
# 2007 Selected Urban Forest Inventory Summary

ArborPro
URBAN FOREST MANAGEMENT

May 2007

# Urban Forestry Inventory Summary

## Executive Summary

The City of Bonney Lake is one of the faster growing cities in Washington State. Bonney Lake is home to 15,320 residents, with a service population in excess of 20,000.

In February, 2007 the Town of Bonney Lake contracted with ArborPro, Inc. to provide a GPS tree inventory and GIS database program for selected parks and street trees. In late March the inventory was initiated with the GPS data collection. ArborPro, Inc. assigned two data collectors to collect the requested tree attributes and the GPS coordinates of every tree as well as tagging trees with identification numbers for easy tracking. The objective of this report is to summarize the findings from the survey and provide information for the creation of an urban forest management plan.

The survey provides information regarding the tree population of the areas selected by the Town which included mainly park environments. Included in the survey are the GPS locations of the trees, species name in Latin and common form, general health assessment, maintenance recommendation and species composition.

**Statistical Highlights:**

- There were 2,273 trees in the survey area representing over 40 different species.
- Douglas Fir and Western Red Cedar comprise nearly half of the survey's tree population.
- Nearly 33 percent of trees were over 60 feet in height. 111 trees are going to present or already have a utility line conflict.
- The GPS points were collected for every tree in the survey at an accuracy level of +/- 3 feet also referred to as "Sub-meter".
- The database provided to manage the survey information is a GIS-based system with interactive mapping capabilities providing a powerful management tool for the future scheduling, data entry and record keeping needs of the Town's trees.
- Maintenance recommendations for each tree have been provided and management plan information has been given to help preserve and enhance the overall health of the tree population and appearance of the Town.

## Introduction and Background

Prior to initiating the project, inventory staff members conferred with the key personnel from the Town of Bonney Lake. During this conference discussions were held to outline the project objectives, inventory attributes, project timeline and layout the final report delivery. Each specified tree was visited and data were recorded for each tree.

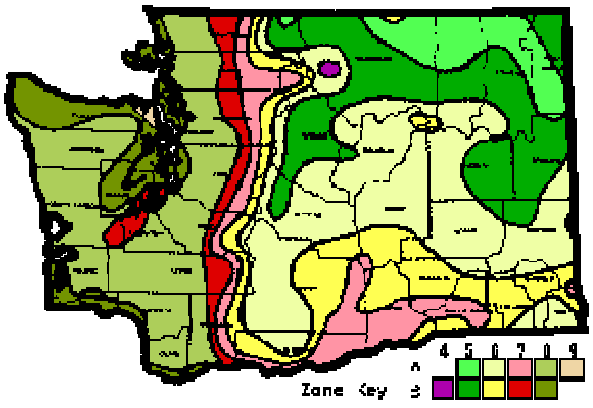
Every urban forestry plan begins with a concise inventory. As requested by staff, the Town has been delivered more than a simple inventory of trees on the property. Utilizing the Global Positioning System (GPS) and Geographic Information System (GIS) technology, a comprehensive tree inventory and a management tool was supplied to maintain and utilize the information. A GIS is a computer based tool for mapping and analyzing tree information in a visual manner. GIS technology integrates common database operations with the unique visualization and geographic benefits offered by maps. This inventory will allow the future use of updated mapping files and can be overlaid with other relevant data including roadways and pathways, irrigation and hardscape infrastructure, building footprints and others.

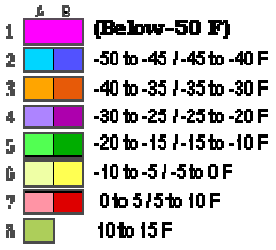
Also listed herein are summations of the tree population, listings of species that are in poor or declining health, and dead or dying specimens.

All of these sites are linked and will be displayed over high resolution orthophotography for a unique, simple and effective way to access the information. The data and visual information provided in this report will assist the Town in the future maintenance issues and management practices of the Town.

## Study Site

The USDA plant hardiness map divides North America into 11 hardiness zones (USDA Misc. Publication No. 1475, January 1990). Zone 1 is the coldest; zone 11 is the warmest. This gives the user a guideline as to which plants or trees have the greatest survivability in the region. The Town lies within the USDA hardiness zones 7b and 8a representing a lowest minimum temperature of -1 degree.



## Study Methodology

The following list of data was collected as well as the GPS coordinates for each tree.

Location Attributes

a. Unique ID – an individual number for each tree with a tree tag placed where necessary.
b. Address and Street Name
c. Species – Both Botanical and Common name
d. Diameter (Diameter at Breast Height / DBH)
e. Height – Collected in 15 foot increments
f. Condition Rating –Excellent, Good, Fair, Poor, Dead
g. Recommended Maintenance- Individual recommendation for each tree
h. Conflicts – Utility Lines
i. GPS coordinates – Sub-meter accuracy

Tree Identification – Each tree was identified by the proper genus, species, common name and cultivar if applicable.

Size Classification – Each tree was identified by the actual diameter at breast height. The actual DBH will be converted into dbh ranges of 6 inch increments.

Height – The height will be collected in the ranges provided below.

0-15’
15-30’
30-45’
> 45’

Condition Rating – The condition of each tree was included in the data collection process. The condition of each tree is a written rating of excellent, good, fair, poor, critical or dead.

Maintenance Recommendations –A determination of the maintenance needs for each tree was recorded. Below is a general listing of the maintenance recommendations:

Routine Pruning
Training Prune
Low Priority Prune
High Priority Prune
Low Priority Removal
High Priority Removal

Utilities – All above ground utility conflicts have been identified.

## GPS Data Collection

Using GPS and GIS for tree inventories is the preferred method for collecting data for the following reasons:


- GPS is incredibly accurate. The equipment used was a Trimble Pro XRS capable of accuracy of +/-3 feet. Offset distances were used only where signal conflicts existed.
- Data is collected in real time on the handheld computer while the GPS unit acquires the satellite connection for the location.
- Data logged into the backpack system is then downloaded to a GIS system for easy handling of the information.
- GIS then allows the user to sort, calculate and otherwise process the raw data into a useful format.
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Why GPS and GIS? Open space environments pose unique challenges to the urban forest manager. Without the constraints posed by hardscape and roadway as a limiting factor for growth and tree selection, a wider distribution of species is common making the management of the property more complex.

Further, scheduling maintenance can be difficult without the use of the street address- based tree locating method, commonplace in municipal urban forests. Using GPS and aerial mapping, the urban forest administrator in a park-like environment similar to Bonney Lake can rapidly select trees for work orders and then schedule and direct workers to the exact maintenance locations for maximum time and resource management.

<u>Tree tags</u>
The tree tags further insure that the correct maintenance is performed and recorded at each tree. Tags were placed on trees that were accessible at ground level. Although some trees were not tagged due to dangerous or difficult access, great lengths were taken to tag as many trees as possible.

# Study Results

## Size Characteristics

The size of a tree provides insight into the age and value of the tree. There are two industry-wide recognized size characteristics, height and diameter at breast height. While height is self explanatory, diameter at breast height (DBH) is determined by the diameter of the tree at 4.5 feet above grade. Both the height and the DBH are represented in ranges due to the dynamic growth rate of trees.

Table 1 – Tree Diameter in inches

| Diameter Range | Count |
|---|---|
| 0-6 | 271 |
| 6-12 | 805 |
| 12-18 | 678 |
| 18-24 | 208 |
| 24-30 | 184 |
| 30+ | 127 |

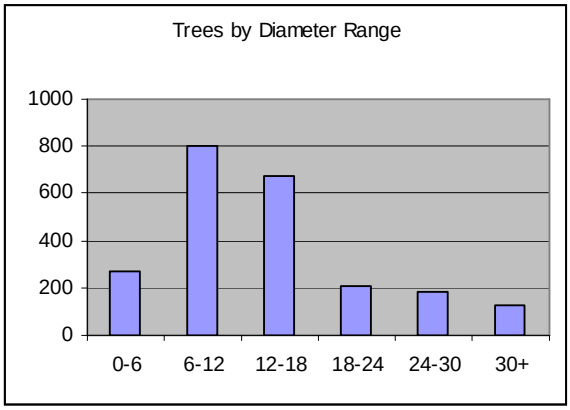
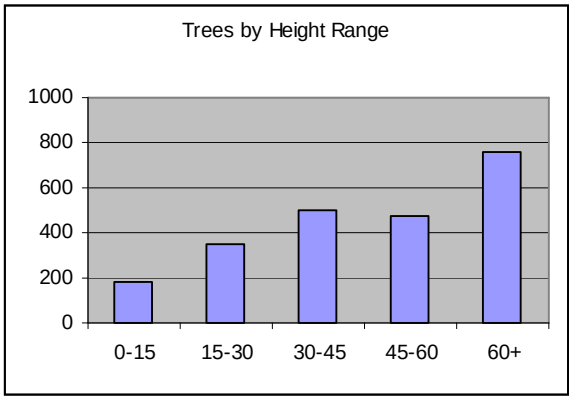



Table 2 – Tree Height in feet

| Height Range | Count |
|---|---|
| 0-15 | 183 |
| 15-30 | 350 |
| 30-45 | 502 |
| 45-60 | 476 |
| 60+ | 762 |



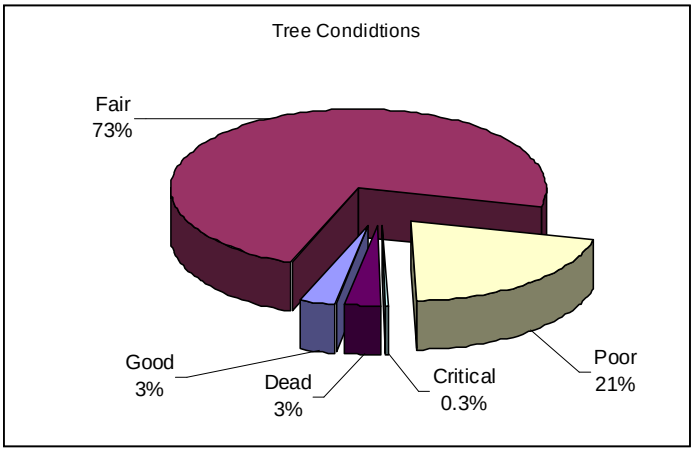

These Characteristics point to the dominant species within the survey towards tall, slender types including the two predominant specimens in Bonney lake; Douglas fir and Red Alder. Douglas firs in old growth forests reached 250 feet with the tallest recorded being in Washington State at 330 feet.

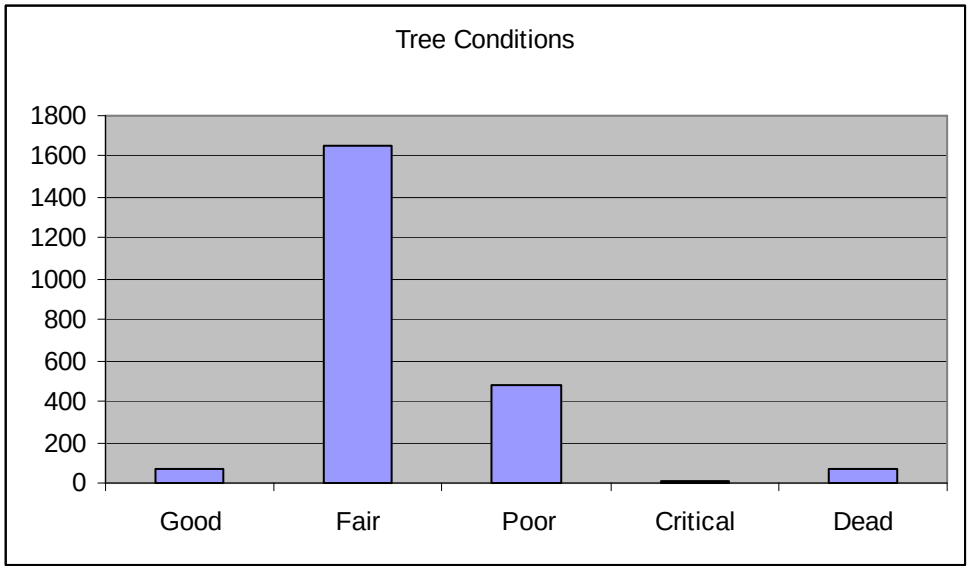
## Tree Condition Evaluation

The survey included an evaluation of the trees that have been inventoried with respect to their overall condition. The evaluation performed was a ground-level sight inspection; this does not guarantee the health or condition of any tree. There are many conditions that can exist in a tree that are not assessed from a ground-level inspection. However, the condition evaluation is helpful in determining the trees that are in the poorest condition. Below are a chart and graph of the tree conditions surveyed in Bonney Lake.

Table 3 – Tree Conditions

| Condition | Count |
|---|---|
| Good | 70 |
| Fair | 1654 |
| Poor | 475 |
| Critical | 7 |
| Dead | 67 |




Numbers here represent the relative lack of structural pruning and the more natural quality of the trees surveyed. Some typical characteristics are listed on the following page to help the reader understand the condition ratings.

## Tree Condition Descriptions

- **Good**

  Good to Excellent branch placement, lack of uncorrectable co-dominant leaders, good pruning history. Canopy generally full and balanced, good foliage color, vigor and shoot elongation typical of species, lack of visible or uncontrollable pests. Conditions ideal to favorable for full development to species potential, sufficient room for canopy and root growth, irrigation and soils exist to sustain development.

- **Fair**

  Decent branch placement, less than ideal scaffold spacing, some co-dominance present, past pruning less than ideal but possibly correctable. Canopy relatively thin, foliage chlorotic, vigor and shoot elongation below norm for species, minor pests or possibility of infestation. Some restriction imposed by deficiencies such as proximity to competing species, proximity to sidewalks, grade changes, poor irrigation, overhanging adjacent trees.

- **Poor**

  Inferior branch placement, crowded scaffold, co-dominance likely, correction or mitigation necessary and likely extensive, restructuring needed to repair past pruning practices. Canopy sparse, dead twigs, stunted or absent new growth, declining number of growing points, pest presence visible or likely. One or more restrictions severe enough to hamper the ability of the tree to develop fully as listed above. Recent changes to the site may manifest themselves symptomatically in the future.

- **Critical**

  Majority of dead limbs and scaffold. Canopy nearly or completely dead. Restrictions to the site likely to cause failure or death of the tree. Tree may already be compromised.

## Recommended Maintenance

| Recommended Maintenance | Tree Count |
|---|---|
| Routine Prune | 1753 |
| Priority 1 Removal | 207 |
| Training Prune | 149 |
| Priority 1 Prune | 100 |
| Priority 2 Prune | 45 |
| Priority 2 Removal | 19 |

| Priority 1 Removals | Common Name |
|---|---|
| 54 | Red Alder |
| 41 | Western Hemlock |
| 36 | Douglas Fir |
| 23 | Western Red Cedar |
| 22 | Bigleaf Maple |
| 16 | Balsam Poplar |
| 5 | Bitter Cherry |
| 5 | White Fir |
| 2 | Theves Poplar |
| 1 | Jeffrey Pine |
| 1 | Lodgepole Pine |
| 1 | Paper Birch |

**Priority 1 Prune**
The trees that have been recommended for a high priority prune should be inspected by staff. These trees are in need of corrective maintenance. The percentages of trees that fall into this category are normally less than 10% of the entire tree population. The budget required to prune these trees should be very reasonable and easy to attain.

| Removal Reason | Count |
|---|---|
| Dead | 67 |
| Decay Present | 41 |
| Disease/General Decline | 22 |
| Prior Limb Conflict | 20 |
| Poor Branch Structure | 16 |
| Leaning | 15 |
| Mechanical/Vehical Damage | 9 |
| Crowded/Insufficient growth Space | 8 |
| Existing Removal Rec. | 8 |
| Hardscape Damage | 1 |

**Priority 2 Prune**
A large majority of the trees surveyed on the fall into the low priority prune category. It is recommended that these trees are placed on a systematic pruning program. The most cost effective program would include grid pruning. Divide the City evenly into tree maintenance grids. Have the entire grid pruned in a budget year. Low-priority pruning cycles can be developed with regard to available funds.

**Priority 1 Removal**
These trees should be surveyed by staff and scheduled for removal and replacement if appropriate. This category includes trees that reflect dangerous conditions combined with significant targets such as proximity to high volume pathways or play areas.

**Priority 2 Removal**
These trees should be scheduled for removal over a reasonable time period based on available funds. The removal process should be followed by a replanting program. The appropriate species should be planted based on specie, site and soil conditions.

**Routine Prune**
Trees are in satisfactory condition and can be pruned on a regular cycle.

## Species Frequency

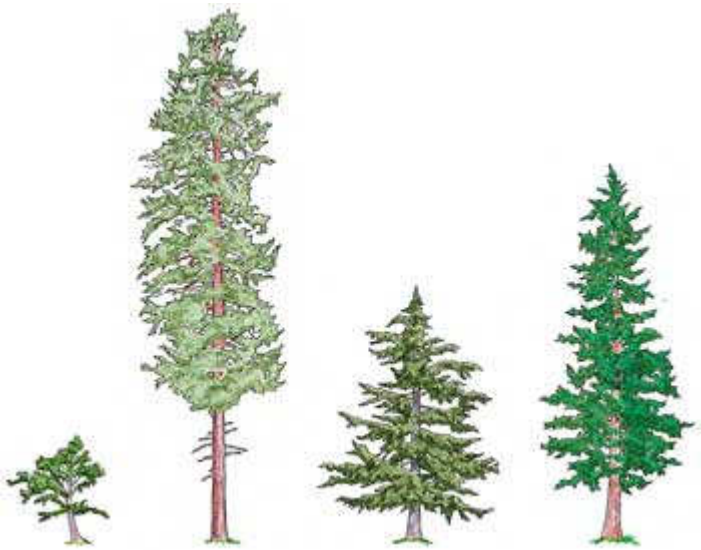
The species population diversity of the survey is listed on the following pages. The survey identified 41 different tree species. The most common tree identified in bonney Lake was the *Pseudotsuga menziesii* commonly known as the Douglas Fir. There are 667 Douglas Fir trees in the survey.

Table 4 – Species Frequency/Diversity

| Common Name | Count |
|---|---|
| Douglas Fir | 667 |
| Western Red Cedar | 474 |
| Red Alder | 400 |
| Western Hemlock | 185 |
| Bigleaf Maple | 162 |
| Red Maple | 118 |
| Balsam Poplar | 60 |
| Bitter Cherry | 52 |
| Purple-Leaf Plum | 34 |
| White Fir | 31 |
| London Plane Tree | 17 |
| American Sycamore | 8 |
| Theves Poplar | 7 |
| Jeffrey Pine | 7 |
| Paper Birch | 6 |
| Japanese Flowering Cherry | 6 |
| Crabapple | 4 |

Continued…

| Common Name | Count |
|---|---|
| Red Fir, Silver Tip | 3 |
| Oregon Ash | 3 |
| White Ash | 2 |
| American Holly | 2 |
| Madrone | 2 |
| Unknown/Unidentifiable | 2 |
| Grand Fir | 2 |
| Sugar Maple | 2 |
| Atlas Cedar | 1 |
| Colorado Blue Spruce | 1 |
| Council Tree | 1 |
| Camellia | 1 |
| Lodgepole Pine | 1 |
| Mountain Hemlock | 1 |
| Alaska Cedar | 1 |
| Pacific Dogwood | 1 |
| White Poplar | 1 |
| Pecos Crape Myrtle | 1 |
| River Birch | 1 |
| Scotch Pine | 1 |
| Siberian Larch | 1 |
| Thornless Honey Locust | 1 |
| Washington Hawthorn | 1 |
| Western White Pine | 1 |
| Norway Spruce | 1 |



*Pacific yew* *Douglas fir* *western hemlock* *western red cedar*

## Trends Analysis

From the data collected, some trees stand out in the landscape for differing reasons. Listed are some of the trends found when queried from several angles.

**Dead Trees** – varied over 9 different species. No one tree species stands out except the Western Hemlock as a function of its total count. Of the 103 Western Hemlocks surveyed, 21 are dead. Western Woolly Adelgid has likely played a part in the decline of this species.

| Dead | Common Name |
|---|---|
| 21 | Western Hemlock |
| 15 | Red Alder |
| 11 | Bigleaf Maple |
| 5 | Western Red Cedar |
| 5 | White Fir |
| 4 | Douglas Fir |
| 3 | Balsam Poplar |
| 2 | Theves Poplar |
| 1 | Jeffrey Pine |

**Poor Condition Trees** – Of the 18 trees species listed in this category, 149 are Douglas Fir. As a proportion of the 667 surveyed, this relatively high number represents primarily weather/wind damage to these trees. The size and storm susceptibility have given way to limb drop or breakage. The Alders are almost unnaturally tall and therefore are getting into the high wind zone.

| Poor | Common Name |
|---|---|
| 149 | Douglas Fir |
| 97 | Red Alder |
| 76 | Western Red Cedar |
| 58 | Western Hemlock |
| 31 | Bigleaf Maple |
| 24 | Balsam Poplar |
| 18 | Bitter Cherry |
| 6 | Paper Birch |
| 5 | White Fir |
| 2 | Japanese Flowering Cherry |
| 1 | Camellia |
| 1 | Lodgepole Pine |
| 1 | Oregon Ash |
| 1 | Purple-Leaf Plum |
| 1 | Scotch Pine |
| 1 | Sugar Maple |
| 1 | Thornless Honey Locust |
| 1 | White Poplar |

## Trends Analysis

Continued…

### Low Priority Removal

| Priority 2 Removals | Common Name |
|---|---|
| 8 | Douglas Fir |
| 4 | Bigleaf Maple |
| 3 | Western Red Cedar |
| 2 | Western Hemlock |
| 1 | Red Alder |
| 1 | White Fir |

### High Priority Trimming

| Priority 1 Trimming | Common Name |
|---|---|
| 32 | Douglas Fir |
| 26 | Red Alder |
| 14 | Bigleaf Maple |
| 9 | Balsam Poplar |
| 8 | Western Red Cedar |
| 6 | Western Hemlock |
| 4 | Bitter Cherry |
| 1 | Thornless Honey Locust |

### Notes from The field

On the list of concerns to our arborist were the trees that are in proximity to high value or high use public spaces. Two that were of interest were the trees surrounding the skatepark and its associated picnic grounds. These trees have existing deadwood and are starting to show wear and tear in this high target area.

Raphiolepis canker may become an issue in the Alder population.

Shoestring root rot is apparent and the planting of prone species, firs, pines and spruces should be done with care and regular inspection.

Downed trees being left to decay, whether to provide habitat or from lack of resources, may be perpetuating this root rot.

*The Top 5 Species at a glance*

**Doug Fir**

| Count | Condition |
|---|---|
| 510 | Fair |
| 149 | Poor |
| 4 | Dead |
| 4 | Good |
| **667** | **Total** |

**Western Red Cedar**

| Count | Condition |
|---|---|
| 372 | Fair |
| 76 | Poor |
| 21 | Good |
| 5 | Dead |
| **474** | **Total** |

**Red Alder**

| Count | Condition |
|---|---|
| 281 | Fair |
| 97 | Poor |
| 15 | Dead |
| 4 | Critical |
| 3 | Good |
| **400** | **Total** |

**Western Hemlock**

| Count | Condition |
|---|---|
| 103 | Fair |
| 58 | Poor |
| 21 | Dead |
| 2 | Critical |
| 1 | Good |
| **185** | **Total** |

**Bigleaf Maple**

| Count | Condition |
|---|---|
| 117 | Fair |
| 31 | Poor |
| 11 | Dead |
| 3 | Good |
| **162** | **Total** |

## Urban Forest Information

From an arborist/urban forest standpoint, it appears that most of the recent infill planting has been primarily of Red Maple. It may be important to vary the species composition in order to prevent a catastrophic loss of a single predominant species in the future.

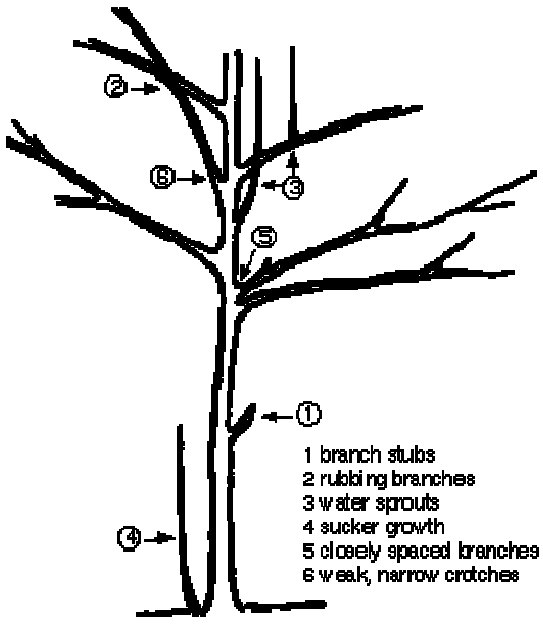
The trees that fall into the two smallest categories in both DBH and Height represent the young urban forest. An important aspect of a young urban forest is professional tree care. Common belief is that a tree does not require pruning until it has achieved a certain age or size. The opposite is often true. Professional young tree maintenance, provided by a certified arborist, will alleviate many potential problems.

Trees that are pruned properly in their first two to three years will be healthy trees that will require less maintenance in the future. Young tree maintenance can also prevent tree liability associated with un-maintained trees. Trees that receive the appropriate pruning measures while they are young will require less corrective pruning when they mature.

Proper care of young trees begins with pruning at planting time only to remove branches damaged during handling and transplanting. Low branches should not be removed because they manufacture critically needed food for the new tree.

Any pruning of a small tree has the effect of changing its look for its lifetime. Proper technique is essential. Damaging cuts can cause structural problems or introduce diseases that last for the life of the tree. Small cuts do less damage to the tree than large cuts. For that reason, proper pruning (training) of young trees is critical. Waiting to maintain a tree until it is mature can create the need for large cuts from which a tree cannot easily recover.

Figure 3. Example: Prune this young tree to remove:



## Urban Forest Information

It is advised to continue planting replacement species that are suited to the location. For example, our arborist has suggested the following:

Smaller street trees with color:

Serviceberry

Western Redbud

Character Tree

Kentucky Coffeetree

## Urban Forest Information

Other trees of interest to the Town may include:

White Oak
Black Oak
English Oak
Crabapples (at right)
Poplars
American Sycamores
Liquidamber
Western Cypress
Leland Cypress
Magnolia “Brownii”

## Summation

The Bigleaf Maple is performing very well and no extensive pest problems were identified. The Sycamore population is also an asset. Where possible, by applying species diversity practices, the urban forest will be at a reduced risk for a decimating pest or disease that may wipe out one or a group of trees leaving the area blighted.

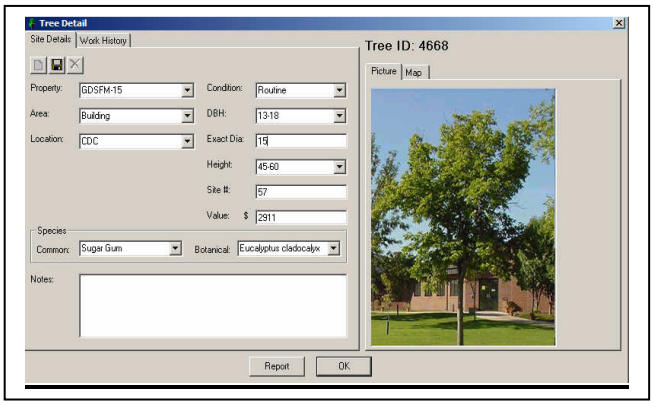
Lastly, it will be necessary to provide the funding and materials for adequate maintenance of the trees. Diligent monitoring and maintenance will help to ensure a healthy urban forest for years to come.

Our arborist and staff are available to assist you with this report and look forward to aiding the Town of Bonney Lake in its urban forest goals.

# ArborPro Software Database Management Tool

ArborPro Software is a comprehensive inventory program to assist in the efficient management of trees, landscape, and physical assets. The program utilizes the latest in GIS technology to provide the user with an immediate visual representation of any field asset.

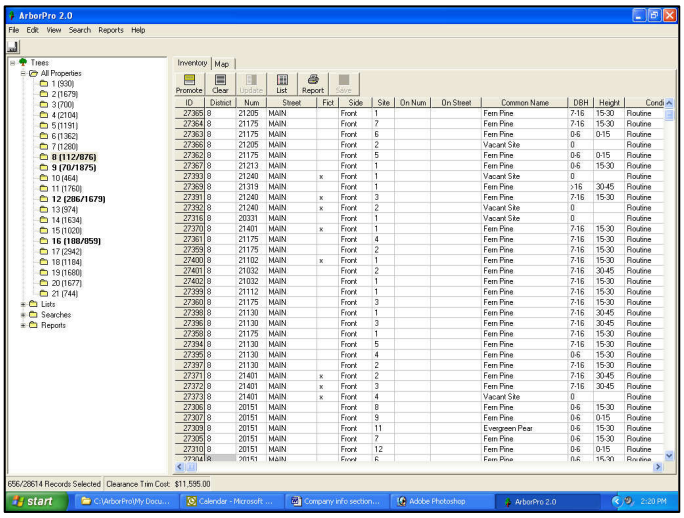
<u>Efficient Resource Management</u>




Time is the most valuable resource for any management staff. Using ArborPro software will optimize the time spent on tree management through the rapid interface of mapped trees to pertinent information. The mapping feature is unique and will eliminate the need for site visits and complex data entry. All assets are inventoried to client specifications, including size, type, condition, and estimated maintenance. Areas or sites can be quickly highlighted on a map, the maintenance costs can automatically be calculated, work lists issued and tasks completed.

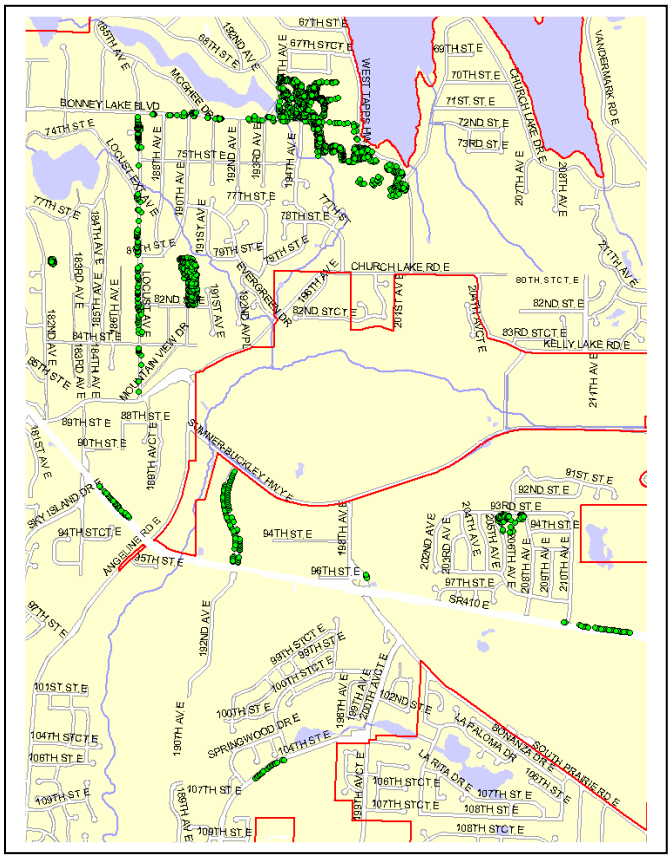
<u>Easy To Use Interface</u>

ArborPro software uses a familiar windows interface. Most of the system features are driven by “drop-downs” or a simple click of the mouse.



GIS Capabilities

ArborPro provides a mapping component that allows the user to locate and display trees over other GIS data and parcel information as well. A single tree can be picked from the map or frame groups of trees to create spatial queries independent of the tabular view. The program can be networked at the Town allowing all individuals working with tree resources a common, easy platform to enhance communication and updating efforts. The program is user friendly and does not require extensive training.




ArborPro can be used by the Town to effectively manage it's urban forest by:

- Proactively removing known hazards and replanting when appropriate.
- Scheduling regular pruning and inspections of trees and maintaining these records for trends analysis. Eliminate wasted funds on trees that need only regular maintenance every couple of years.
- Scheduling regular site visits to pest prone species for evaluation.
- Planning, budgeting and scheduling field work. Especially on a annual system showing all work over multiple years.
- Actively and rapidly entering historical data from the field crews.
- Maintaining a photographic record of problematic trees.
- Maintaining a photographic record of "heritage" trees or donated trees.
- Tracking costs of maintaining the urban forest on a daily, weekly or yearly basis.