

Hurricane Hugo Damages Natural Resources At Virgin Islands National Park...

...and Congaree Swamp National Monument

Damage from Hurricane Hugo to the Congaree Swamp National Monument

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To assess the forest damage in the Congaree Swamp National Monument attributable to Hurricane Hugo, trees >20 cm dbh (diameter at 1.4 m or above butt swell) were censused in both bottomland hardwood forest and cypress-tupelo sloughs. The 0.2 ha plots (20 x 100 m) were located at random in old-growth forest in the southeastern portion of the Monument south of the confluence of Toms Creek and Running Lake, south of Wise Lake, and along the boardwalk to Weston Lake. Twenty-one plots were censused (total area = 4.2 ha), 12 in bottomland hardwood forest and 9 in cypress-tupelo sloughs. To improve the assessment of damage to *Pinus taeda* trees in the vicinity of the Ranger Station, we sampled 100 *P. taeda* trees >20 cm dbh within 20 m of the boardwalk and along the road toward Weston Lake.

Each tree in the plots was identified to species, measured (dbh), and classified as having suffered no serious damage, uprooted, snapped, bent or having lost portions of its crown (25-50, 50-75, and >75 percent). We also noted whether the trees showed obvious signs of having suffered previous damage, the presence of heartrot, the height of breakage, and the compass direction of fall.

Results and Discussion

Cypress-Tupelo Sloughs

Although Hurricane Hugo caused substantial losses of leaves and small branches, only about 19 percent of the trees in the cypress-tupelo sloughs suffered serious damage (Table 1). Uprooting was particularly uncommon in the sloughs. This was surprising because trees in sloughs are generally thought to have relatively shallow roots systems, due to anaerobic soil conditions. Although there were 12 uprooted trees in the 9 plots, none were bald cypress (*Taxodium distichum*) or water tupelo (*Nyssa aquatica*). Furthermore, during the 8 days of field surveys, we observed only one uprooted cypress tree anywhere in the Monument. A recent study of the rooting patterns of bald cypress trees in Florida showed that the trees developed several "sinker" roots that penetrated to greater depths than the rest of the root system (K. Ewel, Univ. of FL, pers. com.). Such a root system may effectively anchor bald cypress trees in the relatively unstable soils of the sloughs. Crown breakage in water tupelo in the sloughs may in part account for the infrequency of uprooting and snapping in this species. After a tree loses leaves and branches, its wind resistance is substantially decreased and the probability of more serious damage is consequently reduced. In the case of cypress, serious damage may be rare both because the trees have strong wood and because cypress trees normally display little leaf area relative to trunk diameter; this too results in low wind resistance.

A large proportion of the trees in cypress-tupelo swamps had obviously suffered severe wind damage previous to Hurricane Hugo. This damage and subsequent recovery left its mark on the crown and bole structure of many of the trees, particularly larger water tupelo trees. Mechanical damage is likely to have contributed to the incidence and severity of attack by heartrot fungi. Trees with heartrot are very susceptible

to further damage even if the crown resprouts. Breakage and resprouting seems to be a major process in the dynamics of this forest.

Among commercial forest species, both bald cypress and water tupelo are rated as relatively resistant to hurricane-related damage (Barry et al., 1982). Along with palm and live oak, bald cypress is ranked as highly resistant to uprooting and breakage. Tupelo is less resistant than cypress but is ranked as less prone to uprooting and breakage than are most oaks, pines and hickories. Observations in forested areas of the South Carolina coastal plain (Francis Marion Forest, Santee Experimental Forest) have also revealed far more extensive damage to pine and oak forest than to cypress-tupelo stands.

Bottomland Hardwood Forest

Approximately half of the trees in the plots in the bottomlands of the Congaree National Monument suffered serious damage but only about 25 percent were uprooted or snapped (Table 2). In contrast to water tupelo and bald cypress, bottomland hardwoods seem equally prone to being uprooted and to suffering stem breakage. The major short-term effect of Hurricane Hugo in both forest types, however, was the loss of much of the foliage and many small branches.

The among plot variation in the proportion of damaged trees was very large. In the bottomland hardwoods, densities of trees ranged from 34-64/0.2 ha and the proportion of uprooted and snapped trees ranged from 4-50 percent. This extreme heterogeneity was undoubtedly due to the specific paths of Hurricane Hugo and the cyclones it probably generated.

Trees that had recovered from serious damage prior to Hurricane Hugo suffered a very high probability of sustaining subsequent damage (Table 3). Architecturally unstable branching patterns of resprouted trees, heartrot and insect damage are probably responsible for this heightened susceptibility to damage of previously damaged trees. The effects of the process of repeated breakage and resprouting on forest structure and composition will be important to monitor as the forest recovers from Hurricane Hugo.

Pinelands

Large *Pinus taeda* trees in general and those in the vicinity of the Ranger Station in particular received special attention. Although two of the bottomland forest plots were near the boardwalk, we increased the accuracy of our assessment of pine damage with a special census. Pines >20 cm dbh within 20 m of the boardwalk and the road to Weston Lake were measured (dbh) and classified by damage type. A total of 100 trees was censused, of which 46 had escaped serious damage (Table 4). Uprooting and snapping were about equally common (21 and 28 trees, respectively). Most of the broken (snapped) trees had heartrot, but we suspect that many of the undamaged and uprooted trees were likewise infected.

Forest damage was severe in areas where pines were common. This is mostly because when a large pine was either uprooted or snapped, it caused a great deal of damage to its neighbors. Three pines fell across the road or trails and consequently were cut by the Monument staff. Examination of the cross-sections of three trees (aged about 156, 157, and 180 years) revealed extremely slow growth rates (<1mm/year) during the last two decades.

In the absence of fire, we doubt that even the extensive damage of Hurricane Hugo will result in success-

ful pine regeneration. Where the canopy was radically opened, the understory of switchcane (*Arundinaria gigantea*), vines, shrubs, and small trees was quite dense even immediately after the storm. Furthermore, thick mats of litter and organic matter still cover the ground except where mineral soil was exposed by uprooted trees. Fire is a distinct possibility, however, especially now with the heavy fuel loads in much of the bottomland forest.

Conclusion

It became evident in the course of our damage survey that the forests of the Monument have suffered severe storms several times during the last few decades. Earlier this year (16 June 1989), for example, the forest was severely damaged by a thunderstorm. We expect that there will be changes in tree species composition in the bottomland hardwoods and particularly where large pines once dominated the landscape. These changes will be evident, however, only if permanent inventory plots are monitored for tree growth, death, and recruitment over the next decades.

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Reference

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