LESSONS FROM HURRICANE DAVID

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On Tuesday, September 4, 1979, Hurricane David reached Savannah, Georgia. The storm lost much of its force before it hit the coast of the United States, and caused little severe damage in Savannah, except to power lines and trees.

On September 6 and 7, we surveyed tree damage caused by the storm. The results emphasize the importance of sound urban forestry practices, for such practices might have reduced considerably the damage to and by trees in Savannah.

We surveyed all damaged trees in a 1.66 square mile area of the city, which included Savannah's central business district, Forsyth Park, and residential areas in the oldest parts of the city. Among the sizeable trees in the survey area were many of the old live oaks for which Savannah is famous, other oak species, and sycamores and sugarberries planted around 100 years ago when parts of the residential area of the city were new.

We examined all trees in this area which were severely damaged; that is, 1) uprooted, 2) with broken main stems, or 3) with broken major branches accounting for at least half of the crown. In the area we surveyed, we found 44 severely damaged trees on streets, in parks, in private yards, or in alleys and vacant lots. We estimated that about 1 percent of the trees in the survey area had suffered severe damage.

Two characteristics of the hurricane probably helped to keep David from doing much more damage to Savannah's trees. First, the weather had been relatively dry prior to the storm. Had the soil been wet and unstable, more trees would probably have been uprooted. Second, the hurricane was weak when it reached the U.S. coast. The peak wind speed was 59 mph in Savannah.

The small number of trees affected by David in Savannah does not permit new conclusions about the relationships between trees and their environment during such storms, but we did see several patterns emerging that reinforce the need for good management of the urban forest.

First, although 22 percent of the municipal trees in Savannah are live oaks (*Quercus virginiana*)[1] only two of these trees in our survey area were severely damaged by the storm. One live oak was uprooted, possibly because for several acres windward of this tree there were no trees or buildings to break the wind. The second damaged live oak, in the central business district, had heart-rot and carried a load of ivy. The other live oaks came through the storm with little damage, testimony both to the intensive and careful maintenance these trees receive, and to the appropriateness of this species to the coastal zone.

Sycamore (*Platanus occidentalis*) and sugarberry (*Celtis laevigata*) are also important species in Savannah, accounting for a total of 7 percent of municipal trees.[1] These species were much harder hit by the storm, accounting for 16 of the 44 damaged trees we located (36 percent). The six destroyed sycamores ranged in size from 14″ to 38″ dbh, averaging 26″ dbh. The 10 severely damaged sugarberries ranged in size from 14″ to 36″ dbh, averaging 22″. The average of all 44 severely damaged trees in the survey area was 23″, so the damaged trees were not unusually large. However, most of them had been planted as street trees and were located on the tree lawn between street and sidewalk, an area far too narrow for the size to which these trees had grown. The confined root space for these trees probably accounts for the fact that these two species were statistically much more often uprooted than broken by the storm ($X^2 = 9.82$, $p \leq .01$). Their root structures, constrained in several cases by a deep granite curbstone on one side and sidewalks or buildings on the other, ran parallel to the street and could not support the trees against gusts of wind from other directions.

Trees and planting spaces should be carefully matched, not only to promote the health of the

[1] *According to a private survey supervised by Stewart C. Forbes and Remer Y. Lane, 1978.*

Figure 1. The roots of this 30″ diameter sycamore ran parallel to the street and could not support the tree against winds coming from other directions.

tree, but also to assure that the tree's roots can give it adequate support. Most of the sycamores and sugarberries destroyed in the storm were too large for their artificially aligned root systems to maintain them against the wind.

In addition to the live oaks, sycamores, and sugarberries in our survey, 26 other trees were severely damaged. Of these, 7 were mulberry (*Morus alba*), and the remaining 19 represent 10 additional species, including water, laurel, and willow oaks (*Q. nigra, laurifolia,* and *phellos*), yellow poplar (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), blackgum (*Nyssa sylvatica*), southern magnolia (*Magnolia grandiflora*), waxmyrtle (*Myrica cerifera*), American elm (*Ulmus americana*), and chinaberry (*Melia azederach*). The very small number of damaged trees in each of these species prevents our drawing conclusions about these particular species.

Of the total of 44 trees damaged in our survey area, 24 were broken either at the main stem or at a major branch. Three of these trees were in yards and we were not able to inspect them closely. The other 21 broken trees had extensive heartrot and several also had interior insect damage. Over one-half of these broken and rotted trees showed external evidence of their hidden problems — crown dieback, fungal fruiting bodies emerging through the bark, lightning scars, large old wounds, or hollows filled with trash or bricks.

A more extensive city tree survey and increased awareness among property owners might have resulted in the identification and removal of these high-risk trees, and the prevention of the damage

they caused.

We applied the ISA tree evaluation formula (2) to 33 of the trees in our sample (excluding the mulberry and chinaberry trees). We used $15 per square inch of trunk cross-section (1), and the species classification for the southern region. We applied the low value of the range given for each location (e.g., 60 percent for street trees). Also, we applied stringent condition multipliers based on our observations of both the exterior and interior state of each tree (3).

The total value of the 33 trees was calculated to be $50,674, with 58 percent of this total contributed by six large but reasonably healthy trees — two sycamores, two live oaks, and one each of sugarberry, magnolia, and laurel oak.

In summary, the lessons of Hurricane David teach the importance of good urban forestry practices. Selecting trees of appropriate size for the available planting area, maintaining existing trees, and community tree inventories which identify trees needing maintenance or removal can pay off under severe weather conditions. These are common sense practices, but they are often neglected. Many municipal budgets do not provide sufficient funding for tree maintenance or to establish and update tree inventories. Such cities are taking the chance of large scale, uncontrolled "removal" of trees during high winds.

Literature Cited

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ABSTRACT

Wikle, Jack. 1980. **An evaluation of tree performance under low-maintenance conditions.** Am. Nurseryman 152(8): 10, 117-118.

During the past 20 years, there has been an increasing interest in planting trees in public places, such as in parks and along highways. However, the amount of funding available for maintaining trees in these areas is limited and may be further restricted in the next few years, due to the current economic climate. In light of this, an experiment was undertaken in 1966 to evaluate the performance of various tree species under low-maintenance regimes. Some of the trees that have done exceptionally well under low-maintenance conditions are: the green-leaved cultivars of *Acer platanoides* (Norway maple), *Acer rubrum* (red maple), and *Tilia cordata* (small-leaved European linden). Although some *Fraxinus* varieties suffered from borer infestations, some others did well, particularly *Fraxinus excelsior* 'Hesse' ('Hesse' ash). Other trees that produced good results were the cultivars of *Gleditsia* (honeylocust), *Pyrus* (pear), and *Sorbus* (mountain ash).