UF UNIVERSITY of FLORIDA
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FOR 209

The Structure and Composition of Tampa's Urban Forest[1]

Michael G. Andreu, Melissa H. Friedman, and Robert J. Northrop[2]

A Brief Overview of Tampa's Urban Ecological Assessment

What is the purpose of an urban ecological assessment?

The purpose of an urban ecological assessment is to provide a detailed look into the economic and ecological characteristics and values of the urban forest. The results from this type of assessment can serve as the basis for: 1) enhancing the understanding of urban forest values, 2) improving or developing urban forest policies, 3) ensuring effective planning and management of the urban landscape and, 4) providing data for the inclusion of trees within environmental regulations.

From February to July, 2007 an urban ecological assessment was conducted in the city of Tampa. A total of 201 permanent sample plots were located within Tampa's city limits (Figure 1). These plots will be revisited every 5 years in an effort to monitor changes in Tampa's urban forest structure and assess how these changes are related to the functions the forest provides.

The team used the **U**rban **F**orest **E**ffects (UFORE) model developed by the USDA Forest Service to calculate values for variables such as: tree diversity; species origin; abundance; tree density; size distribution; tree, shrub and surface covers; and leaf area by land use. The model also quantifies urban forest functions such as: energy savings, air pollution removal, carbon storage and sequestration, and compensatory or replacement values.

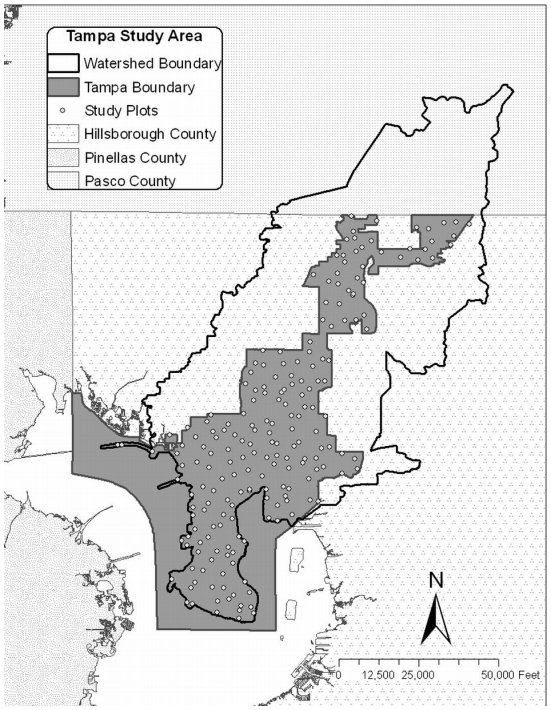

Figure 1. Distribution of study plots.

Structure

What is forest structure?

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2. Michael G. Andreu, assistant professor of forest systems; Melissa H. Friedman, biological scientist, School of Forest Resources and Conservation, IFAS, University of Florida, Plant City Center; Robert J. Northrop, Extension forester, Hillsborough County Extension, IFAS, University of Florida.

Forest structure refers to the distribution of vegetation (woody and herbaceous), both horizontally and vertically across a given area. The structure of the urban forest changes over time as plants grow, die, or are added to a particular location, and as zoning and development alters the landscape. The structure of an urban forest influences the way the forest functions and the environmental services it can provide. For example, if reducing wind to slow soil erosion around an open field in an area is desirable, then an urban forest structure with a dense tree and shrub canopy and dense grass and vegetation would be more effective than one with few overstory trees and shrubs and sparse grass and vegetation.

What attributes are measured in a forest's structure?

Researchers measure and calculate various physical attributes of forest vegetation to determine urban forest structure. Such attributes include tree and shrub: diameter, height, crown area, crown condition, leaf area, total biomass and their spatial distribution. Quantifying the structure of the urban forest enables researchers to relate forest structure to specific forest functions, such as energy conservation for residential homes, carbon sequestration and storage by trees, and air pollution reduction.

How is this study different from a tree canopy study?

In many urban forest assessments, researchers and managers quantify only the amount of tree canopy cover in the city. While this is a useful approach, it does not tell us much about the vegetation below the canopy. Our assessment divides the forest into three layers or strata. The uppermost stratum is the tree layer. This stratum consists of woody species or palm species greater than 1 inch in diameter at 4.5 feet in height. The second stratum is the shrub layer. This stratum represents all woody or palm species less than 1 inch in diameter but greater than 1 foot tall. The final stratum occurs at ground level and includes woody or herbaceous vegetation less than 1 foot tall.

Tree Layer

What is tree cover?

Tree cover is a common metric used to quantify the space occupied by tree canopies across an area. It is ecologically important because it indicates how much of an effect the forest has on the microclimate (e.g. shade in parking lots and homes), how much rain is intercepted by the trees, and the amount of pollutants that are removed from the air.

How much tree cover is in Tampa?

The UFORE study results show that the city-wide average tree cover is approximately 28%. Often the question arises as to the 'right' amount of tree cover for a city like Tampa, but this is not the question that we really need to ask. Instead, the question needs to be focused on the level of services we would like our urban forest to provide, for example: shading, pollution removal, or carbon sequestration. When this question is answered, we can better estimate how much canopy cover is needed to achieve such goals. Through effective monitoring, it will be possible to assess if the target canopy cover is adequate to achieve these goals.

Why is it important to understand the diameter distribution of a forest?

Tree diameters are commonly thought to be indicative of tree age, so small-diameter trees equal young trees and larger diameters indicate older trees. Over 80% of the trees in Tampa are smaller than 6 inches in diameter (Figure 2). This would lead some to believe that the majority of the trees in Tampa are young trees. However, a closer look reveals that 73% of the 1- to 3-inch-diameter trees are mangroves *(Avicennia germinans, Laguncularia racemosa, Rhizophora mangle)* and Brazilian pepper *(Schinus terebinthifolius)*. These species tend to maintain a small diameter throughout their lives and will not grow to large sizes. Therefore, it is critical to understand the species composition of the forest in order to properly interpret the meaning of the diameter distribution in Tampa's urban forest.

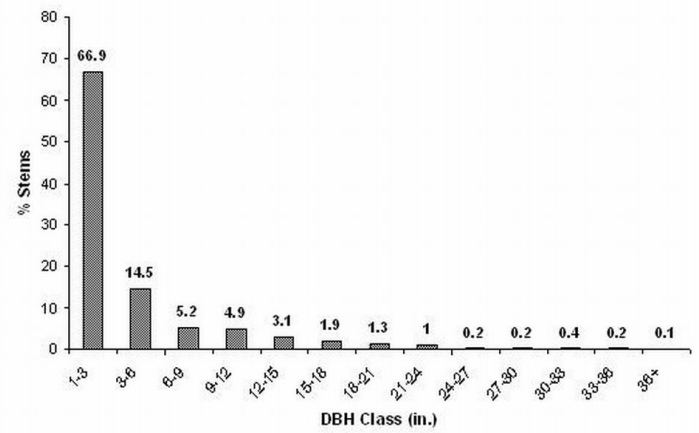

Figure 2. Diameter distribution of the trees in Tampa (at 4.5 feet in height; DBH).

Trees greater than 36 inches in diameter represent less than one percent of the total population of trees in the city.

Trees of this size consist, in large part, of native long-lived species such as oaks and bald cypress. If managers and planners want to ensure larger diameter trees continue to exist in Tampa's urban forest, they will need to make sure that these larger trees present in the landscape today will be replaced by similar ones over time. This means managers and planners will need to protect smaller diameter trees similar in species and growth characteristics to the larger diameter ones now, so that they may become the mature, larger diameter trees in the future. Understanding diameter distribution and species information allows us to develop a comprehensive strategic management plan to meet this objective. Both large- and small-diameter trees are essential to the health and longevity of the urban forest. An urban forest that has variation in tree sizes and species ensures the diversity of structures that support the variety of values the urban forest provides (Andreu et al. 2008).

Shrub Layer

What is shrub cover?

Shrub cover is often overlooked and undervalued as a component of the urban forest. Like tree cover, it is an estimate of the amount of area in the urban forest covered by shrubs. Shrub cover is an important attribute of the urban forest because it adds structural complexity and diversity, both of which have ecological and aesthetic value. Shrubs provide some of the same benefits as trees: they cool microclimates, minimize nutrient runoff, and help remove air pollutants.

How much shrub cover is in Tampa?

In Tampa, it is estimated that approximately 14% of the city is covered with shrubs.

Ground Cover Layer

What is ground cover?

Ground cover is divided into two broad categories: impervious surfaces (asphalt, buildings, and cement), and pervious surfaces (bare soil, duff and mulch, herbs, maintained grass, rock, un-maintained grass and water). Urbanization tends to increase the amount of impervious surface, which affects hydrological processes such as aquifer recharge and surface runoff (Ward and Trimble 2004). In general, pervious surfaces allow rain to soak into the ground and maintain a healthy and plentiful aquifer.

How is ground cover distributed in Tampa?

Thirty-three percent of the ground cover in the city is classified as impervious. The remaining 67% consists of pervious surfaces, including maintained grass, rock, water, bare soil, herbs, wild grass (not mowed or maintained) and duff (Figure 3).

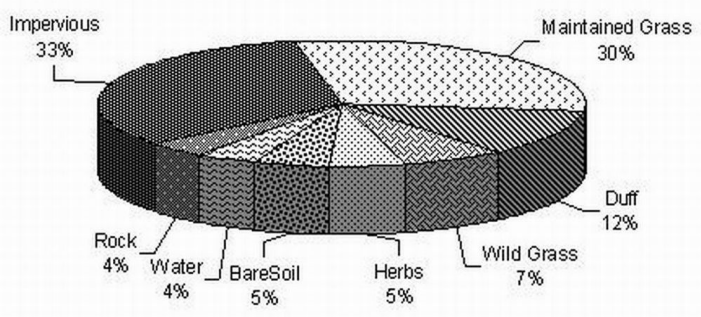

Figure 3. Distribution of ground cover types in Tampa.

Composition

What is the composition of Tampa's urban forest?

The composition of the forest refers to the tree species that make up the forest. If we understand the types of trees in the forest, we can understand how the forest will grow and change over time and how trees may respond to disturbances such as insect outbreaks, diseases, or hurricanes. Some tree species are known to live many years (e.g. bald cypress; *Taxodium distichum* or live oak; *Quercus virginiana*) and others are considered to be relatively short lived trees (e.g. laurel oaks; Quercus laurifolia). Some tree species are resistant to wind events (e.g. cabbage palm; Sabal palmetto) while others break readily in storms (e.g. sand pine; Pinus clausa). Understanding the composition of the forest provides us with insights into issues that may arise as the forest develops. Because Tampa is located in the transitional climate zone between tropical south Florida and temperate north Florida, a unique and diverse suite of species coexist in Tampa's urban forest. In this study, we identified 93 different tree species in Tampa.

How many tree species make up Tampa's urban forest?

Species diversity is the number of species in a given land area. It is an important attribute in the urban forest and can be used as an indication of the forest's vulnerability or resiliency to such natural disturbances as insect or disease outbreaks. Areas that have low species diversity are likely to be less resilient to disturbances. For example, the Southern pine beetle (*Dendroctonus frontalis*) attacks and kills pine trees. When conditions are right, the population of these beetles can rapidly expand, spreading the infestation. The

spread of the beetles slows where pines are mixed with other tree species vs. areas that are monocultures of pine (Gara and Coster, 1968). Thus a forest with greater species diversity tends to be at lower risk to total loss from a single insect, disease, or wind damaging event.

How many trees are in Tampa's urban forest?

It is estimated that there are over 7.8 million trees in Tampa. For this study, a tree is defined as a woody stem with a diameter of 1 inch or greater at 4.5 feet in height. The 10 most common tree species in Tampa are red mangrove (*Rhizophora mangle*), Brazilian pepper (Schinus terebinthifolius), black mangrove (Avicennia germinans), white mangrove (Laguncularia racemosa), live oak (Quercus virginiana), laurel oak (Quercus laurifolia), Darlington oak (Quercus hemisphaerica), cabbage palm (Sabal palm*etto*), Carolina laurelcherry (*Prunus caroliniana*) and white lead tree (*Leucaena leucocephala*) (Figure 4).

The content of this fact sheet was derived from the "City of Tampa: Urban Ecological Analysis" and the full report can be viewed by visiting http://www.sfrc.ufl.edu/urbanforestry/Files/TampaUEA2006-7_FinalReport.pdf

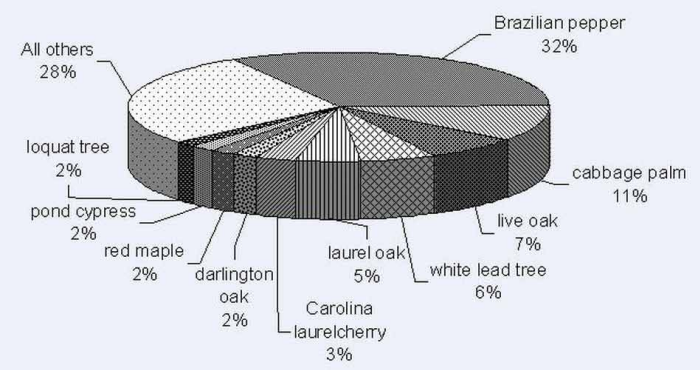

Figure 4. Relative percentage of tree species by number of stems in Tampa.

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