Wilbur D. May Arboretum Tree Inventory and i-Tree Streets Analysis

Wilbur D. May Arboretum
& Botanical Garden
Community Services Department
Regional Parks

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SCOPE OF WORK

This inventory was made possible by a grant from the made possible by the USDA Forestry Service through the Nevada Division of Forestry , which has committed to numerous tree inventories in Nevada. Additional funding was supplied by Washoe County and the Wilbur D. May Foundation.

Funds were disbursed and awarded an skilled contractor. Preliminary meetings were held to determine the most efficient and accurate way to collect and log the data. Washoe County GIS Specialist also met with the horticulturist and contactor to determine our best option. A laptop was available for data collection, but the contractor and specialist suggest we use working maps of specific areas due to the screen issues, awkwardness and unmanageable size of the computer. A spread sheet was developed for data collection and logging. The horticulturist and the contractor meet nearly daily through the season to review work plans, address concerns and monitor the work load. The contractor was paid through Man Power and time sheets were approved and faxed weekly by the horticulturist.

The contactor was assigned to collect field data, DBH (diameter at breast height, or 4 ½ feet above ground level) for nearly 1,651 trees. Since the Arboretum has keep records of their trees and plants for over 30 years, and data logged in a database (ARC Gis), the horticulturist would generate specific field maps for daily use. Because the Arboretum developed an attribute table for accessing and inventorying trees in ArcMap, each map that was generated, showed specific tree species (family, genus, species and cultivar), location and a unique alphanumeric identifier (accession numbers) to catalog each tree and plant. To make field data collection as simple as possible, these maps were taken to specific areas of the Arboretum along with an Excel spreadsheet to cross-reference each accession number and tree. Here all trees were then field justified. DBH's was measured with a measuring tap, recorded then placed in a class size as follows:

- 0 to 3 inches (Class 1)
- 3 to 6 inches (Class 2)
- 6 to 12 inches (Class 3)
- 12 to 18 inches (Class 4)
- 18 to 24 inches (Class 5)
- 24 to 30 inches (Class 6)
- 30 to 36 inches (Class 7)
- 36 to 42 inches (class 8)
- More than 42 inches (Class 9)

Each tree was assessed for condition, which is somewhat subjective. Criteria for the different condition classes are as follows:

- Excellent: Tree is healthy, with perhaps a few small dead branches (Class 4)
- Good: Tree is healthy with numerous small dead branches or leaves (Class 3)
- Fair: Tree is relatively unhealthy with large dead limbs or part of the tree is dead (Class
- Poor: Tree is either dead in place or is dying (Class 1)

For trees in less than excellent condition, comments written on the spreadsheet indicated problems (or if the tree was gone this was written. These comments are valuable for maintenance and planning purposes. The hand-written notes were transferred to the existing database later at the office.

I-TREE STREETS IDIOSYNCRASIES

Since i-Tree lumps all tree species in a given climate region; for the purposes of this i-Tree Streets analysis, the horticulturist and the contractor chose North Climate Region from a list of 18 climate regions in the U.S. because the species list best fits the trees in the inventory. The region contains 129 tree species (called "Species Code" in the program and shown in Appendix 1 of the final report), of which 64 are present in the inventory. However, the arboretum contains 186 tree species, so 122 have to be lumped into categories such as "CEL OTHER," which means "other large evergreen conifer tree." Thus an individual species may not be recognized in i-Tree Streets reports. For the arboretum, this would include both Jeffrey Pine and Giant Sequoia, each of which is more than one percent of the total trees.

For the 110 non-named species, there are two choices: assign a species to a similar species (e.g. Jeffrey Pine is very similar to Ponderosa Pine); or assign the tree to one of the lumped categories (e.g. Giant Sequoia, which represents 26 trees or over two percent of the total population has no species name, so it must be lumped into the "CEL OTHER" category. Thus, neither tree would appear as its species name in any of the reports.

Another required field in the program is "Assigned Species Code," which for the North Climate Region is one of 27 archtypes (shown in Appendix 2 of the final report). An archtype is a either a tree species (e.g. "FRAM" for American Ash, *Fraxinus pennsylvanica*) or a tree genus (e.g. "PY" for Pear*, Pyrus spp.*).Tree species with similar size, habit, leaf surface, etc. are lumped into this archtype, so the benefits would be similar for all the trees in the archtype. Unfortunately, two of the archtypes are not found in the 186 species in the Arboretum, so 159 would have to be lumped.

One of the reports i-Tree Streets analysis provides, derived from DBH measurements, is called "Age Distribution." This is a misnomer, because different trees grow in diameter at different

rates. For example, a 25-year-old giant Sequoia may be 30 inches DBH, while a 25-year-old Austrian Pine may be 12 inches DBH and a 25-year-old Amur Maple may be 6 inches DBH. Therefore, for the purposes of this report, diameter size is given in terms of DBH.

An i-Tree Streets project generates many reports, but two of the most important types for planning, budgeting and maintenance are the "Annual Net Benefits" (the dollar benefits of having the trees) and the "Replacement Value" (the dollar cost of replacing a tree which has been removed). I-Tree Streets dollar annual benefits and replacement cost results have been used all over the U.S., so total dollar values are considered valid. Because of the lumping, individual tree values may not be as valid.

Because of the lumping, i-Tree Streets reports such as species distribution, DBH and tree condition do not accurately represent the Arboretum. For this reason, the graphs for these attributes were generated from the inventory.

An important attribute of i-Tree Streets is "Zone" (in this case, gardens/groves). The model can generate some useful reports by zone, to enable assessment of species diversity, size of trees, etc. But the model cannot handle more than 20 zones comfortably. So eight of the 26 gardens/groves were merged into compatible and contiguous gardens/groves to generate 18 zones for the model.

CREATING AND POPULATING THE I-TREE PROJECT

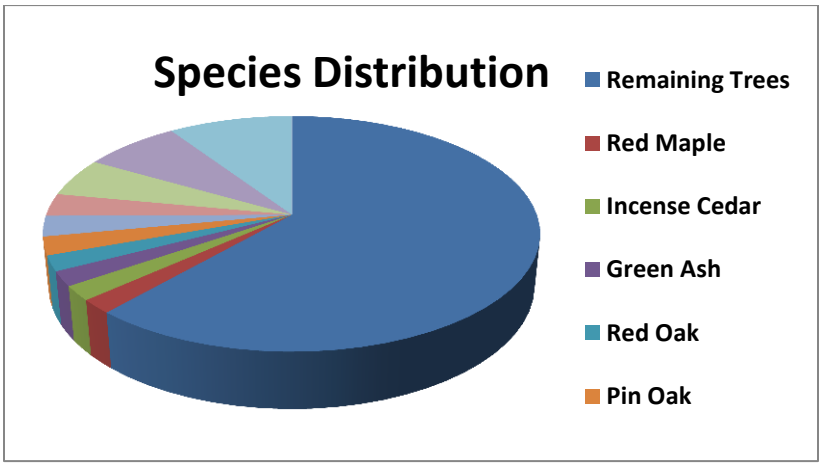
An i-Tree project was created in i-Tree Streets-friendly parameters before any data could be logged and recorded. To create a project, it must be assigned a name, a climate region, ("North" in this case), and a "Complete Survey" must be specified.

This brings up different screens for costs such as tree planting budget and benefits calculation such as electricity prices. It is optional to specify these values, and they were omitted for this project, but the data can be adjusted to reflect values at any time in the future.

The field data that was recorded was imported, and the several programs run. If the program does not run, there generally is a problem with the Excel spreadsheet. Then the importing is cancelled and the Excel spreadsheet is rationalize, re-imported into the Access database, then re-imported to i-Tree Streets and the program is actuated until there are results. This is a lengthy process taking hours to complete.

RESULTS

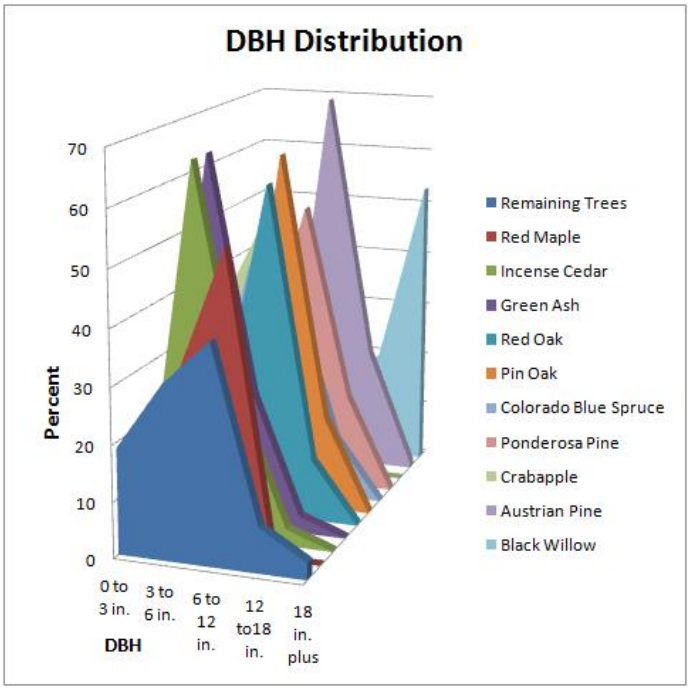
This chart shows the percentage of trees for the 10 most abundant species and the rest of the trees.



There are 186 tree species in the Arboretum (Appendix 3 in the final report). This compares with 100 tree species in the City of Reno's arboretum in Idlewild Park. The Wilbur D. May Arboretum has arguably the most diverse tree community in all of Nevada.

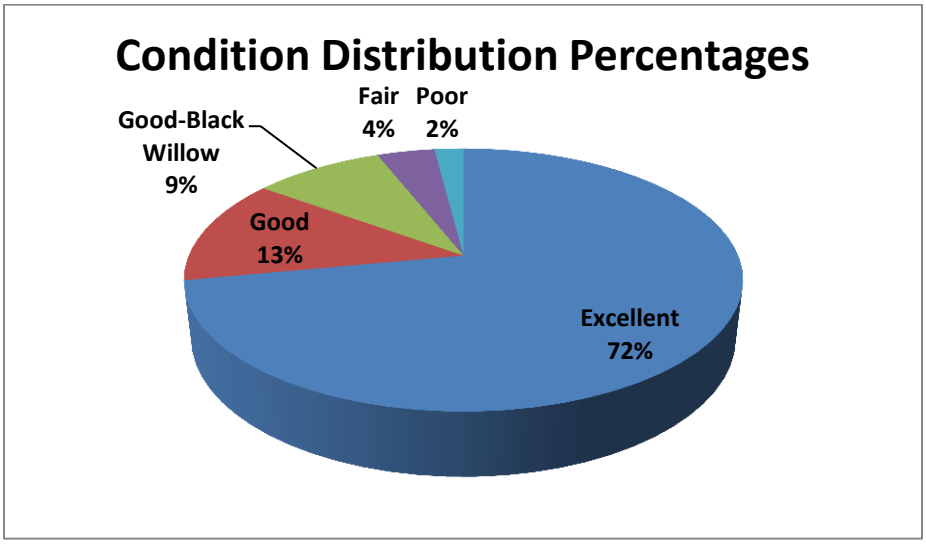
The most abundant tree is Black Willow, which comprises nine percent of all trees; the ten most abundant tree species, as shown in the disc graph, comprise only 39 percent of all trees.

The DBH distribution graph is shown below.



Note that DBH size ranges stop at 18 inches plus. For the ten most populous species, only Black Willow trees and two other trees had DBH greater than 18 inches. For purposes of report clarity, this chart stops at 18 inches plus.

The condition distribution chart is shown below.



Note that "Fair" or "Poor" trees comprise only six percent of total trees. These are trees which probably should be removed or replaced. This indicates that trees in the Arboretum are generally healthy and should not require much maintenance.

ITREE STREETS REPORTS & RESULTS

The i-Tree Streets computer model provides a large number of various charts and tables. One of the most crucial for planning and budget purposes is the Annual Benefits report. This report indicates that the annual aggregated benefit of the Arboretum trees (summing up the categories of reduced energy use, decrease in air pollution, erosion control and aesthetics) is **$ 150,000**.

Another report crucial for planning and budget purposes is the Replacement Value. For an individual tree, the is the amount of money required to replace it should it die. Summing up the replacement value of all trees in the Arboretum gives an aggregate replacement Value is **$ 3,004,000**.

If costs (such as planting, pruning and irrigation) and benefits (such as the reduction in electricity and gas usage and mitigation benefits of less erosion) are input into the model,

cost/benefits reports are generated. For this model costs and benefits were not input, but they can be input and the model can be run again.

Growth Scenario

i-Tree Streets allows for different scenarios. The current scenario is one, but since trees grow in both size and DBH, a future growth scenario can be modeled through a new i-Tree Streets project.

The growth scenario model entailed revising the Excel spreadsheet , importing it into an new Access database and importing that into a new i-Tree Streets project. This project can be repeated many times using different assumptions.

The new model required some assumptions: 1) all trees in fair or poor condition are replaced, and these on average are in the 3 to 6 inch size class after five years; 2)all trees now in the 0 to 3 inch size class were moved into the 3 to 6 inch size class in the new Excel spreadsheet; 2) all trees now in the 3 to 6 inch size class were moved into the 6 to 12 inch size class; and half of the trees in the 6 to 12 inch size class were moved into the 12 to 18 inch size class. All other size classes remained the same.

FINAL RESULTS

The aggregated Annual Benefits increased to **$ 184,000**, an increase of **$ 34,000** (an annual percentage increase of **4.5 percent**). The aggregated Replacement Value increased to **$ 4,229,000**, an increase of $ **1,225,000** (an annual percentage increase of **8.2 percent**). This means that maintaining the trees greatly increases the asset values.

SUMMARY

One thousand five hundred and one trees (1,651) trees were measured in the Wilbur D. May Arboretum. They comprise 186 species, 276 different kinds of trees including varieties and cultivars. Only 39 percent of the trees belong to one of the 10 most-planted species, which indicates a very diverse urban forest.

The trees are also young compared those of other urban forests inventoried recently, because (except for the Black Willows along Evans Creek), no trees were planted before 30 years ago.

Ninety four percent (94%) of the trees are either in “Excellent” or “Good” condition.

The trees were inventoried to provide measurements of the size of each tree (Diameter at Breast Height, or DBH); assessment of tree condition for planning and maintenance; and as input for an i-Tree Streets model (which provides reports and determines the annual benefits and replacement value of the trees in the Arboretum, for planning and budget purposes).

Results of the i-Tree Streets analysis indicate that the trees provide an annual benefit of $150,000, and a replacement value of $3,004,000. An additional i-Tree Streets analysis, assuming growth of the trees five years into the future indicates that the trees would provide an annual benefit of $184,000 and a replacement value of $ 4,229,000.

The results of this inventory will be used to assist the County horticulturist complete its mission and goals of preparing a maintenance and removal plan as well as a budget. The data from this study will provide the horticulturist quantifiable information on the environmental services that trees provide, as well as the structure of the Arboretum forest. Additionally the results will be used to support a Washoe County Community Services Department Regional Park urban forestry program when funding becomes available, and the results will be included in the Washoe County Natural Resource Management plan. Furthermore, the study offers the horticulturist the ability to articulate the significance of community trees in terms of pollution mitigation, storm water run-off reduction, carbon sequestration and storage, all of which aligns with the mission, goals and purpose of the May Arboretum environmental and horticulture educational program.

Currently the results have already been used by the horticulturist. The data was presented at the University of Nevada Cooperative Extension Green Industry program, Park Commission meeting and just recently the Reno Gem and Mineral Society. The presentation explains the value of the Arboretum, its cultural, environmental, educational and historical value to the community (please see Power Point attachment) as well as the environmental benefits. The results will also contribute to increase community awareness of the Arboretum to assist in building capacity, engage decision makers for future plans, foster and strengthen new and old partnerships such as the May Foundation, Park Commission and the May Arboretum Society for future funding.