

Hurricane Katrina Impacts on Mississippi Forests

Sonja N. Oswalt, Christopher Oswalt, and Jeffery Turner

ABSTRACT

Hurricane Katrina triggered public interest and concern for forests in Mississippi that required rapid responses from the scientific community. A uniform systematic sample of 3,590 ground plots were established and measured in 687 days immediately after the impact of Hurricane Katrina on the Gulf Coast. The hurricane damaged an estimated 521 million trees with more than 2.5-cm dbh and killed approximately 54 million trees statewide. Sixty-nine percent of tree mortality occurred in 17 counties in southeastern Mississippi, and 45% of trees killed were loblolly pine trees. Total tree mortality was less than 1% of the statewide population.

Keywords: gulf coast, weather damage, tree mortality, inventory

Natural disasters trigger public interest that requires rapid responses from the scientific community. Image analysis and modeling by Chambers et al. resulted in estimates of severe damage or mortality to 320 million large (more than 10-cm dbh) trees across the Gulf Coast forests in Mississippi (Chambers et al. 2007). Remote sensing is a valuable tool for generating initial estimates of damage from events such as wildfire, tornadoes, and hurricanes. Post-event ground data collection adds important damage information unavailable through remote sensing and enables the further development of accurate remote sensing methods and models.

The US Forest Service Forest Inventory and Analysis (FIA) program collects data on public and private forestland resources nationwide. Shortly after the Aug. 29, 2005 landfall of Hurricane Katrina, FIA personnel at the Southern Research Station launched a massive ground effort to collect post-Katrina damage information across the state of Mississippi. Data collection began on Nov. 2, 2005 and was completed by 97 people in 687 days, ending on Sept. 20, 2007.

Methods

A uniform systematic sample consisting of 3,590 forested and partially forested plots were established and measured in Mississippi after Hurricane Katrina (US Forest Service 2005). Hurricane-related wind and water caused damage to an estimated 3.2 ± 0.03 (mean ± 1 standard error) million ha of forestland (40% of all forestland in the state), although damage levels ranged from negligible to severe (Oswalt and Oswalt 2008). Fifty percent of the damaged forestland occurred in 17 counties from Lawrence and Walthall counties east and Wayne and Covington counties south to the Gulf Coast. The storm damaged 83% of the 1.9 million ha in those 17 counties.

Results and Discussion

An estimated 521 million trees with more than 2.5-cm dbh experienced damage related to Hurricane Katrina. The degree of

damage ranged from minor branch breakage to severe bole twisting/breakage and/or windthrow. Damage for each sampled tree was described with four detailed damage type variables (not mutually exclusive) according to the presence of bole damage, branch damage, excessive bole lean, and/or rootspring. The loblolly (*Pinus taeda* L.) and shortleaf (*Pinus echinata* Mill.) pines species group accounted for the greatest proportion of all damage (more than 18%) in each category, except bole damage (10%).

The FIA program divides Mississippi into sampling units based on a combination of ecological and political boundaries (Figure 1). We observed the heaviest damage for all damage categories in the South unit (Oswalt and Oswalt 2008) where an estimated 84% of the statewide live tree damage occurred. In contrast, the Central, Southwest, Delta, and North units received 11, 2, 2, and 1%, respectively, of the statewide damage. Approximately 80, 85, 84, and 80% of bole damage, branch damage, excessive lean, and rootspring, respectively, was observed in the South unit (Figure 2).

Tree mortality immediately after Katrina was estimated at 54.1 ± 12.7 million trees with more than 2.5-cm dbh (0.4% of all live trees in the state). Sixty-nine percent of trees killed immediately after Katrina occupied forestland in the 17 southeastern counties previously referenced. An estimated 45% of all tree mortality associated with Katrina was loblolly pine. However, this mortality accounted for less than 1% of the statewide loblolly pine population. About 15% of the tree mortality attributed to Katrina involved slash pine (*Pinus elliottii* Engelm.) and impacted an estimated 5% of the statewide slash pine population. An index of mortality weighted by statewide relative density revealed that loblolly pine was most heavily impacted by Hurricane Katrina, followed by sweetgum (*Liquidambar styraciflua* L.), slash pine, water oak (*Quercus nigra* L.), and red maple (*Acer rubrum* L.).

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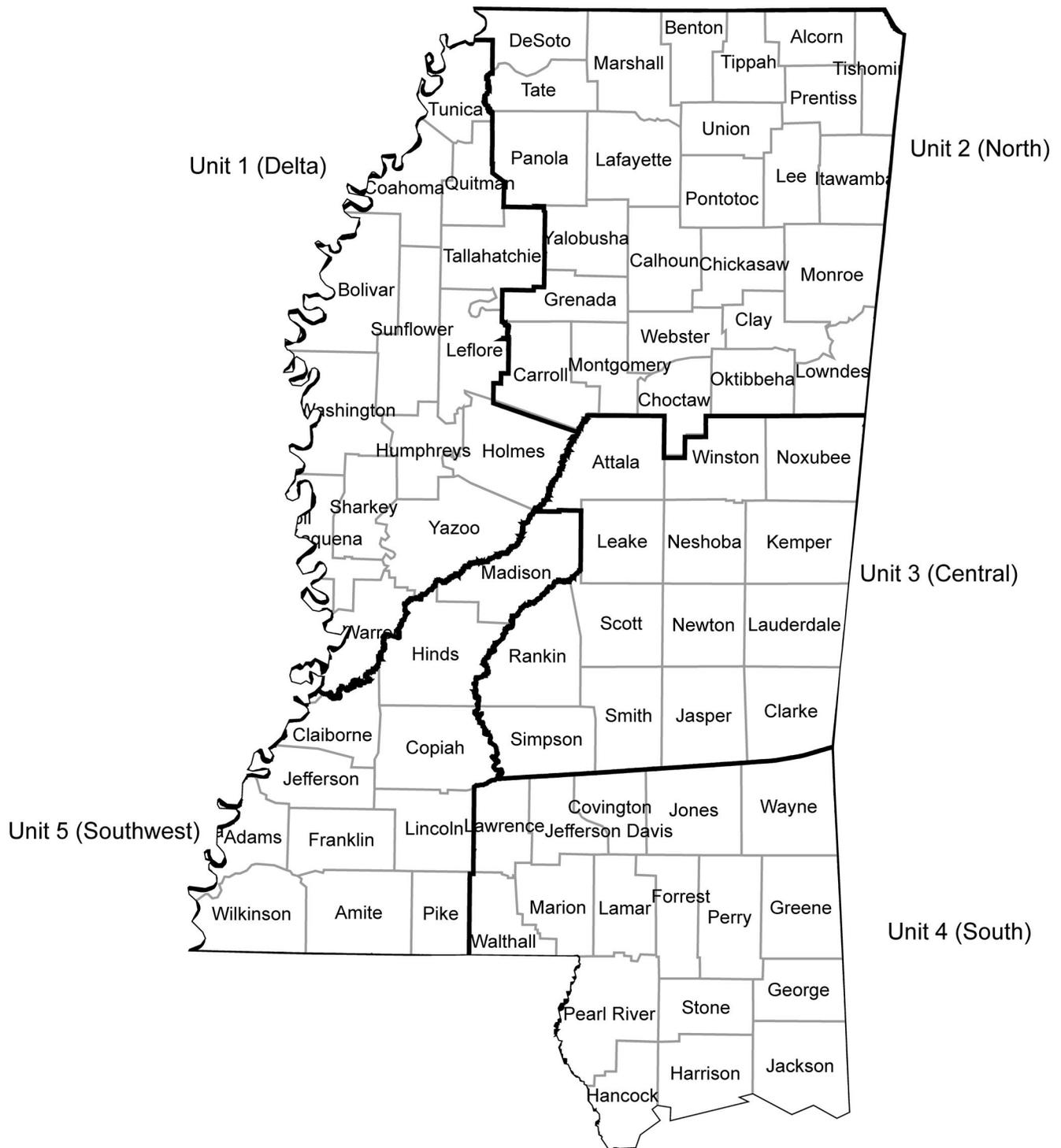


Figure 1. Mississippi counties and FIA survey units.

Summary

Hurricane Katrina had a dramatic impact on coastal Mississippi, Louisiana, and Alabama. In Mississippi, forestland in the southern-most tier of counties experienced the majority of storm-related damage, although not all damage was severe. Although many trees died immediately after Katrina, these figures estimate total mortality to be less than 1% of the statewide pop-

ulation. In addition, a portion of that damage, particularly in the Delta and northern tier of counties where data collection occurred last, may have also included damage from Hurricanes Rita and/or Ivan. FIA's continuous forest inventory will track post-Katrina mortality trends from both direct and indirect factors (e.g., stress-induced mortality, increased susceptibility to disease, and so on).

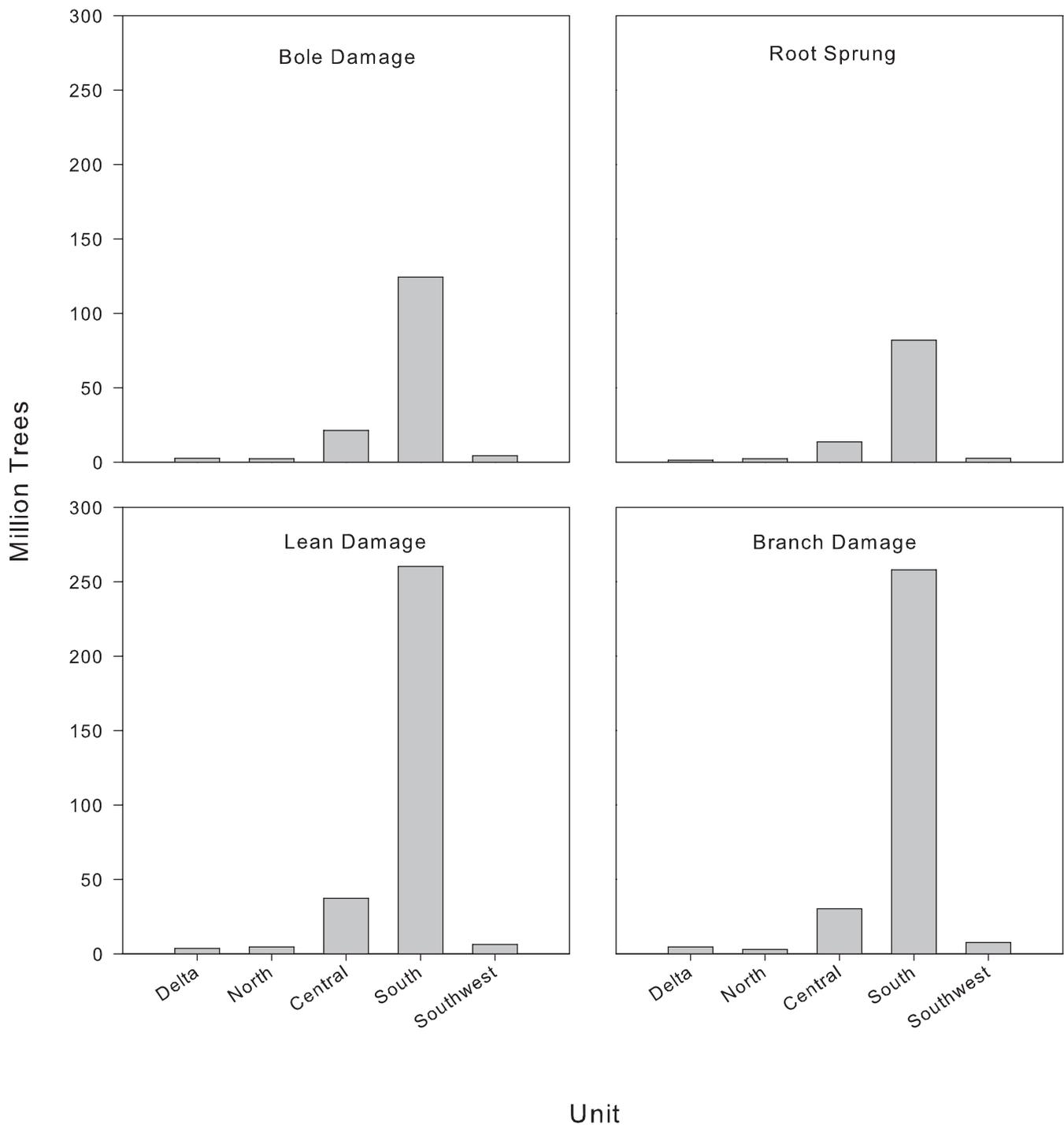


Figure 2. Number of live trees with more than 2.5-cm dbh in each Mississippi survey unit by damage category (categories are not mutually exclusive).

Literature Cited

- CHAMBERS, J.Q., J.I. FISHER, H. ZENG, E.L. CHAPMAN, D.B. BAKER, AND G.C. HURTT. 2007. Hurricane Katrina's carbon footprint on U.S. gulf coast forests. *Science* 16:1107.
- OSWALT, S.N., AND C.M. OSWALT. 2008. Relationships between common forestmetrics and realized impacts of Hurricane Katrina on forest resources in Mississippi. *For. Ecol. Manag.* 255:1692–1700.
- US FOREST SERVICE. 2005. *Forest Inventory and Analysis national core field guide volume 1: Field data collection procedures for Phase 2 plots: Version 3.0*. Available online at www.fia.fs.fed.us/library/field-guides-methods-proc/; last accessed Apr. 17, 2008.