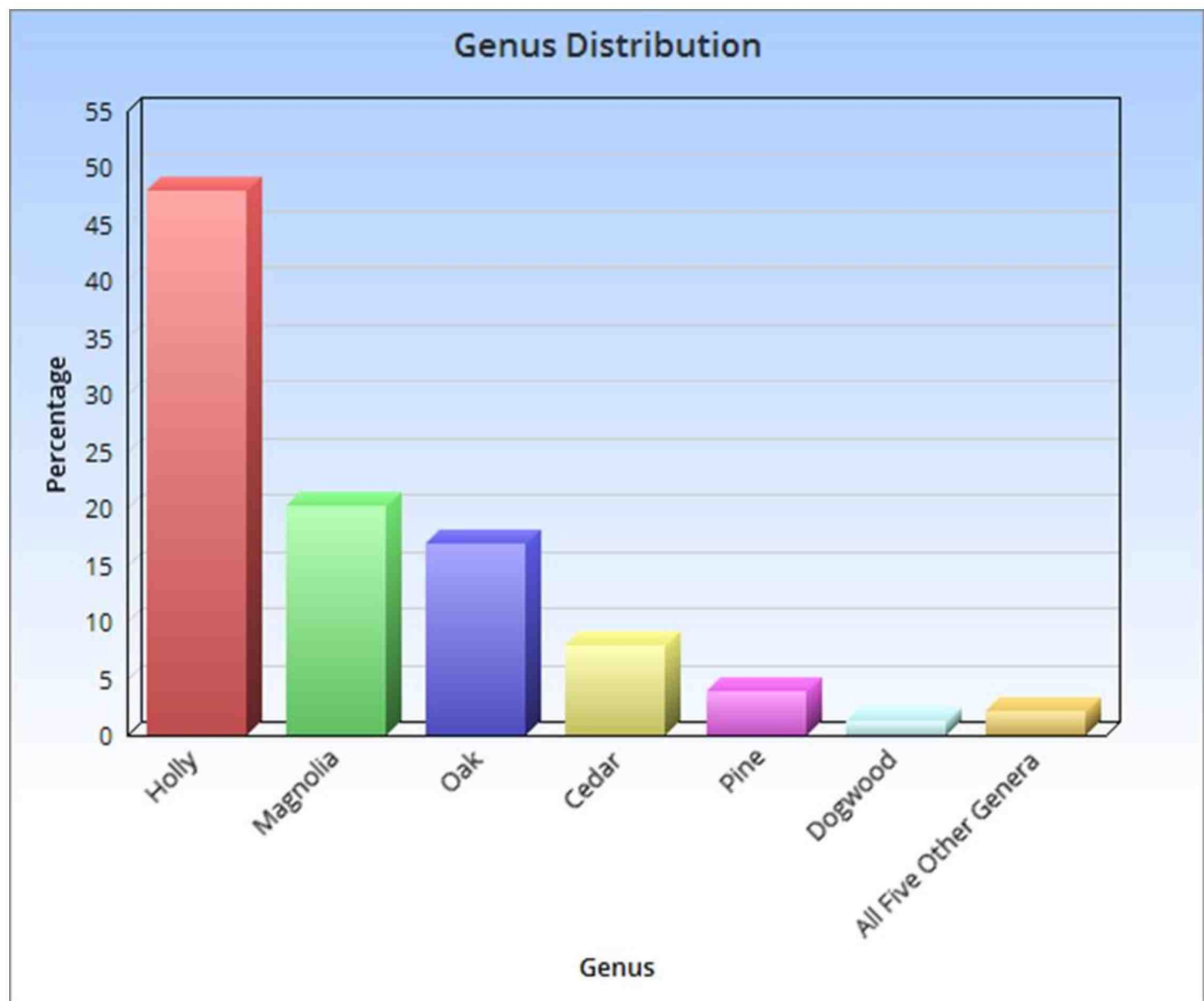
Maintenance Actions

<i>Tree Maintenance</i>	<i>Number of Trees</i>
Remove Basal Sprouts	11
Remove Tree	10
Monitor	7
Remove Dead Wood	5
Raise	1
Remove Brush/Vines	1

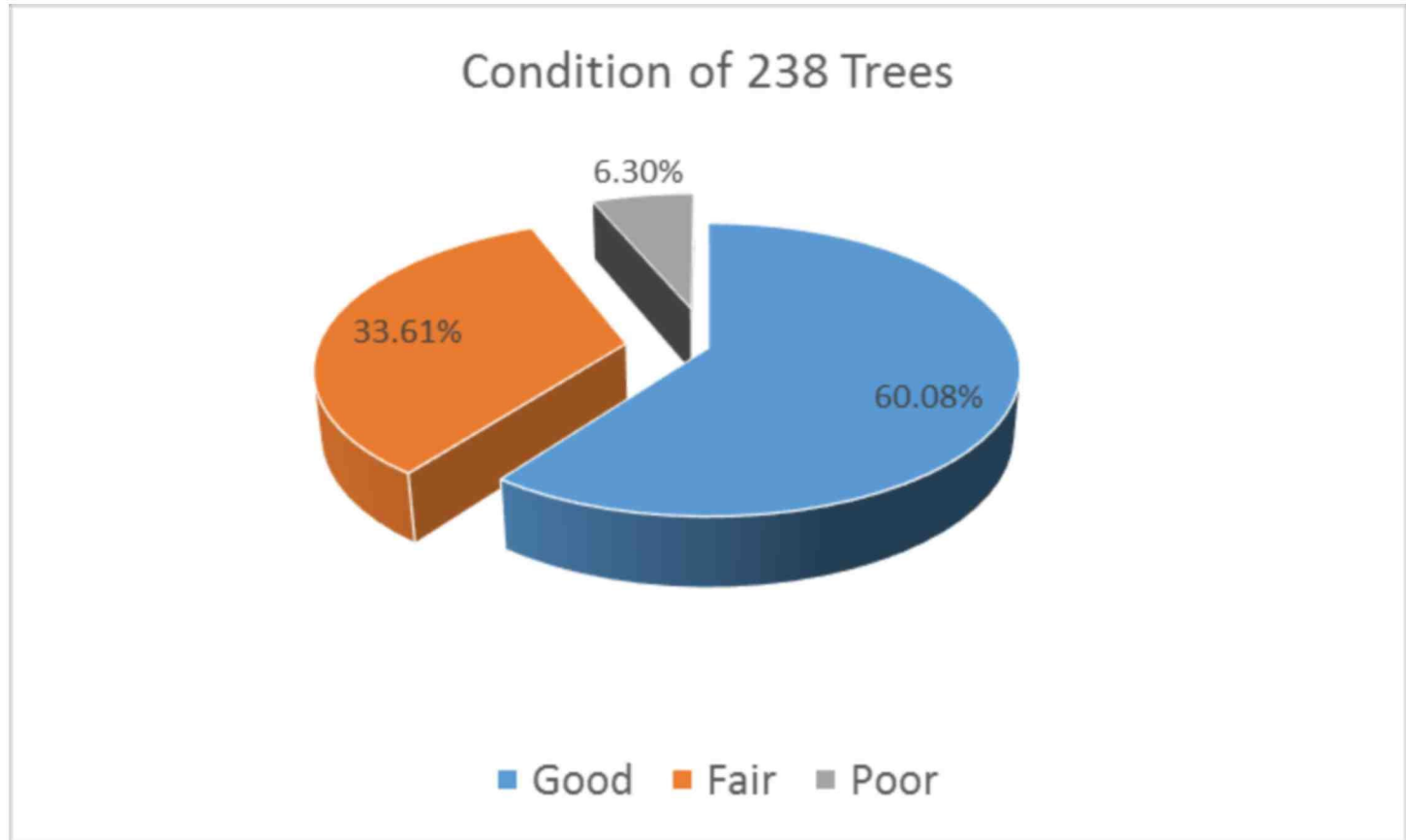


Top Ten Species Distribution

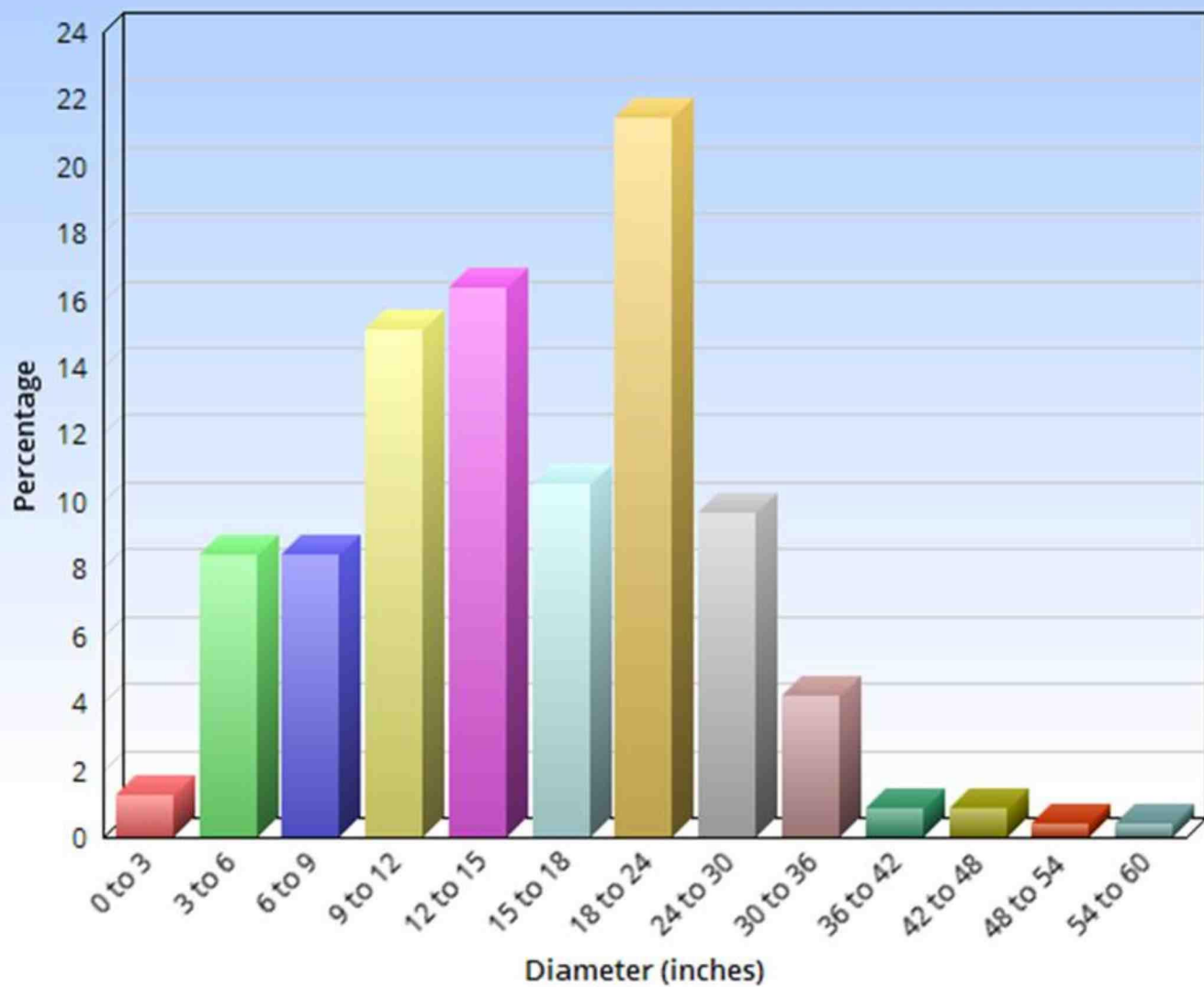




Urban Forest Condition



Diameter Distribution



Maintenance and Monitoring Plan

The advantages that result from establishing a routine maintenance cycle will:

- 💧 Maximize tree crew efficiency
- 💧 Reduce routine pruning costs and improve tree structure and health
- 💧 Prompt identification and management of tree risk conditions
- 💧 Decrease tree mortality
- 💧 Reduce future tree damage from storms



Comparison With Other Jurisdictions

JURISDICTION	MOST COMMON %	2nd MOST COMMON	3rd MOST COMMON	% GOOD/POOR-DEAD	TOTAL # TREES
Fayetteville (Phase I)	Loblolly Pine 17%	Crape Myrtle 12%	Sweetgum 8%	71% 4%	3260 Trees April 2014
Fayetteville (Phase II)	Loblolly Pine 21%	Crape Myrtle 15%	Water Oak 5%	81% 3%	3229 Trees Sept-Oct 2014
Cramerton	Crape Myrtle 13%	Box Elder 13%	Green Ash 8% Red Maple 7%	69% 6%	1019 trees October 2014
Burlington (Phase I)	Crape Myrtle 33%	Willow Oak 11%	Flowering Pear 11%	64% 10%	520 Trees Sept 2015
Wilson (Phase I)	Crape Myrtle 22%	Willow Oak 20%	Holly 3% Maple 3%	63% 5%	4146 Trees Sept-Dec 2015
Graham	Crape Myrtle 36%	Red Maple 10%	Flowering Cherry 5%	86% 1%	1065 Trees Sept 2016
Bath	Crape Myrtle 21%	Live Oak 14%	Loblolly Pine 11%	77% 2%	609 Trees Sept 2016
Wilson (Phase II)	Crape Myrtle 26%	Loblolly Pine 25%	Willow Oak 8%	76% 4%	4406 Trees Nov 2016
Fayetteville (Phase III)	Crape Myrtle 24%	Loblolly Pine 19%	Water Oak 10%	76% 3%	2606 Trees April 2017
Burlington (Phase II)	Crape Myrtle 40%	Red Maple 25%	Nellie Stevens Holly 9%	72% 5%	785 Trees Sept 2017
Wilson (Phase III)	Crape Myrtle 20%	Willow Oak 17%	Loblolly Pine 15%	81% 2%	3717 Trees Oct 2017
Southeastern Baptist Theological Seminary	Southern Magnolia 13%	Flowering Dogwood 9%	Crape Myrtle 8%	75% 2%	749 Trees May 2018
Uptown Greenville	Crape Myrtle 31%	Chinese Elm 12%	Trident Maple 11%	85% 2%	517 Trees Oct 2019
Pinehurst (Phase I)	American Holly 48%	Southern Magnolia 20%	Red Cedar 8%	60% 6%	238 Trees Oct 2019



Discussion



Report and Analysis

October 2019



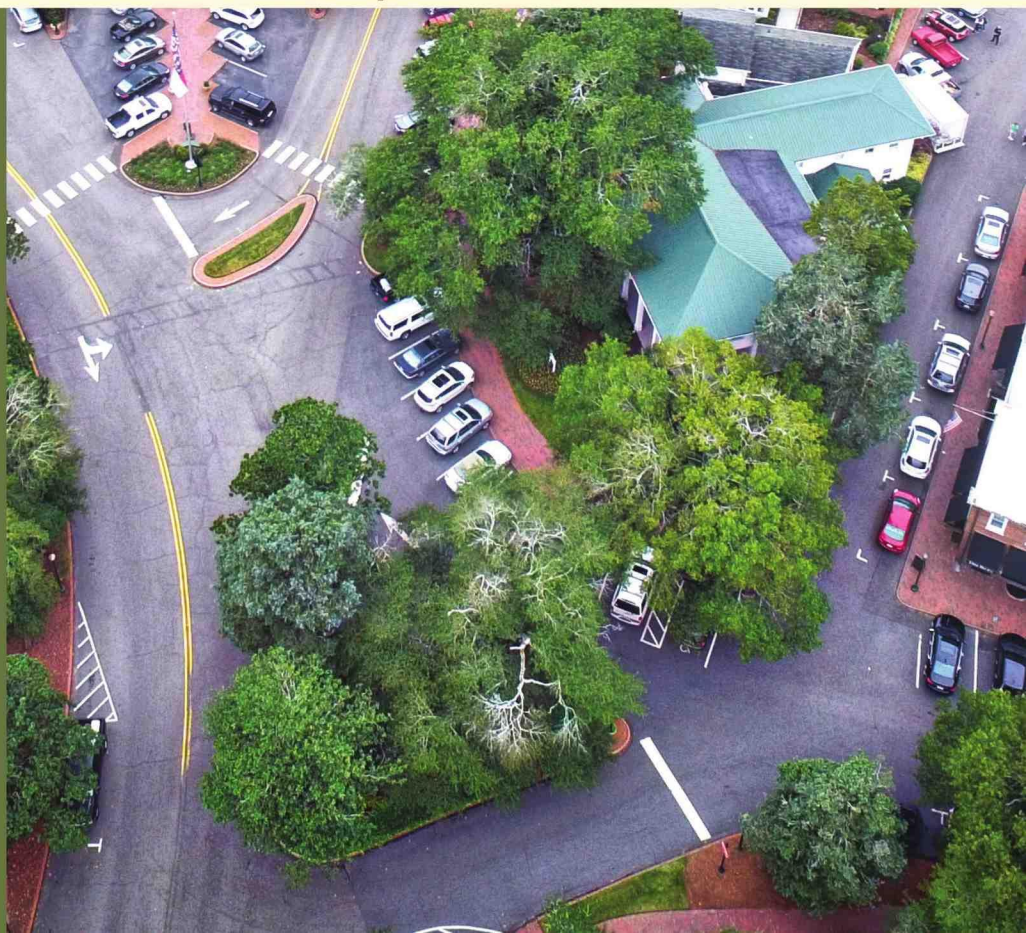
TREE INVENTORY

Examined • Identified
Measured • Recorded

Village of Pinehurst

in cooperation with

Treefull Communities, LLC



EXECUTIVE SUMMARY



This document reports the findings of the tree inventory conducted in the Village of Pinehurst, North Carolina in late October of 2019.

Results

Number of Trees: Approximately 238 trees were inventoried.

Species Diversity: 16 species comprise The Village's inventoried trees with American Holly (48%), Southern Magnolia (20%) and Red Cedar (8%) being the most abundant.

Tree Condition: The majority of The Village's trees (60%) are in good condition. Nearly 34% of the trees are in fair condition and 6% are in poor condition.

Tree Size: 79 (33%) of the inventoried trees have diameters less than 12 inches and 159 (67%) have diameters equal to or greater than 12 inches.

Tree Problems: The most frequently identified concerns are minor deadwood, co-dominant stems and trunk cavities.

Maintenance Actions: There were 6 trees that were assigned high priority to mitigate impending failure – 2 required the removal of dead wood while the remaining 4 required removal altogether.

Recommendations

Removal of identified trees that pose a high risk to people and property should be a priority, followed by the pruning of certain trees that pose a high or immediate threat.

Retain and maintain existing large and older trees where possible. Promote the importance and benefits of large maturing species and mature, properly maintained trees within the Village of Pinehurst.

Young trees should be structurally pruned to promote proper form as they mature. Structural pruning should occur every 3 years for the first 9-12 years.

Species diversity should be increased, even if the current urban forest is well diversified. Select trees to plant in areas where large-maturing varieties are appropriate and choose species other than those already present. Avoid planting trees which currently make up more than 10% of the Village tree population.

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INTRODUCTION



At the request of The Village of Pinehurst, an inventory of all trees on public property was conducted in late October 2019. The species composition, size, health and current maintenance requirements of each tree was identified and evaluated.

The goal of the project was to evaluate the characteristics and condition of the Village's trees and to provide recommendations for maintenance and planning of future budget needs. This information will provide The Village of Pinehurst with the opportunity to maximize the value and benefits of their publicly owned trees and minimize the problems associated with them. Two significant advantages of the tree inventory are that:

- Administrators and managers will have an increased awareness of the current magnitude, condition and needs of their tree resource, and
- The data establishes the baseline for information about the trees that can be updated as they are planted or removed, work is completed or tree conditions change.

Ideally, this inventory allows the community and its partners to efficiently and effectively manage the future of their publicly owned trees.

Practical goals that can be realized include:

- Improved response to public inquiry
- More efficient scheduling of labor and equipment
- Realistic budget requests and long-term planning
- Improved coordination between municipal and private services

DATA COLLECTION AND INVENTORY METHODS

For the Village of Pinehurst inventory, trees were individually examined, identified, measured and recorded. The information collected for each tree included: location by GPS, species, size (DBH), condition and maintenance requirements. The work was carried out by a Consulting Certified Arborist, accompanied by the Buildings and Grounds Superintendent (also a Certified Arborist). Data was collected with a Trimble GEO-XH GPS unit. The following information was recorded for each tree as described below:

Location – All trees are located with GPS coordinates through the use of the Trimble unit.

Identification – Common and botanical name identifies each tree.

Tree Size – Using a Biltmore stick, trees were measured about four and one half feet above the ground in order to obtain the Diameter at Breast Height (DBH). For trees with multiple trunks, only the diameter of the largest trunk was measured and recorded.

Condition Rating – The overall health based on appearance (taking into account observations that include structural soundness, growth rate, and color and density of the crown) was rated. In general, the condition of each tree is recorded in one of the following categories adapted from the rating system established by the International Society of Arboriculture (ISA):

Good – The tree has no major structural problems; no significant damage due to diseases or pests; no significant mechanical damage; a full, balanced crown and normal twig condition and vigor for the species.

Fair – The tree may exhibit the following characteristics: minor structural problems and/or mechanical damage; significant damage from non-fatal or disfiguring diseases; minor crown imbalance or thin crown; minor structural imbalance or stunted growth compared to adjacent trees. This condition also includes trees that have been topped, but show reasonable vitality with no obvious signs of decay.

Poor – The tree appears unhealthy and may have structural defects. Trees in this category may also have severe mechanical damage, decay, and severe crown dieback or poor vigor.

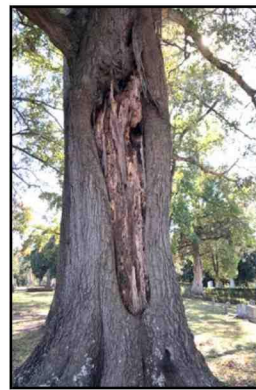
Dead – This category refers only to dead trees.

Tree Problems – Observed conditions may indicate structural concerns, signs of decline in the tree, physical damage,

maintenance issues or site limiting factors. Some descriptions which may be used in this inventory include:

Broken Branches which are specifically noted where they are large enough to present a risk, or have an impact on the appearance of the tree.

Cavities which are visible, appear as openings or holes and can be present at the base, on the trunk or on the larger limbs



of the tree. They indicate the presence of internal decay but because the size of a cavity opening is not related to the extent of internal decay, the condition should be assessed to determine treatment or mitigation of risk. It should be noted that not all cavities have an exterior opening and other indicators of decay, such as fungal fruiting bodies and carpenter ants, can

indicate hidden internal decay and cavities, even when the tree appears healthy and green. Cavities can severely affect the structural stability of a tree.

Competition from Adjacent Trees can occur when two or more trees grow closely together. The sides that face each other are usually sparsely branched or may be completely lacking branches in the shared space due to shade. Generally, this is not an issue for concern as the trees are in equilibrium with their growing site and one another. However, if one of the trees is removed, it may expose the previously protected side of the remaining tree, which may also now appear to have an unbalanced crown. In situations where a desirable tree is being impacted by a less desirable one (due to species, condition or age) it may be recommended to remove the lesser of the two. Some shade tolerant species, such as Flowering Dogwood, perform best under the canopy of a larger tree and are not generally negatively impacted by competition from adjacent trees and should not be removed.

Dead Wood can range in size from dead twigs to large, dead branches. Dead wood is divided into two categories: major and minor. Minor dead wood consists of twigs or small limbs less than two inches in diameter and is an indication that a tree is in a state of



DATA COLLECTION AND INVENTORY METHODS

decline. Major dead wood consists of limbs greater than two inches in diameter, and is considered by most tree experts to be the threshold at which the falling limbs become a hazard to life and property below.

Leaning at an angle of 35 degrees or greater is noted where either a recently planted tree may benefit from being straightened or a tree is leaning following a weather event. Large leaning trees cannot be corrected of this defect, however, assessment of the tree can indicate whether the lean is recent or long-term. Based on observations, a tree may or may not be recommended for removal, but the lean and its significance will be noted and appropriate recommendations made.

Pests/Diseases are noted when the appearance of insects or diseases are apparent.

Root Injury is often a result of mechanical damage from lawn maintenance, construction, utility maintenance, etc. Such injuries can lead to internal decay which can affect the structural integrity of the tree.



Avoiding mechanical damage from mowers and string trimmers and protecting tree roots by tunneling or by locating and installing required utilities away from or around trees will prevent most major root damage that occurs beneath the ground surface.

Sidewalk/Curb/Asphalt Damage is a common problem in areas where adequate space does not exist between the curb and sidewalk, particularly for large, old trees. As the roots grow larger over the course of many years, cracks and lifting become increasingly apparent in the infrastructure.



Split Crown is commonly seen in, but not limited to, Bradford Pear due to wind or ice damage. Once a major portion of the canopy has broken away, the crown may be unbalanced, similar to a tree that is growing in close proximity to another and removal may be necessary.



Topped trees have had a severe cutting back of limbs to stubs, whether close to the origin of the branch or farther out along the limb. Not only does this disfigure the tree, but it causes stress by removing the leaves which produce food all the way to the roots. A tree forced to use stored carbohydrates to pro-

duce new leaves may be more prone to decline and disease. Should a tree survive topping, the replacement branches are weakly attached and more prone to failure. There are no good reasons for topping any tree, although trees severely damaged by storms or other causes, or certain trees under utility wires or other obstructions may be topped, where proper pruning practices will not address a conflict and tree removal is not an option. Crown reduction by a qualified Arborist is the correct approach where a reduction in tree height is desired.

Trunk Injury occurs mostly in the same fashion as do root injuries. And, in the same way, can lead to internal decay. Even when a trunk wound has closed over (it can never "heal") the



damage and any decay can still impact the structural stability of the tree when internal cavities occur.

Weak Branch Union is a fork, which occurs when two similarly-sized (co-dominant) branches arise from the same location. In young trees, or for smaller-sized forks, this can be addressed by training or structural pruning, respectively. In larger trees, such a fork may require other maintenance and/or monitoring to address any structural issues that exist, due to included bark, decayed wood or a combination of the two.



Maintenance Actions - By applying these recommendations, some of the "conditions" affecting the tree will correct, improve or mitigate the concern. In order of priority:

Remove Tree when the tree is either dead or is structurally unsound and cannot be mitigated due to the severity of the issue or the existing target.

Monitor when, due to an existing condition, the tree should be placed on a monitoring schedule for the remainder of its life, to address maintenance, mitigation or other actions as the tree ages.

Remove Dead Wood as it appears, is the removal of dead limbs. To manage risk, branches two inches or greater in diameter should be promptly scheduled for removal.

Remove Broken Branches such as hangers and other broken limbs to avoid damage or injury. They may not be a concern where no target exists.

DATA COLLECTION AND INVENTORY METHODS

Routine Prune is recommended for trees, as they all benefit from timely removal of dead, damaged, decayed or diseased wood, as well as for structural reasons, or sidewalk and utility clearance.

Raise refers to the removal of the lower-most branches of the tree, usually to reduce conflict with pedestrians, vehicles or line-of-sight for signs, road access or other visibility issues, or as the tree increases in height and caliper, eventually leaving adequate space for walking beneath. This practice, and any other pruning activity, should never result in the removal of more than 25 percent of the tree's live crown.

Reduce is the reduction of the canopy, as opposed to the destructive practice of "topping" and involves removing the end of a branch at the juncture of a lateral branch that is at least one third of the size of the main limb. This method does not stress the tree and it also promotes strong branch attachment.

Corrective Prune is done to improve branch structure for the long and short-term. When performed on young trees, it is inexpensive and highly effective and can be called **Training Prune**, while for larger, mature trees it may be referred to as **Structural Prune**.

Cleaning Prune is the process of removing dead, diseased, dying or otherwise damaged/defective branches from a tree. This both reduces the risk of human safety hazards and promotes health and good structure in the tree itself. By eliminating defective branches, pruning can improve a tree's allocation of nutrients and enhance photosynthetic productivity. A pruned tree will be more efficient and less stressed as now it can better channel resources to functioning parts of the tree and is not attempting to preserve dying sections. Thinning dead, diseased or damaged branches also limits possible routes of entry for disease and reduces the risk of already present disease or decay spreading to the remainder of the tree.

Treat Insects/Disease when a tree is being impacted by a problem that warrants treatment, depending on the problem and severity. Common examples include various types of aphids and Powdery Mildew on Crape Myrtle, or Septoria Leaf Spot and Spot Anthracnose on Dogwood. These conditions can be treated with an insecticide or fungicide when appropriate.

Add Mulch is recommended when it is lacking or insufficient. The mulch layer should be between 2-3" or 4" on sandy soils; thick enough to keep out weeds and extend outward from the trunk to, or beyond, the outer most branches of a young tree, and not placed in contact with the trunk.



Remove Excess Mulch is a recommendation often used in landscaped areas due to the habit of mounding mulch around and up the trunk of the tree, similar in appearance to a cone or volcano. This is both a wasteful and detrimental practice.

Trees can develop adventitious and girdling roots, or may simply slowly decline.

Remove Stakes/Guys is necessary when new trees are staked at the time of planting but no one returns to remove them after establishment. All hardware should be removed within one year of planting, if staking is even necessary at all. Left in place, the tree can be girdled by the guys as it increases in diameter. This will either kill the tree above the guy, or if it survives, create a weak point in the trunk resulting in failure.

Remove Basal Sprouts refers to the removal of a proliferation of sprouts around the base of the tree. This form of maintenance is commonly required in Crape Myrtle, and is often enhanced in response to repeated topping of that species.

Remove Brush/Vines refers to saplings, shrubs or vines that may be growing around the base of the tree or on the trunk and into the crown. This unwanted plant growth competes for nutrients and light and stresses the tree in general. Vines in particular must be carefully cut at the base so as not to injure the trunk of the tree.

Replace the tree when it has been recommended for removal because of decline, death or injury and the site is suitable to plant another tree in the same or nearby location.

General Notes – This section is reserved for notations in regards to location and additional maintenance actions and tree problems. Unique qualities related to exceptional size, etc., such as "Champion Tree" may be noted here as well.

CHARACTERISTICS OF THE VILLAGE OF PINEHURST URBAN FOREST

The characteristics of the Village of Pinehurst urban forest include species, diameter and condition. By identifying these aspects of the Village’s trees, one can learn much about the forest’s composition, size and health. It is important to know the species as well as the number of trees present in a location. Species composition data is essential in that tree species vary considerably in life expectancy, structure and form, maintenance requirements, as well as susceptibility to certain pests and diseases. These characteristics affect management issues such as types of maintenance, frequency of activities and budgets. Similarly, tree diameter can

help to estimate the relative age or maturity of the tree population. The condition assessment helps to develop a plan of action to both improve existing tree conditions, so they can better withstand stress, and to improve their future management on the site in order to maintain good health and condition.

Species Diversity

Of the 238 trees inventoried, this portion of the Village of Pinehurst urban forest contains 16 species with American Holly (48%), Southern Magnolia (20%) and Red Cedar (8%) being the most abundant. In general, no one species should account for more than 10% of the total tree population, and no group of spe-

Table 1. Species Distribution

Species	Number of Trees	Proportion
American Holly	114	47.90%
Southern Magnolia	48	20.17%
Red Cedar	19	7.98%
Laurel Oak	18	7.56%
Sand Laurel Oak	13	5.46%
Live Oak	6	2.52%
Longleaf Pine	6	2.52%
Flowering Dogwood	3	1.26%
Willow Oak	3	1.26%
Loblolly Pine	2	0.84%
American Elm	1	0.42%
Black Gum	1	0.42%
Carolina Cherry Laurel	1	0.42%
Green Ash	1	0.42%
Shortleaf Pine	1	0.42%
Sweetgum	1	0.42%

cies should account for more than 20%. This is a useful rule of thumb for maintaining a broad diversity of urban trees and it also creates a good starting point for the Village. The reason for these guidelines is to avoid having a large number of trees succumb to a problem at one time, whether a pest or disease, response to ice or wind, or aging into mortality all at the same time. This can have a significant impact on available budgets. An example of this is the over-planting of American Elms and the resulting impact of Dutch Elm-Disease, or the recent introduction of Emerald Ash Borer.

Diameter Distribution (Relative Tree Age)

Tree diameter is not only a measure of tree age and size, but it is also a valuable indicator of the benefits provided by trees. Generally, trees increase in size with age, along with the value and the magnitude of the benefits they provide. An uneven-aged population is desirable for managing tree maintenance costs over time. There must be a sufficient number of younger, smaller trees in the tree population to account for the loss of trees over time and thereby maintain a sustainable urban forest. Trees provide the most benefits as they reach maturity, but without early and less expensive maintenance when they are young, their care becomes significantly more costly. The graph in Figure 3 shows the number of trees in various size classes.

CHARACTERISTICS OF THE VILLAGE OF PINEHURST URBAN FOREST

Figure 1. Top Ten Species Distribution

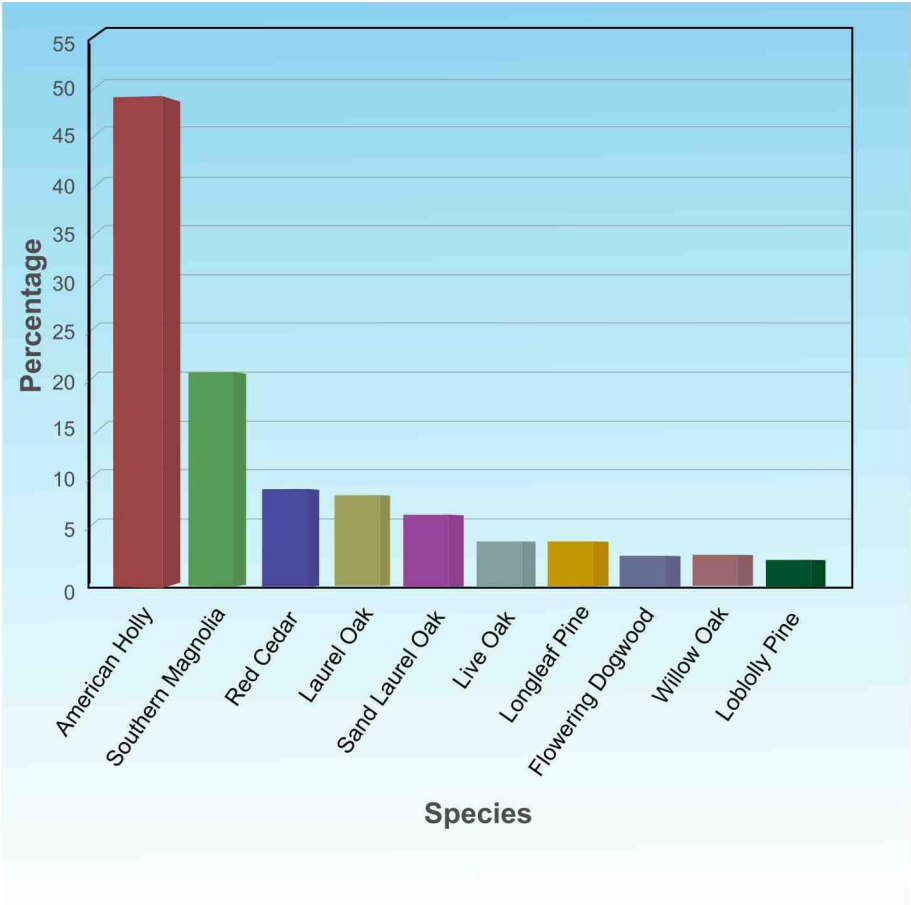
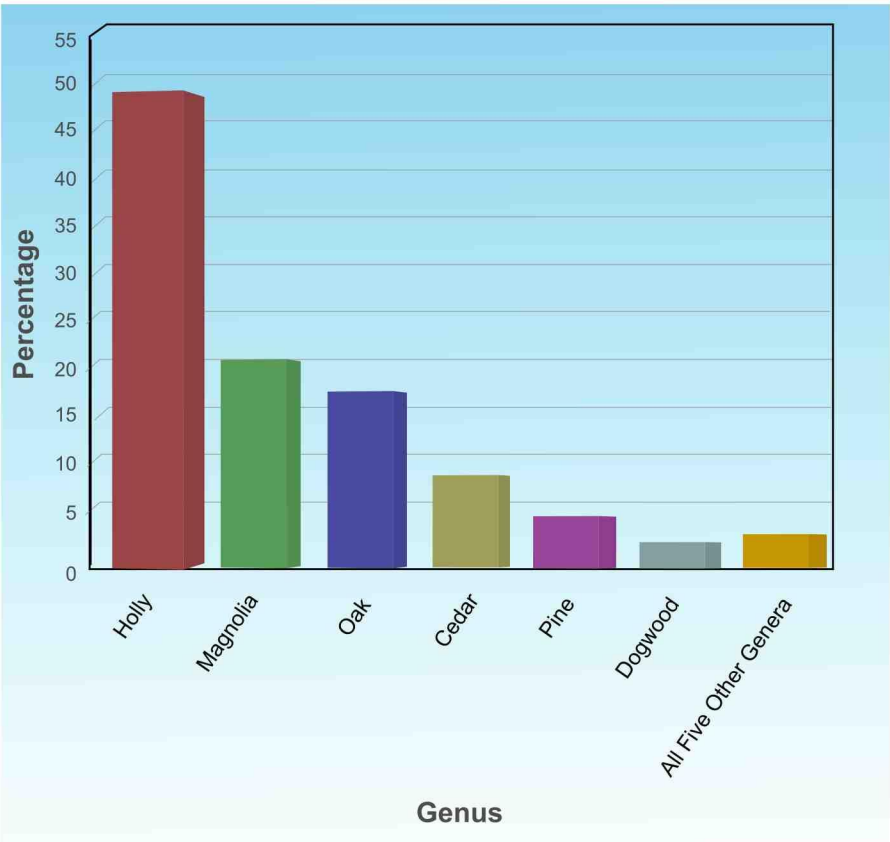


Figure 2. Genus Distribution



CHARACTERISTICS OF THE VILLAGE OF PINEHURST URBAN FOREST

Figure 3. Diameter Distribution

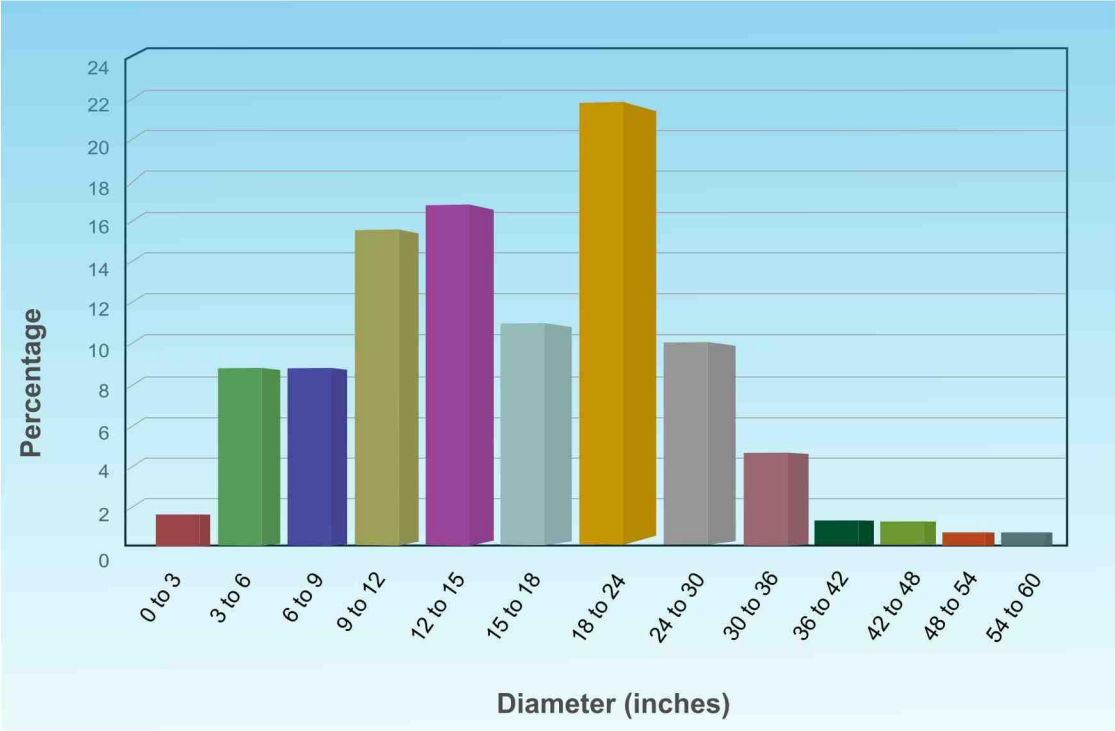


Table 2. Diameter Distribution

Diameter (inches)	Number of Trees	Percentage of Trees
0 to 3	3	1.26%
3 to 6	20	8.40%
6 to 9	20	8.40%
9 to 12	36	15.13%
12 to 15	39	16.39%
15 to 18	25	10.50%
18 to 24	51	21.43%
24 to 30	23	9.66%
30 to 36	10	4.20%
36 to 42	2	0.84%
42 to 48	2	0.84%
48 to 54	1	0.42%
54 to 60	1	0.42%
> 60	0	0.00%

CHARACTERISTICS OF THE VILLAGE OF PINEHURST URBAN FOREST

General Health and Condition

Trees were evaluated and, based on their overall outward appearance, were assigned one of four condition classes: good, fair, poor or dead. The condition class takes into account more than just the abundance of green leaves. Condition was based on visual observations of the trees’ crown, trunk and any visible roots. Indicators of stress such as the dieback of twigs and epicormic shoots along the trunk or branches can cause the condition rating to be less than good. Other factors, including the presence of decay and cavities, depending on their extent, can also reduce the condition rating.

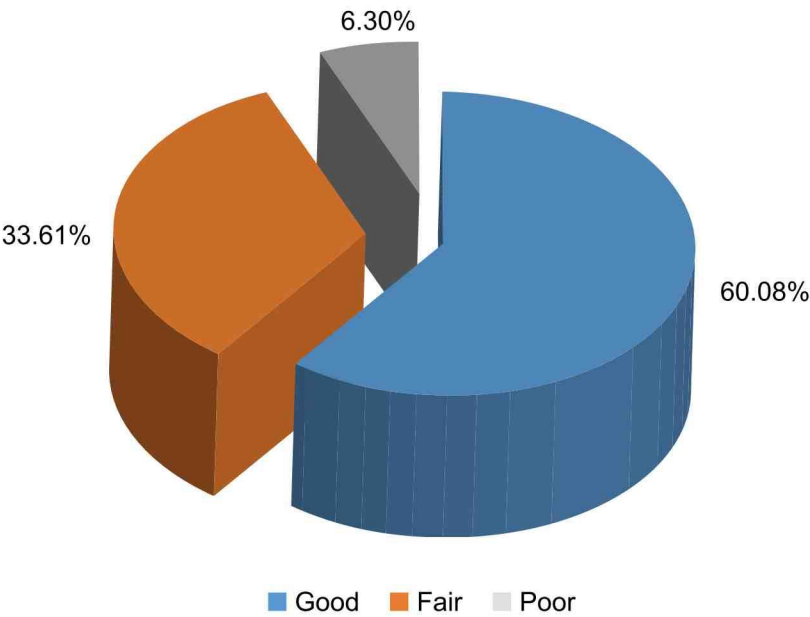


Tree with lightning damage

Table 3. Tree Condition

Tree Condition	Number of Trees	Proportion
Good	143	60.08%
Fair	80	33.61%
Poor	15	6.30%
Dead	0	0.00%

Figure 4. Tree Condition



CHARACTERISTICS OF THE VILLAGE OF PINEHURST URBAN FOREST

Tree Problems

The problems observed in the trees are noted in the table below, corresponding to the descriptions at the beginning of this report. Table 4 shows the problems by location on the tree (crown, trunk and roots). In many cases, a single tree may have more than one problem recorded. The most significant two issues noted are the presence of minor deadwood (28) and co-dominant stems (19). Trunk cavities (16) are also a concern as they can affect tree stability. For trunk and root damage/decay, assessment as to the extent of the internal decay is necessary to determine whether the trees present a risk of failure and require removal, or mitigation and monitoring.

Table 4. Tree Problems

Problem	Number of Trees
Deadwood (Minor)	28
Codominant Stems	19
Cavity in Trunk	16
Damage to Trunk	9
Deadwood (Major)	8
Decay in Trunk	6
Cavity in Crown	3
Structural Issues	2
Topped	2
Decay in Crown	1
Dieback	1
Leaning	1
Pests/Diseases	1

While the Village of Pinehurst has been active in general pruning, including that from storm damage over the years, there are still some concerns with crown condition, mostly in the form of major deadwood. Proper pruning practices can address structural issues, and proactive pruning can help correct problems that could fail during a storm, causing damage to the tree and to any targets.

A pruning regime should start when the trees are young with training pruning, an inexpensive investment into the future form of the trees by reducing the development of crown struc-

ture issues. Early and ongoing maintenance of the younger trees will maximize the ecosystem services provided by these high value members of the urban forest and help ensure that they will contribute to the Village infrastructure for many years to come.

Mature trees will benefit from structural pruning to reduce issues such as an unbalanced crown, or an over-extended limb or crowded branching. Pruning these trees can help reduce the potential for eventual storm breakage that could damage the tree to the point that it must be removed.

CHARACTERISTICS OF THE VILLAGE OF PINEHURST URBAN FOREST

Maintenance Needs

Recommendations for each tree's general maintenance needs and/or corrective actions were recorded. These actions are based on a combination of the previously described Tree Problems and the Condition Rating of the tree. In many cases there is more than one maintenance need recommended per tree. Priority should be given as assigned in the inventory (low, medium, high, immediate). The recommended actions should be taken within the constraints of the Village of Pinehurst's Urban Forestry budget.

Of most significance is the need for monitoring and necessary action among the older trees with trunk cavities (16) which can result in tree failure. Ten trees are recommended for removal overall. This list of maintenance needs is merely a snapshot of the Village of Pinehurst's trees at the time of the inventory. Additional tree problems and maintenance needs will continue to develop and additional removals will be necessary over time.

Table 5. Maintenance Recommendations

Maintenance	Number of Trees
Remove Basal Sprouts	11
Remove Tree	10
Monitor	7
Remove Dead Wood	5
Raise	1
Remove Brush/Vines	1

Table 6. Species and Condition Comparison with Other Jurisdictions

JURISDICTION	MOST COMMON %	2nd MOST COMMON	3rd MOST COMMON	% GOOD/POOR-DEAD	TOTAL # TREES
High Point Core	Crape Myrtle 17%	Red Maple 8%	Sweet Gum 6%, Willow Oak 7%	75% 5%	4,386 Trees August 2011
Fayetteville (Phase I)	Loblolly Pine 17%	Crape Myrtle 12%	Sweetgum 8%	71% 4%	3260 Trees April 2014
Fayetteville (Phase II)	Loblolly Pine 21%	Crape Myrtle 15%	Water Oak 5%	81% 3%	3229 Trees Sept-Oct 2014
Cramerton	Crape Myrtle 13%	Box Elder 13%	Green Ash 8% Red Maple 7%	69% 6%	1019 trees October 2014
Burlington (Phase I)	Crape Myrtle 33%	Willow Oak 11%	Flowering Pear 11%	64% 10%	520 Trees Sept 2015
Wilson (Phase I)	Crape Myrtle 22%	Willow Oak 20%	Holly 3% Maple 3%	63% 5%	4146 Trees Sept-Dec 2015
Graham	Crape Myrtle 36%	Red Maple 10%	Flowering Cherry 5%	86% 1%	1065 Trees Sept 2016
Bath	Crape Myrtle 21%	Live Oak 14%	Loblolly Pine 11%	77% 2%	609 Trees Sept 2016
Wilson (Phase II)	Crape Myrtle 26%	Loblolly Pine 25%	Willow Oak 8%	76% 4%	4406 Trees Nov 2016
Fayetteville (Phase III)	Crape Myrtle 24%	Loblolly Pine 19%	Water Oak 10%	76% 3%	2606 Trees April 2017
Burlington (Phase II)	Crape Myrtle 40%	Red Maple 25%	Nellie Stevens Holly 9%	72% 5%	785 Trees Sept 2017
Wilson (Phase III)	Crape Myrtle 20%	Willow Oak 17%	Loblolly Pine 15%	81% 2%	3717 Trees Oct 2017
Southeastern Baptist Theological Seminary	Southern Magnolia 13%	Flowering Dogwood 9%	Crape Myrtle 8%	75% 2%	749 Trees May 2018
Uptown Greenville	Crape Myrtle 31%	Chinese Elm 12%	Trident Maple 11%	85% 2%	517 Trees Oct 2019
Pinehurst (Phase I)	American Holly 48%	Southern Magnolia 20%	Red Cedar 8%	60% 6%	238 Trees Oct 2019

URBAN FOREST MAINTENANCE AND MANAGEMENT RECOMMENDATIONS

Much like any natural resource, the urban forest needs to be conserved and managed. A tree inventory is an important tool in managing and planning urban tree populations. By providing complete and up-to-date information about the diversity, condition, and size of trees, a tree inventory enables the community to care for the existing trees as well as plan intelligently for those of the future.

Recommended Actions

Planting & Replacement

As noted in the observations about the Village species distribution, there is a significant percentage of American Holly (48%) and Southern Magnolia (20%). Reducing the proportion of these species to 10% should be a reasonable goal to balance the forest composition. The reduction of these species requires broadening the choices and suspending the planting of Southern Magnolia, and even more so, American Holly for a period of time so additional varieties can be included to incorporate both slow growing trees for long-term presence and impact and, where desired, faster growing and small maturing trees that can help create a variety of sizes for aesthetic purposes in larger open spaces.

Specifically, these plantings should focus on large-growing, native shade trees such as the Oaks (White, Scarlet, Southern Red, Swamp Chestnut, Nuttall and Shumard), Maples (Red and Florida), Tulip Poplar, Bald Cypress, American Beech, Hickory, Winged Elm, American Basswood, Black Tupelo and Sycamore (not highly recommended as street trees but adapts well in urban environments where there is adequate planting space with no overhead electric lines). In confined spaces, such as where there are overhead electrical conductors, existing planting strips which are less than four feet wide and in sidewalks, smaller native varieties should be used such as Carolina Cherrylaurel, Flowering Dogwood (in shady areas only), Eastern Redbud, American Hornbeam, Carolina Silverbell, Sourwood and Downy Serviceberry. ALL new trees should be added to the existing inventory as they are planted!

Careful species and cultivar selection are necessary. When developing bid specifications for nurseries, it is recommended that specific cultivars be named, as well as transportation and handling according to ANSI Z60.1 standards. Whether using Village staff to plant trees or contracting, planting Best Management Practices should be followed according to ANSI A-300, Part 6 – Tree, Shrub and Other Woody Plant Management – Standard Practices (Planting).

Management Issues

To maximize the longevity of the trees in maximum health and condition requires some changes:

- **Lawn Maintenance** – Training of maintenance staff and monitoring of work is strongly recommended. Although not a major problem in this phase of the Village's Tree Inventory, the mechanical damage caused by mowers and trimmers creates wounds that open the trees to decay and that decay can become a significant complicating factor in the management of the Village's trees. Avoiding further damage is a priority if the urban forest is to continue to serve the Village into the future. This means that workers should be trained on "why" avoiding damage is important and how to avoid causing more injuries, and then be periodically assessed as to their success in implementing change.
- **Mulch** – Not only is mulch an important cultural practice that benefits tree health but the correct application of mulch can also provide protection to trees and tree roots from mechanical damage. Mulch can reduce the extent of mowing required as well as provide visual boundaries for lawn maintenance workers. Ideally, mulch should be installed, or raked or added as necessary to provide soil cover and limit turf competition. Additionally, an educational outreach to Village staff might help in engaging them to support the mulching activities and reduce complaints.

Tree Maintenance Recommendations

The purpose of this report is to provide a snapshot of the current structure and maintenance needs of the Village tree population. Based on the data collected and presented in this report, any recommendations should be carried out in accordance with and conform to written specifications from the tree care standards provided in ANSI A300 and follow safety standards in ANSI Z133.

As previously discussed, the maintenance requirements for each tree is determined from observations of the base, trunk, large branches and canopy of the trees. These recommendations are the basis for the development of appropriate and realistic management goals. The implementation of the recommendations will allow the Village of Pinehurst to realize the full potential of the urban forest through the most cost-effective use of available funds.

When collecting the inventory data, each tree requiring removal and most types of pruning was assigned a task "priority rating" of low, medium, high or immediate based on observed issues which can increase chances of tree failure in relation to existing targets such as buildings, parked cars, playground equipment, etc. This evaluation is not to serve as a guarantee of tree failure or stability, but merely as a guideline in prioritizing tree maintenance.

URBAN FOREST MAINTENANCE AND MANAGEMENT RECOMMENDATIONS

Removals

Based on this inventory, the Village of Pinehurst had ten trees recommended for removal as of late October 2019. The removal of trees identified as needing immediate and high priority removal, as well as those that should be scheduled for removal at a later time, will bring a more proactive approach to managing the Villages' trees.

Pruning

At the time of the inventory there were only six trees listed as requiring some form of pruning. Improving the branch structure (cleaning and structural), removing deadwood and training will benefit the trees. The largest challenge remains prioritizing these trees to ensure that those with the greatest long-term potential remain on the site, so that the budget targets such trees before spending funds on the ones with other issues or decline that limit their long-term potential. Any pruning work must follow the ANSI A300 Part 1 – Tree, Shrub and Other Woody Plant Management – Standard Practices (Pruning) and Best Management Practices.

Maintenance and Monitoring Plan

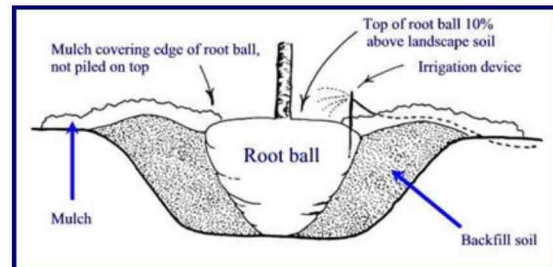
Once the removal, pruning and additional maintenance of the specified trees have been completed, attention should be given to establishing a routine monitoring and maintenance cycle. This on-going cycle should be structured enough to ensure inspection of all trees on a time frame advised by a Certified Arborist working with the Village tree staff on a long-term basis to manage the Village's trees.

The advantages that result from establishing a routine maintenance cycle will:

- Maximize tree crew efficiency, whether contracted or in-house
- Reduce routine pruning costs by improving tree structure and health
- Prompt identification and management of risk tree conditions
- Decrease tree mortality through the early identification and treatment of disease and insect conditions
- Reduce future tree damage from storms

In addition to planning, there is also a need to establish procedures to ensure that the Tree Inventory information is kept up to date. Inspections following major storm events, even when no immediate or serious damage has occurred is advised, with any observed issues documented and immediately entered into the inventory with the required maintenance scheduled.

Figure 5. Proper Planting and Mulching



SOURCES OF FUNDING

Funding sources for tree care range from the Village's budget to joint programs with area companies and merchants. The Village of Pinehurst is encouraged to explore the following sources of support for tree care:

- **Government grants.** Federal programs such as the Urban and Community Forestry Grant appropriate funds for tree planting and maintenance programs in cities throughout the United States. The North Carolina Department of Transportation (NCDOT) has funding available for transportation enhancement activities, including roadside beautification.
- **Foundation grants.** The Foundation Center, online at <http://fdncenter.org/> is a good reference.
- **Private donations.** Area corporations and organizations may donate funds to special tree planting and maintenance programs. Local officials can generate public support of tree care through programs such as the existing "memorial tree" program or special tree improvement projects. Individual businesses or local groups might also be sources of funding.
- **Volunteer groups.** Local officials can encourage community organizations to donate funds or organize fund-raising activities or other support for community tree planting and maintenance programs.
- **Cooperative tree-planting programs.** In such programs, home-owners are offered a selected choice of street trees at a reduced price. In effect, a cooperative tree-planting program allows the homeowner to assume some of the cost of street tree planting while the Village can limit the species choices. Again, the key to the success of such a program is a detailed plan for implementing and publicizing the project. Raleigh's "Neighbor-Woods" program is an excellent example of such an organization.
- **Automobile Damage Reimbursement:** The Village should be reimbursed for any tree damage caused by an automobile accident, if the provision is in the Code of Ordinances.



APPENDIX

Pruning Young Trees

Proper pruning is essential in developing a tree with a strong structure and desirable form. Trees that receive the appropriate pruning measures while they are young will require little corrective pruning when they mature.

Keep these few simple principles in mind before pruning a tree:

- Each cut has the potential to change the growth of the tree. Always have a purpose in mind before making a cut.
- Proper technique is essential. Poor pruning can cause damage that lasts for the life of the tree. Learn where and how to make the cuts before picking up the pruning shears.
- Trees do not heal the way people do. When a tree is wounded, it must grow over and compartmentalize the wound. As a result, the wound is contained within the tree forever.
- Small cuts do less damage to the tree than large cuts. For that reason, proper pruning (training) of young trees is critical. Waiting to prune a tree until it is mature can create the need for large cuts that the tree cannot easily close.

Making the Cut

Where you make a pruning cut is critical to a tree's response in growth and wound closure. Make pruning cuts just outside the branch collar. Because the branch collar contains trunk or parent branch tissues, the tree will be damaged unnecessarily if you remove or damage it. In fact, if the cut is large, the tree may suffer permanent internal decay from an improper pruning cut.

If a permanent branch is to be shortened, cut it back to a lateral branch or bud. Inter-nodal cuts, or cuts made between buds or branches, may lead to stem decay, sprout production, and misdirected growth.

Pruning Tools

When pruning trees, it is important to have the right tool for the job. For small trees, most of the cuts can be made with hand pruning shears (secateurs). The scissor-type, or bypass blade hand pruners are preferred over the anvil type. They make cleaner, more accurate cuts. Cuts larger than one-half inch in diameter should be made with lopping shears or a pruning saw.

Never use hedge shears to prune a tree. Whatever tool you use, make sure it is kept clean and sharp.

Establishing a Strong Scaffold Structure

A good structure of primary scaffold branches should be established while the tree is young. The scaffold branches provide the framework of the mature tree. Properly trained young trees will develop a strong structure that requires less corrective pruning as they mature.

The goal in training young trees is to establish a strong trunk with sturdy, well-spaced branches. The strength of the branch structure depends on the relative sizes of the branches, the branch angles, and the spacing of the limbs. Naturally, those factors vary with the growth habit of the tree. Pin oaks and Sweetgums, for example, have a conical shape with a central leader. Elms and live oaks are often wide-spreading without a central leader. Other trees, such as lindens and Bradford pears, are densely branched. Good pruning techniques remove structurally weak branches while maintaining the natural form of the tree.

Trunk Development

For most young trees, maintain a single dominant leader growing upward. Do not prune back the tip of this leader. Do not allow secondary branches to outgrow the leader. Sometimes a tree will develop double leaders known as co-dominant stems. Co-dominant stems can lead to structural weaknesses, so it is best to remove one of the stems while the tree is young.

The lateral branches growing on the sides contribute to the development of a sturdy well-tapered trunk. It is important to leave some of these lateral branches in place, even though they may be pruned out later. These branches, known as temporary branches, also help protect the trunk from sun and mechanical injury. Temporary branches should be kept short enough not to be an obstruction or compete with selected permanent branches.

Permanent Branch Selection

Nursery trees often have low branches that may make the tree appear well-proportioned when young, but low branches are seldom appropriate for large-growing trees in an urban environment. How a young tree is trained depends on its primary function in the landscape. For example, street trees must be pruned so that they allow at least 16 feet of clearance for traffic. Most landscape trees require only about 8 feet of clearance.

APPENDIX

The height of the lowest permanent branch is determined by the tree's intended function and location in the landscape. Trees that are used to screen an unsightly view or provide a windbreak may be allowed to branch low to the ground. Most large-growing trees in the landscape must eventually be pruned to allow head clearance.

The spacing of branches, both vertically and radially, in the tree is very important. Branches selected as permanent scaffold branches must be well-spaced along the trunk. Maintain radial balance with branches growing outward in each direction.

A good rule of thumb for the vertical spacing of permanent branches is to maintain a distance equal to 3 percent of the tree's eventual height. Thus, a tree that will be 50 feet tall should have permanent scaffold branches spaced about 18 inches apart along the trunk. Avoid allowing two scaffold branches to arise one above the other on the same side of the tree.

Some trees have a tendency to develop branches with narrow angles of attachment and tight crotches. As the tree grows, bark can become enclosed deep within the crotch between the branch and the trunk. Such growth is called included bark. Included bark weakens the attachment of the branch to the trunk and can lead to branch failure when the tree matures. You should prune branches with weak attachments while they are young.

Avoid over-thinning the interior of the tree. The leaves of each branch must manufacture enough food to keep that branch alive and growing. In addition, each branch must contribute food to grow and feed the trunk and roots. Removal of too many leaves can "starve" the tree, reduce growth, and make the tree unhealthy. A good rule of thumb is to maintain at least half the foliage on branches arising in the lower two-thirds of the tree.

Newly Planted Trees

Pruning of newly planted trees should be limited to corrective pruning. Remove torn or broken branches, and save other pruning measures for the second or third year.

The belief that trees should be pruned when planted to compensate for root loss is misguided. Trees need their leaves and shoot tips to provide food and the substances that stimulate new root production. Un-pruned trees establish faster with a stronger root system than trees pruned at the time of planting.

Pruning Mature Trees

Pruning is the most common tree maintenance procedure. Although forest trees grow quite well with only nature's pruning, landscape trees require a higher level of care to maintain their safety and aesthetics. Pruning should be done with an understanding of how the tree responds to each cut. Improper pruning can cause damage that will last for the life of the tree, or worse, shorten the tree's life.

Reasons for Pruning

Because each cut has the potential to change the growth of the tree, no branch should be removed without a reason. Common reasons for pruning are to remove dead branches, to remove crowded or rubbing limbs, and to eliminate hazards. Trees may also be pruned to increase light and air penetration to the inside of the tree's crown or to the landscape below. In most cases, mature trees are pruned as a corrective or preventive measure.

Routine thinning does not necessarily improve the health of a tree. Trees produce a dense crown of leaves to manufacture the sugar used as energy for growth and development. Removal of foliage through pruning can reduce growth and stored energy reserves. Heavy pruning can be a significant health stress for the tree.

Yet if people and trees are to coexist in an urban or suburban environment, then we sometimes have to modify the trees. Village environments do not mimic natural forest conditions. Safety is a major concern. Also, we want trees to complement other landscape plantings and lawns. Proper pruning, with an understanding of tree biology, can maintain good tree health and structure while enhancing the aesthetic and economic values of our landscapes.

When to Prune

Most routine pruning to remove weak, diseased, or dead limbs can be accomplished at any time during the year with little effect on the tree. As a rule, growth is maximized and wound closure is fastest if pruning takes place before the spring growth flush. Some trees, such as maples and birches, tend to "bleed" if pruned early in the spring. It may be unsightly, but it is of little consequence to the tree.

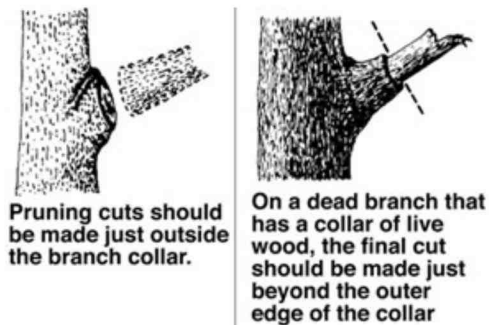
A few tree diseases, such as oak wilt, can be spread when pruning wounds allow spores access into the tree. Susceptible trees should not be pruned during active transmission periods.

APPENDIX

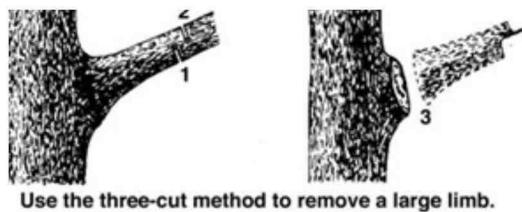
Heavy pruning just after the spring growth flush should be avoided. At that time, trees have just expended a great deal of energy to produce foliage and early shoot growth. Removal of a large percentage of foliage at that time can stress the tree.

Making Proper Pruning Cuts

Pruning cuts should be made just outside the branch collar. The branch collar contains trunk or parent branch tissue and should not be damaged or removed. If the trunk collar has grown out on a dead limb to be removed, make the cut just beyond the collar. Do not cut the collar.



If a large limb is to be removed, its weight should first be reduced. Making an undercut about 12 to 18 inches from the limb's point of attachment does this. Make a second cut from the top, directly above or a few inches farther out on the limb. Doing so removes the limb, leaving the 12- to 18-inch stub. Remove the stub by cutting back to the branch collar. This technique reduces the possibility of tearing the bark.



Pruning Techniques

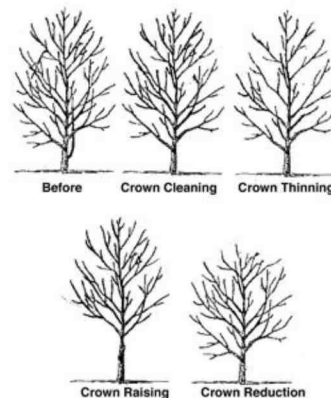
Specific types of pruning may be necessary to maintain a mature tree in a healthy, safe, and attractive condition.

Cleaning is the removal of dead, dying, diseased, crowded, weakly attached, and low-vigor branches from the crown of a tree.

Thinning is the selective removal of branches to increase light penetration and air movement through the crown. Thinning opens the foliage of a tree, reduces weight on heavy limbs, and helps retain the tree's natural shape.

Raising removes the lower branches from a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas.

Reduction reduces the size of a tree, often for clearance for utility lines. Reducing the height or spread of a tree is best accomplished by pruning back the leaders and branch terminals to lateral branches that are large enough to assume the terminal roles (at least one-third the diameter of the cut stem). Compared to topping, reduction helps maintain the form and structural integrity of the tree.



How Much Should Be Pruned?

The amount of live tissue that should be removed depends on the tree size, species, and age, as well as the pruning objectives. Younger trees tolerate the removal of a higher percentage of living tissue better than mature trees do. An important principle to remember is that a tree can recover from several small pruning wounds faster than from one large wound.

A common mistake is to remove too much inner foliage and small branches. It is important to maintain an even distribution of foliage along large limbs and in the lower portion of the crown. Over-thinning reduces the tree's sugar production capacity and can create tip-heavy limbs that are prone to failure.

Mature trees should require little routine pruning. A widely accepted rule of thumb is never to remove more than one-quarter of a tree's leaf-bearing crown. In a mature tree, pruning even that much could have negative effects. Removing even a single, large-diameter limb can create a wound that the tree may not be able to close. The older and larger a tree becomes, the less energy it has in reserve to close wounds and defend against decay or insect attack. The pruning of large mature trees is usually limited to removal of dead or potentially hazardous limbs.

APPENDIX

Wound Dressings

Wound dressings were once thought to accelerate wound closure, protect against insects and diseases, and reduce decay. However, research has shown that dressings do not reduce decay or speed closure and rarely prevent insect or disease infestations. Most experts recommend that wound dressings not be used. If a dressing must be used for cosmetic purposes, then only a thin coating of a nontoxic material should be applied.

Hiring an Arborist

Pruning large trees can be dangerous. If pruning involves working above the ground or using power equipment, it is best to hire an Arborist. An Arborist can determine the type of pruning necessary to improve the health, appearance, and safety of your trees. An Arborist can provide the services of a trained crew, with all of the required safety equipment and liability insurance.

There are a variety of things to look for when selecting an Arborist:

- Membership in professional organizations such as the International Society of Arboriculture (ISA), the Tree Care Industry Association (TCIA), or the American Society of Consulting Arborists (ASCA)
- Certification through ISA's Certified Arborist program
- Proof of insurance
- List of references (don't hesitate to check)

Avoid using the services of any tree company that

- Advertises topping as a service provided; knowledgeable arborists know that topping is harmful to trees and is not an accepted practice
- Uses tree climbing spikes to climb trees that are being pruned; climbing spikes can damage trees, and their use should be limited to trees that are being removed

Pruning Information Source: International Society of Arboriculture

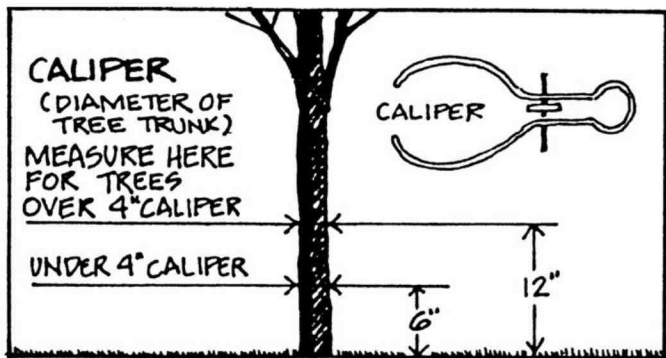


GLOSSARY



Southern Magnolia's and American Holly's line the streets of Pinehurst creating stark wintertime beauty on January 4th, 2018.

Caliper - the diameter measurement of tree-trunk taken at six inches above ground level for trees up to and including four inches in caliper. For larger trees, measurement of caliper shall be taken at twelve inches above ground level.

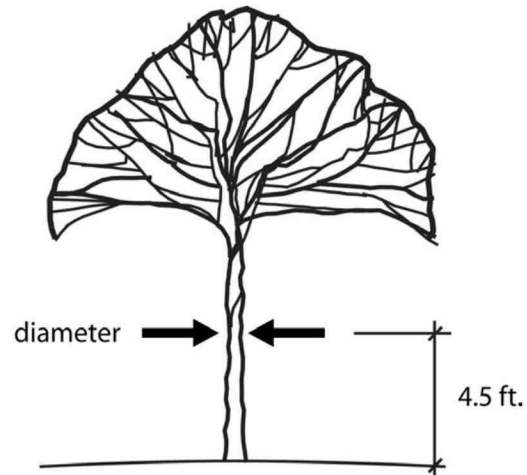


Canopy - the portion of a tree above the trunk.

Champion Tree - any tree that is listed on the National Register of Big Trees, which is a list of the largest living specimens of each tree variety found in the continental United States. The Village of Pinehurst, at its discretion, may be interested in starting a "local" Champion Tree program even though such trees may not actually appear on the National Registry.

Cultivar - a cultivated plant that has been selected and given a unique name because of its decorative or useful characteristics.

DBH (Diameter at Breast Height) - the diameter of a tree 4.5 feet above the average ground level.



Drip Line - the area beneath a tree's canopy extending to the outermost tips of the branches above.

International Society of Arboriculture (ISA) - an international non-profit organization headquartered in Champaign, Illinois USA. Its mission statement: "Through research, technology, and education promote the professional practice of arboriculture and foster a greater public awareness of the benefits of trees." (<http://www.isa-arbor.com/>)

Maintenance - proper cultural practices including pruning, fertilization, pest management and root system protection.

Monoculture - a single, homogeneous culture without dissension or diversity.

Tree Inventory - the gathering of accurate information on the health and diversity of the community forest on a development site or within a community.



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