HEALTH OF LIVE OAKS IN GULFPORT, MISSISSIPPI, OCTOBER, 2003

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INTRODUCTION

Concern over the health and appearance of street and urban trees (particularly live oaks, *Quercus virginiana* Mill) in Gulfport, Mississippi in recent years resulted in a baseline urban tree inventory of the city being performed. The inventory was completed during the summer of 2001 by graduate students and staff of the Urban Forestry Program at Southern University, Baton Rouge, Louisiana under the direction of Associate Professor Kamran Abdolahi . They estimated that 63% of the street and urban tree population was comprised of live oaks and that about 25% of those were in a declining condition (Figure 1). Decline was evidenced by crown dieback, reduced foliar density and various injuries (mostly construction and soil compaction). However, the exact cause(s) of the decline for each of these trees was beyond the scope of the inventory. For that reason and concerns that serious, undiagnosed diseases may be present, a follow-up survey was performed in October, 2003 in an effort to determine, if possible, the cause(s) for decline in the affected trees.

Figure 1.—Severely declining and healthy live oaks.

METHODS

In order to categorize cause(s) of street and urban tree decline, this study compared tree and growing space conditions for matched pairs of nearby declining versus healthy live oaks. An urban and street tree survey was made of live oaks on every other north-south and east-west street (about a 50% survey) in the older section of Gulfport (Figure 2). Most live oaks were concentrated in this area as determined by the previous inventory (Abdolahi 2001). A crew of two drove each street in one or both directions as necessary viewing all the live oaks (when parks, schools, or other public properties were encountered, they were surveyed in their entirety). Every live oak tree in a declining condition (dieback ≥15% of the crown and/or crown density ≤40%) was identified for data collection along with the nearest healthy (non-declining) live oak of similar size. Therefore, our sample group consisted of an equal number of declining and healthy trees.

Data collected on each tree conformed substantially to the Urban Forest Effects Model (UFORE; Nowak and others 2001) methods and are outlined in Table 1.

Table 1.—Data collected on surveyed live oak trees.

Data Element	Description
Condition category	**DE**=declining; **ND**=non-declining; (based on selection criteria)
Owner	**ST**=public street tree, in the public ROW; **PS**=private street tree, off the ROW, but ≥1/3 of crown overhanging; **PU**=public park, school or other non-street tree
Land use of adjacent property	**RE**=residential; **MF**=multi-family residential; **PR**=park, cemetery, golf course; **CI**=commercial/industrial/institutional; **VA**=vacant; **AG**=agriculture
Diameter at breast height	DBH to nearest inch
Crown density	Total mass of crown blocking light; estimated to nearest 5%; higher is better
Crown dieback	Proportion of crown with recent dieback; estimated to nearest 5%; lower is better
Foliage transparency	Amount of light transmitted through foliage; estimated to nearest 5%; lower is better
Ground cover under the crown dripline	Estimated to the nearest 5% by category (totals 100%): **BLDG**=buildings; **CMNT**=cement; **ASPH**=asphalt or tar; **PAGR**=packed gravel paving; **LOGR**=loose gravel paving; **MULC**=mulch; **DUFF**=natural leaf litter; **GRSS**=grass; **FORB**=forbs; **SHRU**=shrubs; **ORNA**=ornamental bedding plants; **EXPR**=exposed roots; **BG**=bare ground
Exposed roots within ground cover	Estimate to nearest 1%, any roots exposed, regardless of the ground cover areas recorded above
Damage to exposed roots	Estimate to nearest 1% the surface area of exposed roots damaged in any way (generally mechanical)
Damage	Up to 3 damages recorded by location, damage, and severity; Locations: 1=roots; 2=bole; 3= bole; 7=branches; 8=foliage; Damage types: 1=canker/gall; 2=decay or conk; 3=open wound; etc. (see UFORE for full detail); Severity: usually estimated to nearest 5% depending on type (see UFORE for full detail)

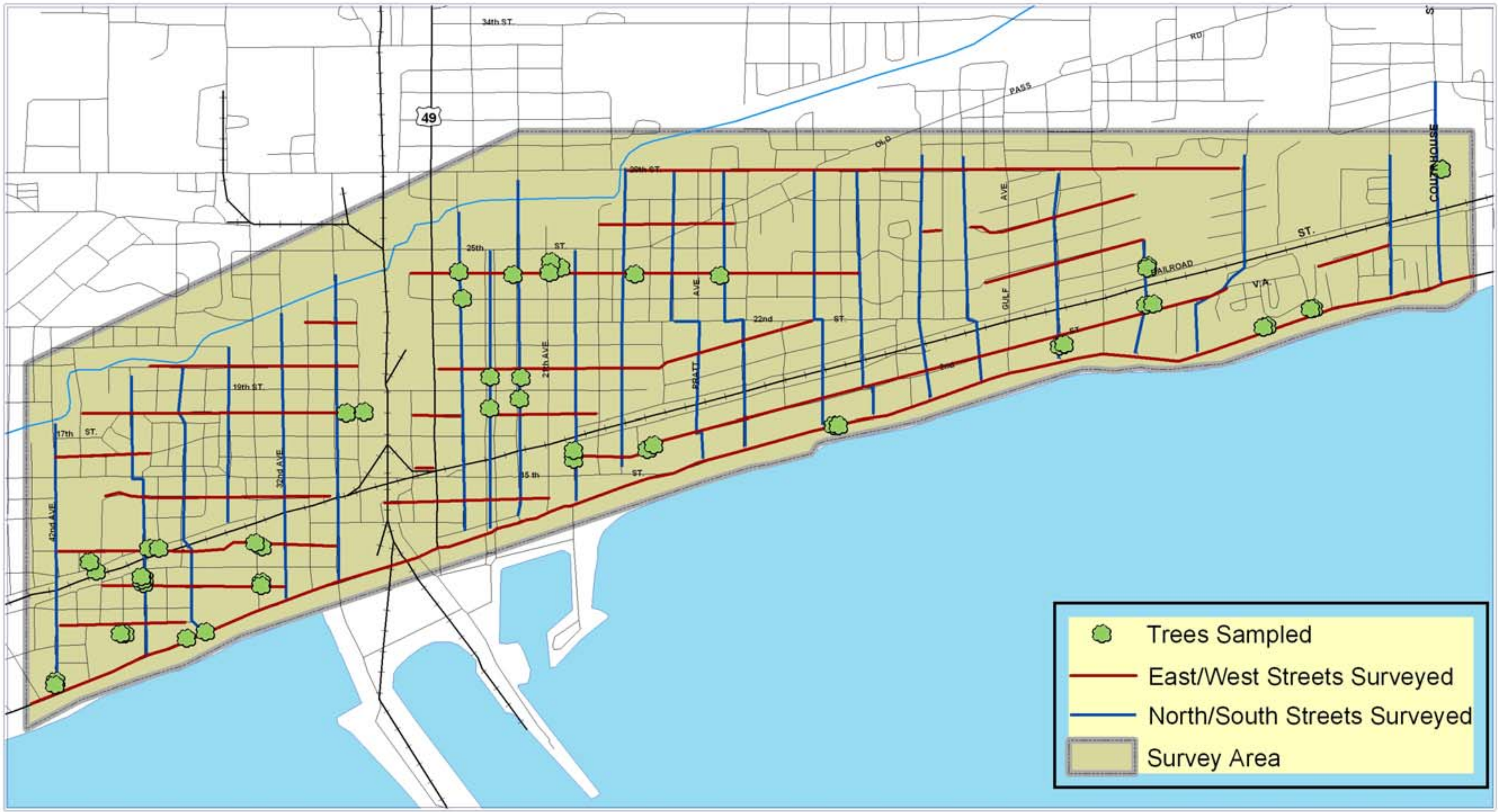

Figure 2. – Streets surveyed and locations of sampled trees in Gulfport, Mississippi, October, 2003

In addition, we examined each tree for symptoms specific to two tree diseases of concern—***oak wilt*** and ***sudden oak death***. Oak wilt is a tree-killing disease of eastern oaks (particularly red oaks) and live oaks (in Texas) caused by the pathogenic fungus *Ceratocystis fagacearum*. Although it kills a number of trees in many mid-western and eastern states each year, the eastern hardwood forest has not been greatly impacted by it; however, live oaks in some areas of Central Texas have been devastated. For oak wilt we looked for veinal chlorosis/necrosis, marginal necrosis and defoliation of symptomatic leaves (Figure 3). Symptoms are most often found on trees with sudden and severe dieback or mortality.

Figure 3.—Foliar symptoms of oak wilt on live oak.

Sudden oak death is a relatively new disease affecting tanoak (*Lithocarpus densiflorus*), Coast live oak (*Quercus agrifolia*), California black oak (*Quercus kellogii*) and other species in California and Oregon. It is caused by a pathogenic fungus, *Phytophthora ramorum*. There is great concern that it could be transmitted to other areas of the country and devastate native oak populations. Symptoms on tanoak and oak are diffuse cankers under the bark, noticeable due to bleeding or oozing of dark sap through the bark (Figure 4). Dieback is often associated with this symptom on affected trees and mortality can result, particularly with tanoak.

Figure 4.—Bleeding canker of sudden oak death disease.

RESULTS

A total of 24 pairs of declining and healthy live oak trees were located and surveyed for a total of 48 trees (Figure 2). The data were summarized to compare the declining versus non-declining sample groups.

Tree Characteristics

Tree diameters for the 2 groups were very similar (Table 2). Dieback was substantially higher for declining trees (as would be expected due to our tree selection procedure); this combined with a substantially lower crown density and a higher foliage transparency indicate that the declining trees are indeed less healthy.

Table 2.—Means of tree characters of declining and healthy live oaks.

Category	DBH (inches)	Density (%)	Dieback (%)	Foliage Transparency (%)
Declining	32.5	37.7	20.4	38.7
Healthy	33.3	55.8	1.7	20.8

Ownership

Ownership was similar for both groups of trees. This was expected since healthy trees were generally chosen nearby the declining trees. Nevertheless, there were more declining trees in the public land category and fewer in the private street tree category compared to the group of healthy trees (Figure 5).

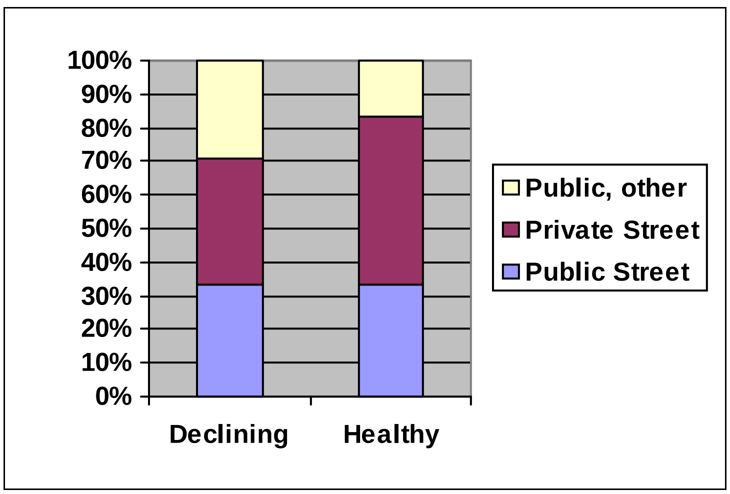

Figure 5.—Percent of declining and healthy live oaks with various ownership.

Adjacent Land Use

Among adjacent land uses, declining trees were more often associated with commercial/industrial properties (Figure 6). Healthy trees occurred more frequently at residential sites.

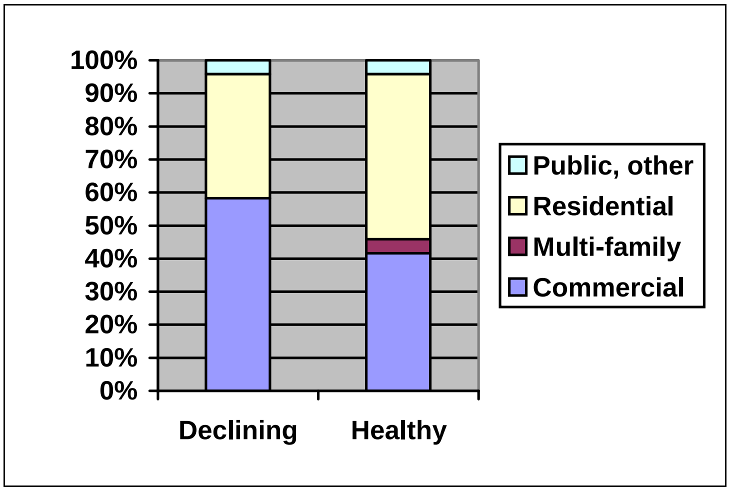

Figure 6.—Proportion of trees by adjacent land use.

Ground Cover

For this summary, ground cover types were grouped into those that would be rather impermeable to rain or irrigation water (BLDG, CMNT, ASPH, PAGR) and graphed as a percent of the total (Figure 7). Declining trees had substantially higher areas of impenetrable ground cover than healthy trees.

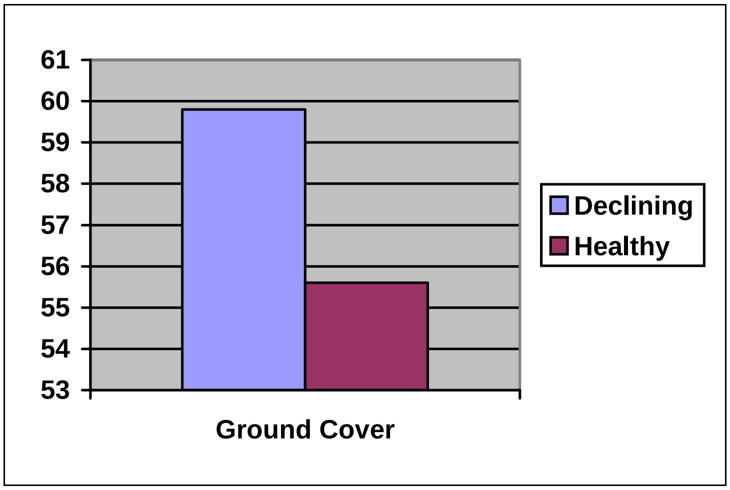

Figure 7.—Average percent of restrictive ground cover area under sample tree crowns.

Exposed Roots and Damage

Figure 8 displays the percentage of area with exposed roots and the percent exposed root area with damage. Neither sample group had a large area of roots exposed, and damage to them was only in the 20-30% range. Healthy trees, however, had higher percentages of both.

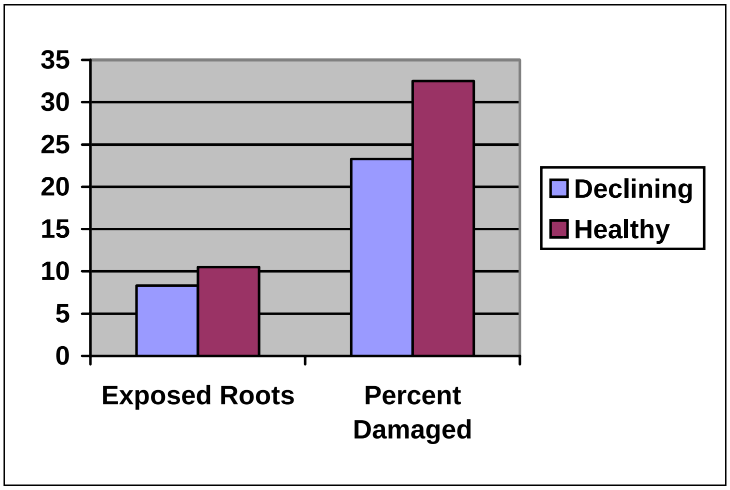

Figure 8.—Percent area with exposed roots and percent of root surface area damaged for declining and healthy live oaks.

We combined the exposed roots and damaged area values into a root damage index by multiplying the percentage of exposed roots by the percentage of those roots damaged (Figure 9). This yielded a value for damage that was over twice as high for healthy trees as declining trees.

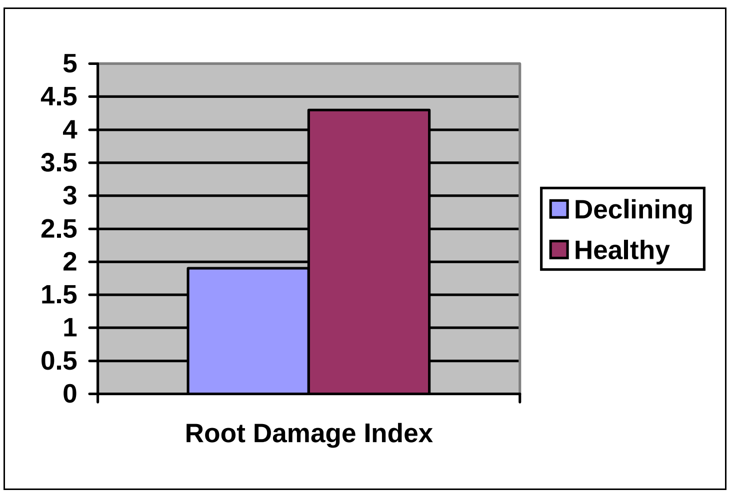

Figure 9.—Root damage index for declining and healthy live oaks.

Damages

The number of damages recorded for a tree may be an indication of the amount of stress or injury a tree has sustained. In general, declining trees had more damages than healthy trees. This fact was magnified for trees with 2 or 3 damages (Figure 10).

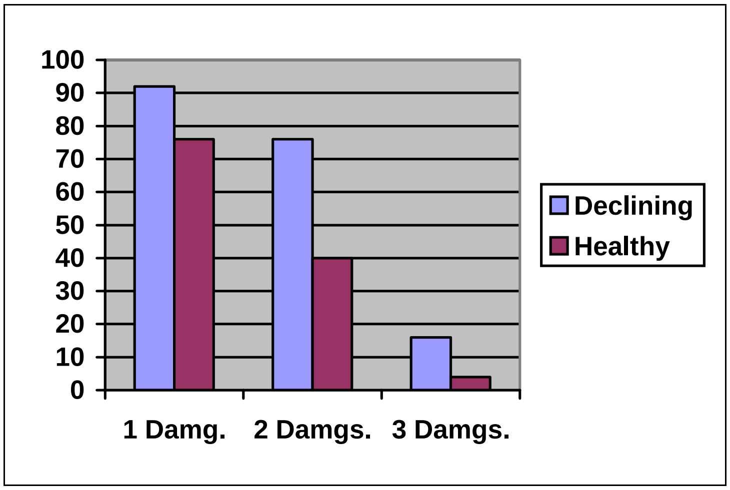

Figure 10.—Percentage of trees with 1, 2 or 3 damages recorded.

Not all damages, however, have equally deleterious effects on a tree. Some damages (eg. on roots, base or bole; large wounds, decay, decay conks or girdling roots) are probably more significant than others (eg. small wounds, wounds to younger trees, damaged foliage, etc.) Damage types we considered more serious were grouped and almost 40% of declining trees were found to have at least one serious damage and about 3% had two. Less than 25% of healthy trees had one serious damage and none had two or more (Figure 11).

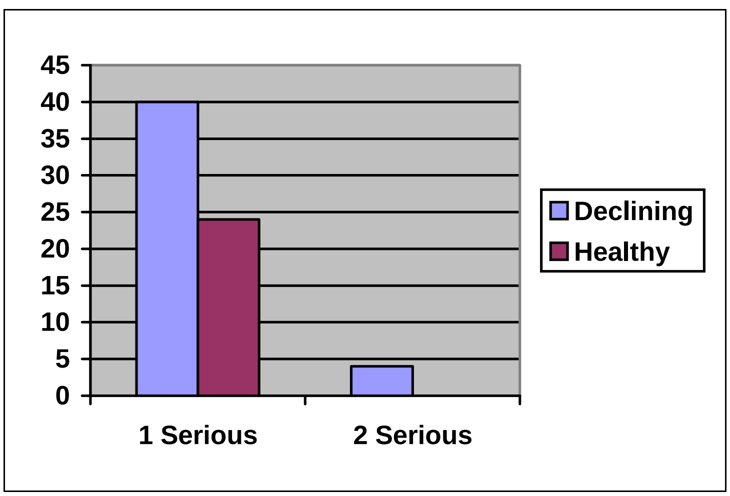

Figure 11.—Percentage of trees with serious damage types.

<u>Symptoms Associated with Oak Wilt</u>

No trees were observed with any symptom suggestive of oak wilt infection.

<u>Symptoms Associated with Sudden Oak Death</u>

Symptoms similar to those associated with sudden oak death were rarely observed. Oozing sap or wet spots on trees were clearly associated with wood borers or wetwood condition (a benign and common bacterial infection of trees), not cankers. One tree, however, did have evidence of past oozing sap in a canker-like configuration that looked somewhat suspicious; the sap, however, it was hard and crystallized at the time of survey indicating that the bleeding occurred some time ago. This tree was further examined by cutting small windows through the bark at the margin of the cankered area. Under the bark was a robust and healthy mycelial felt of the soil-borne root and butt rot fungus *Armillaria* (probably *tabescens*), one species of several that cause armillaria root disease (Wargo and others 1983; Williams and others 1986). While the oozing sap is an uncommon symptom of armillaria infection, the infection itself is fairly common, especially among oak and hickory species in the eastern hardwood forests.

CONCLUSIONS

In general, we found Gulfport's live oak population to be typical of those found in most areas of the South. A number of trees are declining, but there are a large number of healthy, vigorous trees as well. While we made no effort to quantify the proportion of the live oak population with decline, we were able to draw a few conclusions about the declining trees we surveyed in comparison to healthy trees.

Most importantly, we found no evidence of any serious, contagious live oak disease such as oak wilt or sudden oak death. The one suspicious tree sampled had a rather common pathogen invading it, and, while not desirable, the situation is not uncommon or catastrophic. That particular tree may indeed die or become hazardous with dieback from the infection; and nearby trees may be at some risk to contract the same disease from underground spread of the fungus. But, this disease spreads slowly and is most active during periods of extreme tree stress brought on by drought or similar events. It poses little threat to the live oak population as a whole.

From the data collected and observations made, it appears that declining and healthy trees occur on public and private ownerships at almost the same level, and that declining trees are slightly more likely to occur in association with commercial/industrial land use than with residential or other land uses. Restrictive surfaces that interfere with moisture penetration were at greater levels around declining trees and the number of damages and the occurrence of serious damages were likewise more prevalent on declining trees. The presence of exposed roots and the amount of damage on them seemed unassociated with decline, although this may be in part due to the fact that greater impermeable surface area was associated with declining trees, leaving less area for surface roots to be exposed and evaluated.

We conclude that the declining trees in Gulfport are probably the result of a number of interacting factors mostly related to stresses. Urban trees typically grow in constrained spaces with soil often covered by impermeable surfaces or compacted with traffic or disturbed by construction activities. Multiple damages are often present from past and current injuries from human activities, storms, and etc. Seasonal and multi-year drought events put further stress on trees and may periodically increase the extent of dieback and decline in urban trees. Recent drought years for southern Mississippi contributed to the current condition of trees..

Trees suffering from decline may die or become hazardous and will eventually need to be removed. An active urban forestry program to maintain and replace trees in the city and provide species diversity will assure a continuing and healthy urban forest for Gulfport. Efforts by the City and County working in conjunction with the community to this end have been commendable. Based on the feedback we received from several concerned landowners during the survey, street and urban live oaks play an important role in the quality of life in Gulfport and the efforts to maintain their health should be continued and increased.

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