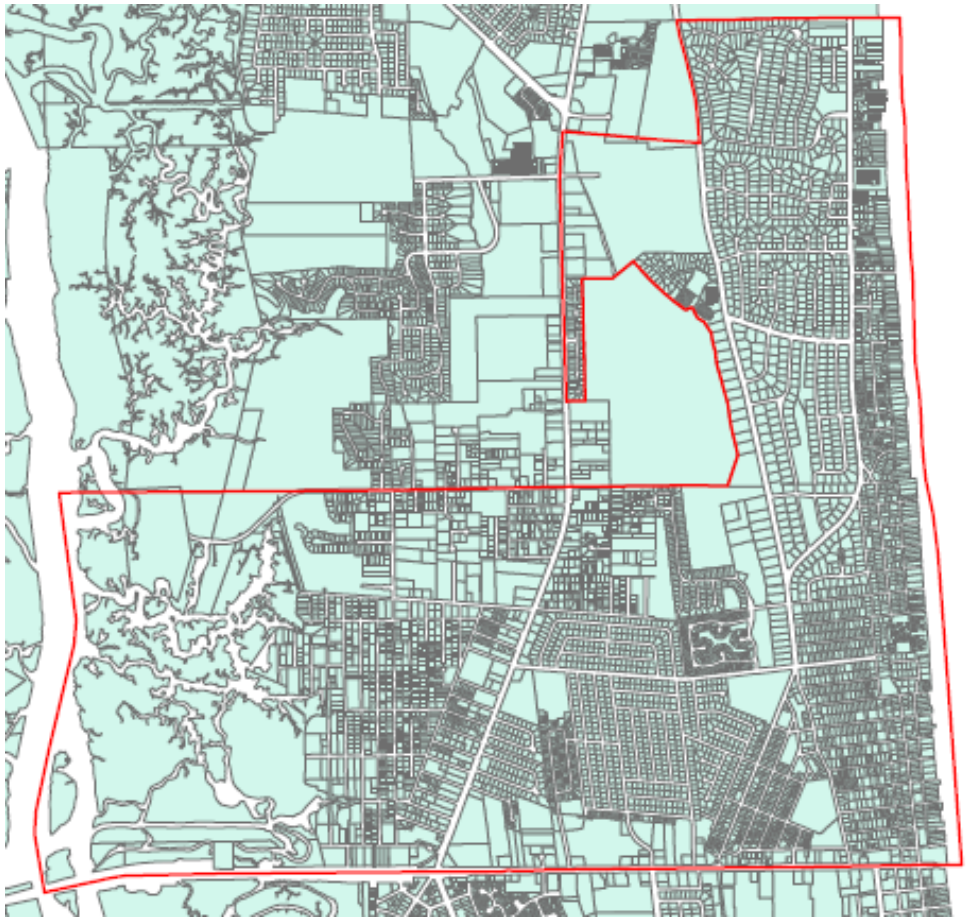
# Tree Canopy Assessment
# City of Atlantic Beach, Florida
# January, 2015



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## SUMMARY

The City of Atlantic Beach, Florida has contracted with Legacy Arborist Services (LAS) of Tallahassee, Florida to conduct an assessment of the historical tree canopy within their city boundaries. LAS utilized the *iTree Canopy* software developed by the US Forest Service to analyze digital images of the city tree canopy taken in both December, 2003 and January, 2014. Charles Marcus, an ISA certified arborist employed by LAS, performed the assessment.

The current tree canopy covers 30.0% of the city's total area. Grass and bare soil occupies an additional 21.1%. Impervious surfaces, including pavement and roofs, cover 25.0%. Marshes and open water occupy 21.1%, and beach or dune areas occupy 2.7%. These figures compare with a 2003 tree canopy of 31.8%, grass and bare soil covering 21.7%; and impervious surface covering 22.6% (Marsh/open water and beach/dune area remain the same). This represents a decrease in tree canopy of 5.7%, a decrease in grass and bare soil coverage of 2.8%, and an increase in impervious surface of 10.6% during the 10 year period of the assessment. These figures are listed in tabular format in the addenda.

Atlantic Beach appears to be maintaining a healthy and vital tree canopy overall. It is recommended, however, that city leaders maintain a proactive approach to both minimizing tree canopy loss and limiting or mitigating increases in impervious surfaces as the city grows and re-develops.

## IMPORTANCE OF TREE CANOPY

People inherently understand the aesthetic or visual value of trees to their community. In addition, however, they also need to recognize the economic contributions that trees make to the developed environment, as well as their contribution to public health, crime reduction, and other amenities that are more difficult to quantify. Although trees require resources to maintain them, the value of the "ecosystem services" they provide in return exceeds their cost of maintenance. Examples of ecosystem services provided by trees include reducing the costs of stormwater management, energy production and use, and absorbing air pollution. *iTree Canopy* can estimate the value of air pollution mitigation provided by the city's tree canopy (see the attached addenda). Additional ecosystem services can be measured using other modules of the *iTree* Software Suite. The value of the stormwater and energy benefits are typically quite a bit more than the air pollution benefits. Since trees located on privately owned land contribute ecosystem services to the overall community, some reasonable regulation of privately owned trees benefits the general public.

The tree canopy measured in this assessment can be defined as the total estimated land area covered by the leaves, branches, and trunks of all standing trees when viewed from above. The proportion of land covered by the tree canopy – typically expressed as percent canopy cover – serves as a convenient measure of the magnitude of the community forest and the services the canopy provides. Tree canopy can be readily assessed, easily communicated, and provides a useful measure for setting goals, prioritizing actions, and tracking changes.

Impervious surfaces, although necessary for a number of reasons, increase the cost of stormwater management for local public works departments. They increase stormwater volumes and associated non-point source pollution. They also increase ambient summer air

temperatures in the city by reflecting heat that was previously absorbed by the tree canopy and the soil beneath. This in turn can also result in higher energy costs for nearby buildings and a less favorable environment for residents. Impervious surfaces also reduce the availability of oxygen, water, and nutrients to tree roots, which in turn reduces the ecosystem services that these trees can provide.

## METHODOLOGY

Atlantic Beach city officials have recognized the importance of the city's tree canopy. For that reason, they directed LAS to estimate changes to the canopy over the past 10 years. They wished to quantify long-term impacts from the three hurricanes that passed through the city in August and September, 2004, as well as evaluate the effectiveness of current city ordinances designed to protect the tree canopy. The *iTree Canopy* software provided LAS with a relatively inexpensive and expedient means of carrying out this assessment. This software is scientifically based and has been peer reviewed.

The user begins the assessment by defining the land cover types they wish to measure. For this assessment, those cover types include the following:

- Trees and Shrubs (current canopy)
- Grass and Bare Soil (potential areas to increase canopy)
- Impervious Surfaces (areas permanently disturbed by development – no longer plantable)
- Marsh/Open Water/Dunes (natural areas not suitable for canopy increase)

Once the user identifies these land cover types and then defines the geographical boundaries of the assessment area, the software generates a series of random points on current Google Earth images. As each point appears on the screen, the user enters the cover type on which the point falls. The user continues to sample a sufficient number of points to achieve the desired level of statistical accuracy. In this case, 1000 points within the city boundaries were sampled. Once current imagery is sampled and a report is generated, the software transposes the same sample point locations onto Google Earth images from a selected previous reference year, 2003 in this case. The user records the land cover types present on those points at that time, and generates a new report for the reference year for comparison purposes. Points were classified as Trees/Shrubs if the tree canopy covered from above an impervious surface or other cover type. If the trees only shaded the other cover type from the side, however, they were not classified as tree canopy.

## GENERAL OBSERVATIONS

The city tree canopy appears to primarily consist of Live Oak (*Quercus virginiana)*, North Florida Slash Pine (*Pinus elliotii*), and Sabal (Cabbage) Palm (*Sabal palmetto*), as well as other species indigenous to flatwoods and upland soils of North Florida. These species grow within the city for the most part in mixed stands, but occasionally in either pure stands or as individual trees. There doesn't appear to be any widespread disturbances to the tree canopy, either natural or human-caused. Individual residential and commercial property owners have converted small areas over the past 10 years from tree canopy to either grass, pavement, roofs, or improvements such as decks or swimming pools. Some previously grassed or unpaved areas are now built upon and paved over. Some previously unshaded impervious surfaces and grassed areas are now covered by tree canopy because of adjacent tree growth and some new plantings. Some individual trees were retained in areas that

previously either had dense canopy or were not yet developed. This could indicate that property owners are being at least somewhat conscientious in conserving tree canopy, and that measures taken by the city are having some positive effect.

## COMPARISON TO OTHER CITIES

There is no set tree canopy percentage that would be considered "optimal" everywhere. Each community has a number of considerations that are unique to its particular circumstances, including climate, geography, land cover, previous land use patterns, available resources, local priorities, and other factors.

Atlantic Beach currently has an estimated tree canopy percentage of 30%. If the land area occupied by marshes, open water, and dunes is deducted, this percentage increases to 39%. These figures compare favorably with the average Florida statewide tree canopy coverage in developed areas of 26.7%, and 32.1% when unplantable natural areas are eliminated. The statewide average for impervious surface in developed areas is 16.9%, which is lower than the current 25.0% in Atlantic Beach. Examples of tree canopy cover from other Florida cities include Tampa@28%, Orlando@22%, Miami@5%, Gainesville@52%, Jacksonville@46%, Orange Park@45%, and Ocala@29% (Nowak, 2009). Other southeastern city tree canopies include Atlanta@48%, Austin, TX@32%, and New Orleans@23% (Leff, unpublished).

Setting ambitious canopy cover goals can help to engage the public, motivate officials to action, secure funding for tree management, and encourage stewardship. On the other hand, several communities have launched ambitious tree planting initiatives to increase their tree canopy which failed because of poor planning and execution. The right species needs to be planted in the right place and receive adequate post-planting care.

## STATISTICAL ACCURACY

A tabular summary of the results of this assessment and the statistical boundaries are included in the addenda. This assessment is accurate enough to provide the City of Atlantic Beach with a historical perspective of the condition of the city tree canopy and a basis for developing strategies for future management of the canopy. Tighter confidence intervals can be obtained either by collecting data from a network of sample plots in the field or employing more sophisticated (and expensive) software for conducting tree canopy analyses.

## WHERE TO GO FROM HERE

The following measures can help the City to increase, or at least maintain, the tree canopy coverage over the next several years.

Conserve the Current Tree Canopy: Protecting larger trees or clumps of trees is the most effective strategy. Energy savings can be derived from retaining canopy trees within 20-60 feet of buildings. The tree's Critical Root Zone (CRZ) needs to remain undisturbed as much as possible. This could mean rearranging the configuration of buildings and improvements on the development site, as well as restricting construction equipment from the CRZ.

Minimize the Creation of Additional Impervious Surfaces: Consider alternatives to asphalt and concrete on at least portions of development or re-development sites. Establish tree islands or corridors of adequate size in parking lots (these can be incorporated into the site stormwater

management system). Install pavers or some type of pervious pavement in proximity to trees. Engineers can provide these alternatives if asked to do so.

Identify Opportunities for Tree Plantings on Publicly Owned Lands: The 21% grass and bare soil cover identified in this assessment provides at least some opportunities for additional tree plantings. Select sites where it would be desirable to add tree canopy, and calculate the number of canopy trees that could be planted on these sites. Conflicts with overhead and underground utilities, as well as other existing infrastructure need to be considered in advance.

Hold a Tree Sale/Giveaway for Property Owners: Both Greenscape Jacksonville and the Duval County Cooperative Extension Service have considerable experience in carrying out these events. Selecting suitable species for your area that residents will like and obtaining quality nursery stock of the appropriate size need to be carefully considered in advance. Providing recipients with an educational venue which includes site selection, proper planting technique, and post-planting care is also essential. Some type of fanfare, or incorporation with another community event, can also help increase resident participation.

Conduct More Detailed Assessments: As previously mentioned, more precise assessments of your community trees can be procured by either data collection on the ground or more sophisticated Urban Tree Canopy (UTC) analysis. These can be done city-wide, or just in areas of particular concern to city leaders. It may be more economical to conduct these studies in cooperation with other neighboring communities. Trees along hurricane evacuation routes and other significant thoroughfares can be the initial focus for street tree inventories. Trees in heavily used parks and other public areas would also be good candidates for individual inventory and condition assessment. Review of city tree and landscape ordinances by an outside entity may help to identify where they can be made more effective without being too intrusive.

Develop an Urban Forestry Management Plan: This document would synthesize all of the above recommendations into a comprehensive long-range document specifically designed for the City of Atlantic Beach. The plan would include current conditions, future goals, strategies for achieving the goals, and resources needed to do so. Input from city leaders and the general public, perhaps in a facilitated session, would be an essential part of formulating the plan.

**Legacy Arborist Services remains available to the City of Atlantic Beach to provide assistance with the management of their tree canopy, whether through casual communication by phone or email or through the implementation of specific projects for a nominal fee. We can also direct you to a number of sources of additional information about trees.**

# i-Tree

# Canopy Assessment and Tree Benefits Report

# City of Atlantic Beach, Florida

*Estimated using 1000 random sample points from Google Earth images taken **January 19, 2014**.*

| Cover Class | Description | Abbr. | Points | % Cover |
|---|---|---|---|---|
| Tree/Shrub | Canopy Cover | T | 300 | 30.0 ±1.45 |
| Impervious | Buildings, Roads Unplantable | I | 250 | 25.0 ±1.37 |
| Marsh, Open Water | Unplantable | M | 211 | 21.1 ±1.29 |
| Grass, Bare Soil | Plantable Areas | G | 211 | 21.1 ±1.29 |
| Dunes | Unplantable | D | 27 | 2.70 ±0.51 |

**Tree Benefit Estimates**

| Abbr. | Benefit Description | Value | ±SE | Amount | ±SE |
|---|---|---|---|---|---|
| CO | Carbon Monoxide removed annually | $103.57 | ±5.00 | 1,274.46 lb | ±61.55 |
| NO2 | Nitrogen Dioxide removed annually | $93.97 | ±4.54 | 2.38 T | ±0.11 |
| O3 | Ozone removed annually | $7,807.67 | ±377.07 | 23.29 T | ±1.12 |
| PM2.5 | Particulate Matter less than 2.5 microns removed annually | $14,307.13 | ±690.95 | 1.18 T | ±0.06 |
| SO2 | Sulfur Dioxide removed annually | $10.18 | ±0.49 | 1,444.15 lb | ±69.74 |
| PM10* | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | $5,090.57 | ±245.85 | 7.78 T | ±0.38 |
| CO2seq | Carbon Dioxide sequestered annually in trees | $112,578.15 | ±5,436.87 | 5,813.98 T | ±280.78 |
| CO2stor | Carbon Dioxide stored in trees (Note: this benefit is not an annual rate) | $1,822,581.04 | ±88,020.14 | 94,125.36 T | ±4,545.71 |

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# i-Tree

# Canopy Assessment and Tree Benefits Report

## City of Atlantic Beach, Florida

*Estimated using 1000 random sample points from Google Earth images taken **December 31, 2003**.*

| Cover Class | Description | Abbr. | Points | % Cover |
|---|---|---|---|---|
| Tree/Shrub | Canopy Cover | T | 318 | 31.8 ±1.46 |
| Impervious | Buildings, Roads Unplantable | I | 226 | 22.6 ±1.36 |
| Marsh, Open Water | Unplantable | M | 211 | 21.1 ±1.29 |
| Grass, Bare Soil | Plantable Areas | G | 217 | 21.7 ±1.29 |
| Dunes | Unplantable | D | 27 | 2.70 ±0.51 |

**Tree Benefit Estimates**

| Abbr. | Benefit Description | Value | ±SE | Amount | ±SE |
|---|---|---|---|---|---|
| CO | Carbon Monoxide removed annually | $105.99 | ±5.03 | 1,304.20 lb | ±61.95 |
| NO2 | Nitrogen Dioxide removed annually | $96.16 | ±4.57 | 2.43 T | ±0.12 |
| O3 | Ozone removed annually | $7,989.85 | ±379.52 | 23.84 T | ±1.13 |
| PM2.5 | Particulate Matter less than 2.5 microns removed annually | $14,640.97 | ±695.46 | 1.21 T | ±0.06 |
| SO2 | Sulfur Dioxide removed annually | $10.42 | ±0.49 | 1,477.85 lb | ±70.20 |
| PM10* | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | $5,209.35 | ±247.45 | 7.96 T | ±0.38 |
| CO2seq | Carbon Dioxide sequestered annually in trees | $115,204.97 | ±5,472.33 | 5,949.64 T | ±282.61 |
| CO2stor | Carbon Dioxide stored in trees (Note: this benefit is not an annual rate) | $1,865,107.93 | ±88,594.16 | 96,321.62 T | ±4,575.36 |

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# City of Atlantic Beach, Florida
## iTree Canopy Statistical Analysis - 95% Confidence Intervals

| | Tree Canopy Cover | | | Impervious Surface | | | Grass, Bare Soil | | | Marsh, Open Water | | | Dunes, Beach | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | LCL | UCL | Mean | LCL | UCL | Mean | LCL | UCL | Mean | LCL | UCL | Mean | LCL | UC |
| 2014 | 30.0 | 27.2 | 32.8 | 25.0 | 22.3 | 27.7 | 21.1 | 18.6 | 23.6 | 21.1 | 18.6 | 23.6 | 2.7 | 1.7 | 3.7 |
| 2003 | 31.8 | 28.9 | 34.7 | 22.6 | 19.9 | 25.3 | 21.7 | 19.2 | 24.2 | 21.1 | 18.6 | 23.6 | 2.7 | 1.7 | 3.7 |
| % Change | - 5.7% | | | +10.6% | | | -2.8% | | | | | | | | |

Upper Confidence Limit (UCL) = Mean + (Standard Error x 1.96)

Lower Confidence Limit (LCL) = Mean - (Standard Error x 1.96)

The actual values of the parameters measured in this analysis have a 95% chance of falling between the LCL and UCL.

% Change = ((2014%-2013%)/2003%) x 100. Tree Canopy Cover Example: ((30.0-31.8)/31.8)) x 100 = -5.7%

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USDA Forest Service, DAVEY, Arbor Day Foundation, SMA Society of Municipal Arborists, ISA International Society of Arboriculture, Casey Tree Washington D.C.

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