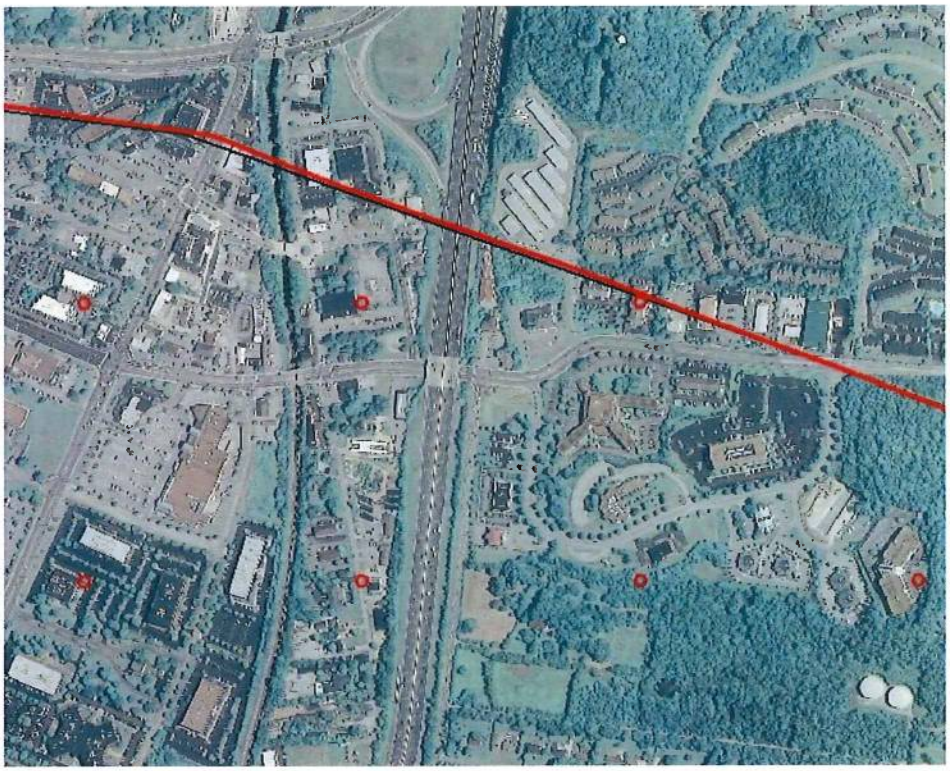
Brentwood

Tree Canopy Report



Presented to

Brentwood Tree Board

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Urban Forest
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Canopy Cover Analysis for Brentwood
August, 22, 2013

Introduction

Trees in our communities provide many benefits, including energy savings, air quality improvements, storm water management, property value increases, and quality of life and health improvements. These benefits have an economic value and are supported by research done by the USDA Forest Service. A 2010 news release by the Forest Service stated the following:

"Reports issued by the Forest Service Northern and Pacific Northwest Research Stations focused on specific cities - Chicago, Portland and Sacramento. The studies detailed the following findings:

- Chicago's 3.6 million trees annually reduce air pollution by about 890 tons, a $6.4 million benefit per year.
- In Sacramento, trees planted on the south and west sides of houses reduced summertime electricity bills by an average of $25.16.
- In Portland the study found that street trees growing in front of or near a house added an average $8,870 to its sale price and reduced time on the market by nearly two days.

"These economic benefits spilled over to neighboring properties as well. For instance, a neighborhood tree growing along the public right-of-way added an average of $12,828 to the combined value of all houses within 100 feet.

"Nationally, benefits from the estimated 3.8 billion urban trees are significant. These trees are estimated to have a structural value of over $2 trillion, and store carbon valued at over $14 billion. Urban trees also annually remove air pollution valued at $4 billion and remove carbon dioxide, a dominant greenhouse gas, valued at around $460 million per year."

From: http://www.fs.fed.us/news/2010/releases/11/trees.shtml, Release No. 1029

Background

The software used for this analysis is fGIS, which the Division of Forestry accessed from the web. It is based on an early version of ArcView and is modified for forestry uses.

Aerial photos that we used for analysis were taken by flights in 1997 and 2010. Both years' photos were taken at one meter resolution. The 1997 photo was black and white and was taken in the winter (leaf off) and the 2010 photo was color and taken leaf on.

The city's boundary layer was obtained from the Brentwood Planning Office in the fall of 2012, and reflects the boundary of Brentwood at that time. The area within this boundary is estimated to be approximately 26,440 acres.

Method

A dot grid was generated and applied over the aerial photos, then each dot was examined to determine if the point was canopy, or impervious surface, or not. Each dot or point was a small circle, and the "reading" of the point was accomplished by looking inside the circle. Photos were analyzed using a scale of between 1:3000 to 1:6000, depending on the year of the photo and whether the analysis was for canopy or impervious surface.

Canopy Results from the 2010 Photo

A 1320 ft. by 1320 ft grid was overlain on the aerial photo to determine canopy. The results are listed below:

Grid Size (mi)	# points	points canopy	canopy percent	Standard error	Points for 5% std error
1/4 mi	661	258	39.0	1.9%	96

Note: 2 points were water points

Brentwood's tree canopy is 39.0%.

Staff typically will conduct a second analysis using a denser grid, usually a 990 ft by 990 ft., but with a standard error of less than 2 percent it was determined that a ¼ mile grid was sufficient for Brentwood.

Impervious Surface Results from the 2010 Photo

The same grid size was utilized to analyze impervious surface. The results from this analysis for the ¼ mi. grid is listed below.

Grid Size (mi)	# points	points imperv surf.	imperv surf percent	Standard error	Points for 5% std error
1/4 mi	661	118	18.9	1.5%	59

Brentwood's impervious surface is 18.9%

Canopy and Impervious Surface Results from the 1997 Photo

The 1997 photo analysis was also done with a 1320 X 1320 ft. (1/4 mi.) grid. Again, 661 points were analyzed with the following results:

	Yes points	percent	Standard Error	points for 5% std error
Canopy	249	37.7	1.9%	94
Impervious Surface	97	14.7	1.4%	51

Additional Notes

For your reference, the large map was printed at 1:36000 scale. Small maps were printed at a scale of 1:62,000.

Discussion of Differences and Similarities between the 2010 and 1997 Photos

A. The same town boundary layer was applied to both photos in order to compare canopy on identical areas of land.

B. Canopy percent has increased 1.3% over the last 13 years. Intuitively this may not make sense given the development that has taken place over this time period. However, the difference is less than the percent of error in the sampling, which means one could make the statement that the canopy of Brentwood is stable. It may also indicate that the tree ordinance is working to help replace trees, or areas that have been developed were farmland instead of forest, which would not have changed canopy in these instances. Using the figures from the analysis, it is estimated the town gained 342 acres of canopy in this time period.

C. Impervious surface percent has increased from 14.7 to 18.9 percent, an increase of 4.2%. this translates into 1110 acres being paved or built within the city.

Note: The 1997 photo was much more difficult to analyze canopy and impervious surface due to it being a black & white photo taken during leaf off.

Comment on fGIS Software

Some people may question the use of an early version of ArcView versus what is currently available. The Division of Forestry's urban forestry program uses it because of the advantage the forestry adaptations yields, and we have compared canopy analysis results of this software to newer software programs in other communities and found the differences are negligible.

What's next for Brentwood?

The Tree Board could:

1. Field check some of the points to determine if canopy and impervious surface are present. If the Tree Board is interested in doing this, the Board would need aerial photos with a lower scale, as 1:62,000. The Division of Forestry can provide these if the tree board pursues this.
2. Set goals to maintain or improve canopy.
3. Review the tree ordinance to see if it can be strengthened to maintain canopy in development situations
4. Identify plantable spaces and work toward increasing canopy

Assumptions and Calculations on Adding to Brentwood's Canopy Cover

Brentwood's canopy cover percentage is slightly higher than the typical community, which runs around 35%. However, a generally accepted ideal for communities is 40%, so a goal to increase canopy is desirable. To increase canopy 1% would require planting an additional 264 acres of trees. Making the assumption that an acre would need approximately 50 trees

and the cost per tree for a 1" caliper tree would be $50, the cost would be $660,000. Plus it would take a minimum of 30 years time to achieve this.

The above example demonstrates the value and importance of maintaining and strengthening Brentwood's tree ordinance so that the community would be able to retain as much canopy as possible as the community continues to develop.

Appendix A.

i-Tree Tools – i-Tree Canopy

i-tree canopy is an online tool that anyone can use to analyze canopy for any area of land, including their own yard. It can be found at http://www.itreetools.org/canopy/index.php It uses the aerial photos from google maps and in most cases is accessing 2012 or 2013 photos. After accessing the above web address, click on applications (the 3rd blue button), and i-tree canopy. The screen that appears will show Washington DC and a list of 3 **easy** steps on the right.

Step 1 – Define a boundary. One can either load an existing shape file to use (part a) or draw their own boundary (part b). Both steps start by accepting a licensing agreement. To continue with a custom boundary (part b), one can look at any part of the world, but usually one will drill down to their little corner of the world by using the zoom in feature on the left side along with a left click and hold on the mouse to adjust location.

Once one has found the desired location on the aerial photo, One clicks on the blue crown in the upper left corner, then positions the mouse on the aerial photo and clicks once to establish a corner. Then as the mouse is moved, a line is drawn until the mouse is in position over another corner. This is repeated as many times as needed until the area to study is closed with a final click at the beginning point. (Curved lines can be simulated with many short line segments.) The final click encloses an area for study by highlighting it in light red. To finish Step 1, click finish in the lower right corner.

Step 2 – Click on the bar for step 2, and decide whether tree and non-tree classes are sufficient. If they are, click Done in the lower right corner. For more classifications, click the plus sign below the non-tree classification, and in the box called cover class, type in a classification (impervious surface, water, etc.). When finished, hit submit. And when finished defining the cover classes, hit Done in the lower right.

Step 3 – Click on step 3 to begin counting points on the aerial photo. To get the first point, click the plus sign below the Id column. A point will appear on the aerial photo and one decides what the land cover is. If it's tree under cover class, go on and click the plus sign for the second point. If it's something else, click the down arrow to the right for the other classes you defined in step two.

As you begin to classify points, one will notice that the above the chart for classifications, the number of points for each class is compiled along with a standard error calculation. The standard error figure is important because to have a reasonable accurate measure of canopy cover or some other classification, the standard error should be around two percent or less.

When finished establishing and counting points, one can save data – save data button at the bottom of the screen, or just close the web site. If you save the data, the information is stored as a data (.dat) file, which can be accessed later from i-tree canopy or other programs (not Windows) that recognizes this type of file.