

# Evaluating Cypress Sustainability—FIA Data “In the Hot Seat”

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**Abstract:** *The use of cypress (Taxodium species) for mulch boomed during the 1990s, and its growth in popularity created concerns about the sustainability of cypress forests in the Southern United States. A combination of factors, including Hurricane Katrina, cypress harvesting practices, and the unique requirements for successful regeneration of cypress drew media attention and fueled debates over sustainability of cypress forests. The wood industry, Federal, State, and local governments, academia, environmental and conservation organizations, and retailers all became entangled in the issue. This eventually culminated in proposed legislation to place a moratorium on cypress harvesting and the decision by at least one large retailer to cease selling cypress mulch that was produced in Louisiana. These factors launched an intensive search for viable data about the cypress resource. Requests for Forest Inventory and Analysis (FIA) cypress data escalated. This paper describes the challenges FIA encountered in meeting the need to quantify trends in the cypress resource despite changes in inventory methods, forest-type definitions, plot design, processing algorithms, sample intensity, etc. The paper explains the constraints that were overcome to report region-wide cypress data and to develop a Southwide cypress factsheet. It also shows how FIA data was used to provide State level cypress trends, focusing on Florida as an example.*

**Keywords:** Cypress-tupelo forest type, cypress volume, factsheets, FIA, forums, mulch, sustainability.

## Introduction—Background on Cypress Mulch

Traditionally, cypress has been used for lumber. Popular uses included siding, decking, and trim work. Entire houses and even boats were built with cypress lumber. More recently, the use of cypress as a mulch has increased. Originally composed of cypress edgings, shavings, and mill residues, its increased popularity, due to its perceived durability, increased demand. This led to the use of low quality saw log and small diameter whole tree utilization for mulch. Ironically, old growth cypress heartwood lumber earned the decay-resistant reputation, yet evidence exists that second growth wood does not possess these qualities to the same degree (U.S. Department of Agriculture Forest Service Forest Products Laboratory). Cypressene is the natural oil in the wood that resists

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insects and decay (Campbell and Clark 1960) and is the basis of the heartwood reputation. Decomposition rates suggest that much of the cypress mulch was actually little better than some other types of mulch, such as pine bark (Duryea and others 1999). Nevertheless, the cypress mulch industry boomed and demand for cypress mulch persists.

## **The Controversy—Sustainability**

Opposition to the use of cypress for mulch has swelled among environmental organizations since the 1990s. Media attention was drawn to the issue and focused on the perceived threat to survival of the forest type. This concern emanates from two basic premises surrounding the species. First, there is a perception that cypress stands are not being regenerated after harvest. This is fueled by the unique silvics of cypress and the sites on which they occur. Cypress is one of the few softwoods capable of stump sprouting, but not all stumps resprout. Resprouting ranges from one-quarter to one-half of the former stand (Randall and others 2005). Natural regeneration from seed varies greatly and is keyed to unpredictable water level fluctuations (Brandt and Ewel 1989). Although guidelines exist for planting cypress (Vince and Duryea 2004), there is little evidence that it occurs on a large scale.

Second, the facts that cypress typically grows on wetland sites and that many of these sites fall under federal jurisdiction (Section 404 of the Clean Water Act), complicate the issue and highlight environmental sensitivities.

The quest for accurate information on Southwide trends in the cypress resource developed from all sides of the controversy. Immediately apparent was the limited data available to track cypress forests and a paucity of research beyond the species' physiology, wood value, and regenerative capabilities. This gap in knowledge was unlike that for other softwoods in the South, especially the southern yellow pines (loblolly, slash, and longleaf). Hanging in the balance and threatening the cypress mulch industry, were important decisions by major retailers involving the sale of cypress mulch and by some State governments concerning moratoriums on cypress harvesting. Any suspension of sales or harvesting would likely lead to the demise of the cypress mulch industry.

Demands for data to establish the facts about the extent of and trends in the cypress resource were significant enough to cause the U.S. Forest Service (USFS) Southern region to seek a rapid assessment of the cypress resource.

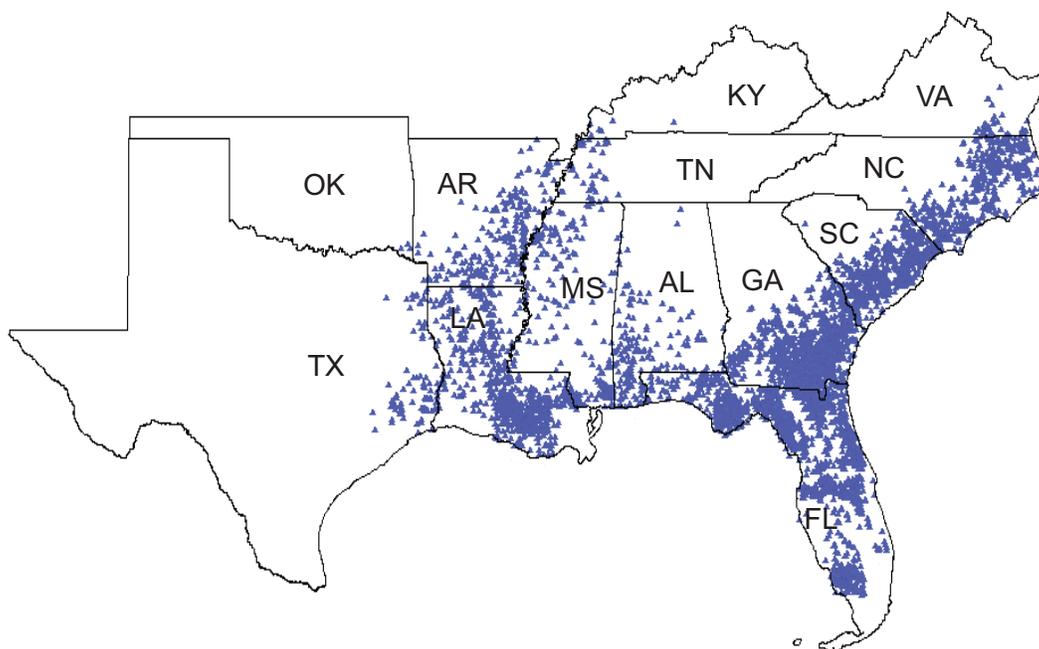
## **Analysis of Constraints—Solutions**

The USFS Forest Inventory and Analysis (FIA) program was the main and obvious source for broadscale data related to forests. Therefore, the Southern region requested FIA data regarding cypress sustainability for use in the rapid

assessment. However, only limited information was available in the FIA data. One reason this occurred is that FIA historically collected cypress acreage information based on the oak-gum-cypress forest-type category. Use of this category always overestimates actual cypress forest acreage because it includes acres of all bottomland hardwood stands, gum stands, cypress stands, and various other mixtures. FIA developed a cypress-tupelo forest-type definition, but it included pure tupelo stands along with pure cypress and any mixed stands. The cypress-tupelo forest type essentially captures all stands where cypress or tupelo equal 25 percent or more of the stocking (U.S. Department of Agriculture 2007).

In order to address issues identified with the burgeoning cypress mulch industry, a preliminary definition of the cypress type first materialized in FIA with the 1995 Florida's Forests report (Brown 1999). Stocking levels were used to establish a threshold beyond which a stand would be called a cypress type. This format was similar to the threshold used to change an oak-pine type to one of the individual pine forest types and was based on 50 percent and greater stocking of the particular species. The new cypress forest-type data was limited to Florida. Pre-1995 cypress data for Florida was developed solely for the 1995 report and did not exist previously. As a result, recent requests for trends in area of cypress have been limited even in Florida and difficult to address across the remaining southern States. Eventually, interest in cypress led FIA to implement a permanent cypress forest-type definition in the early 2000s. However, many States were either between surveys or in transition to annual inventories and all did not implement the type simultaneously. Thus, the solution for the rapid assessment was to use the cypress-tupelo type for a general area trend analysis of the extent of cypress in the South. At least the cypress-tupelo type would represent all the acres in a cypress forest type plus a (typically) small percentage in tupelo. In addition, a map was produced depicting the distribution of all sample plots with one or more cypress trees recorded (figure 1) in the 13 States of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Except for west Texas, the distribution emulated the native range of cypress (Burns and Honkala 1990).

Volume of cypress could be ascertained because FIA had the capability of tracking volume of any individual species by compiling estimates from single trees throughout the sample base. Therefore, trends in volume were obtainable and sourced from the FIA database (FIADB) through the FIA mapmaker Web application (Miles 2008). The former lack of a cypress forest type is probably why volume was used in a similar analysis of the status of southern cypress in the 1970s (Sternitzke 1972). At that time, evidence suggested the cypress resource was increasing after bottoming out during the housing boom shortly after World War II. Sternitzke touched on growth and removals for baldcypress, highlighting changes in Florida and Louisiana, while combining that for the remaining States. At the time of his analysis, baldcypress growth Southwide was 2.5 times that of removals. In 2008, FIA data showed that growth of all cypress in the South was



**Figure 1:** Distribution of FIA sample plots where one or more cypress trees were recorded.

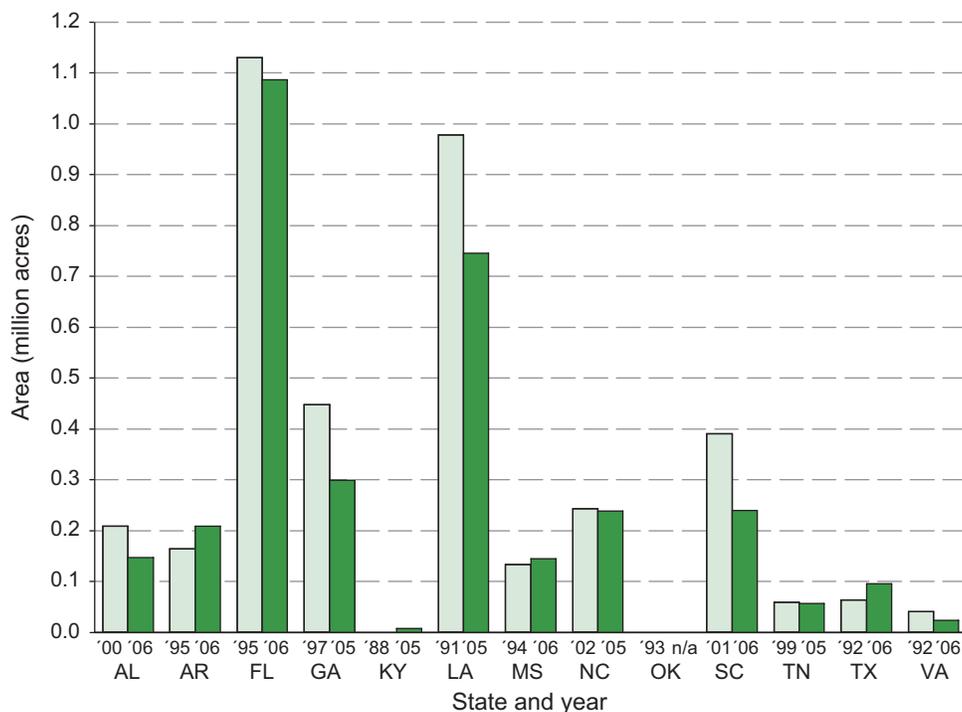
2.1 times that of removals. There was substantial variation among the States, as evidenced by Florida's cypress growth at 1.5 times that of removals versus 0.8 in North Carolina, 1.7 in Georgia, 2.3 in South Carolina, and 12.4 in Alabama. However, even State level data disguised large differences between subregions of a State. For instance, in the four regions of Florida, cypress growth ranged from 4.4 times removals in the northwest panhandle, 2.9 in central Florida, 1.3 in northeast Florida, and just 0.6 times removals in south Florida. These are growing-stock numbers that can be compared with Sternitzke's use of growing stock. In order to avoid any subtle inaccuracies in applying growing-stock standards, FIA's all-live volumes were used in the rapid assessment for current reporting purposes.

Bald and pondcypress were combined in the assessment to avoid two potential pitfalls in the data. First, this precludes misidentification between the bald and pondcypress species, particularly in light of some intergrades between the two. Second, Florida contains sizable populations of pondcypress compared with other southern States.

Immediately obvious were the differences between the States in year of inventory data available for use in the assessment. On an individual State basis, analysis of the cypress resource within a State was easier and mostly limited by the timeframe of the surveys which determined if any trends in area could be established. Whether considering area or volume, the validity of individual State analysis was dependent on the degree of prevalence of cypress within that State. If cypress occurrence were minimal, as was the case in Oklahoma,

Kentucky, Virginia, and Tennessee, then sampling errors around the data were too high for statistically reliable estimates to stand alone. This justified the Southwide approach to reporting on the cypress resource. However, since Florida and Louisiana contain more than one-half of the South’s cypress resource, both in area and in volume, either of these States could be evaluated individually with some degree of reliability. The disparity in date of surveys among the 13 States precluded declaration of Southwide trends between two specific years. It required stating any Southwide trends between an aggregation of the 13 States’ **“latest”** surveys to an aggregation of the 13 States’ **“previous”** surveys’ data. This problem and solution was not limited to area, but involved the otherwise preferable volume comparison method as well.

It was difficult to ascertain trends in area because of the historical lack of a cypress forest-type definition and the varying dates per State at which a definition was finally enacted in the data collection. The randomness of the timing and date of the previous periodic surveys dictated whether or not a particular State would have a valid area trend for cypress. Interest was higher among data seekers and lay people for area information, thus inclusion of “best we could” area estimates and trends into the assessment output despite all the anomalies involving the use of area (figure 2). Confidence intervals were withheld for area trends due to variances in obtaining the older data.



**Figure 2:** Area trends of cypress-tupelo timberland by State (based on available data) and year.

Trends were more easily obtained for cypress volume, which is why the rapid assessment relied on volume to best indicate sustainability trends. Confidence intervals were included in the portrayal of volume information (figure 3). To reiterate however, State level volume data often subdued differences between subregions of a State. As in the case of Florida, where more of the cypress volume occurred in the Northeast and Central regions, between the latest two surveys it increased slightly in the Northwest region while remaining almost stable in the Central part of the State and decreasing in the Northeast and South regions (figure 4).

Throughout FIA reporting and with the FIADB, clients are cautioned against using small subsets of the data. Ironically, analysis of cypress was a subset of FIA survey data in that the cypress-tupelo forest type comprised <2 percent of the total timberland in 11 of the 13 southern States. Even in the two States where it was most prevalent, it comprised <7 percent of the total timberland present.

In the initial analysis, we planned to assess the growth and removal situation for cypress at localized levels. However, these further subsets of data were too troublesome to contend with for a rapid broadscale general assessment of the resource. These factors are part of the reason why the analysis was limited to area of cypress-tupelo forest type and volume of cypress species and ownership. Incorporating growth and removals further reduced the sample to a smaller and less reliable subset of data. As it were, just with volume and area, several States declined in cypress-tupelo area but their volume of cypress rose or remained almost steady. These trends were inexplicable or defied logic. The many differences between the periodic surveys and the annual surveys complicated or

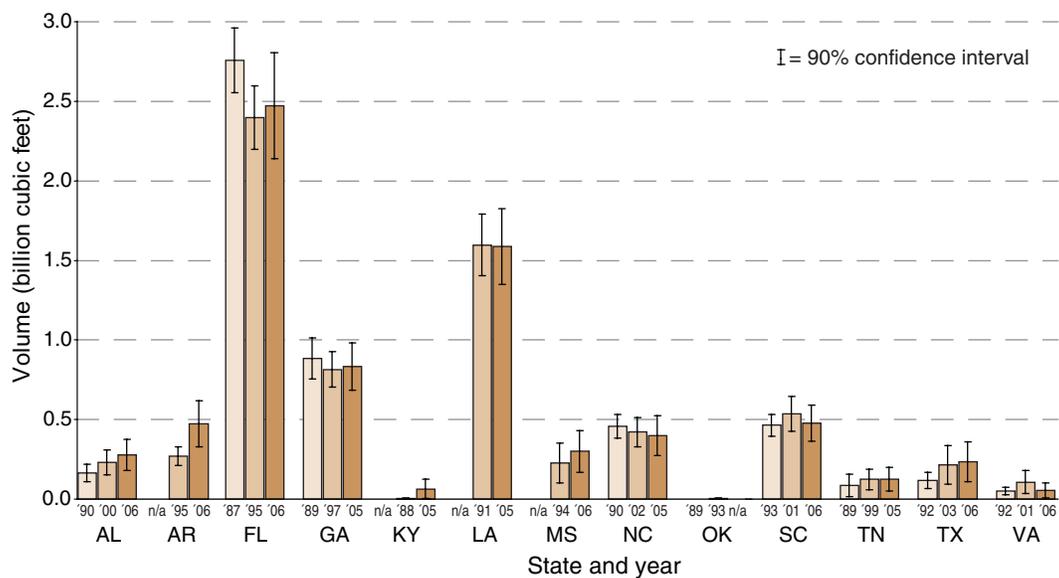
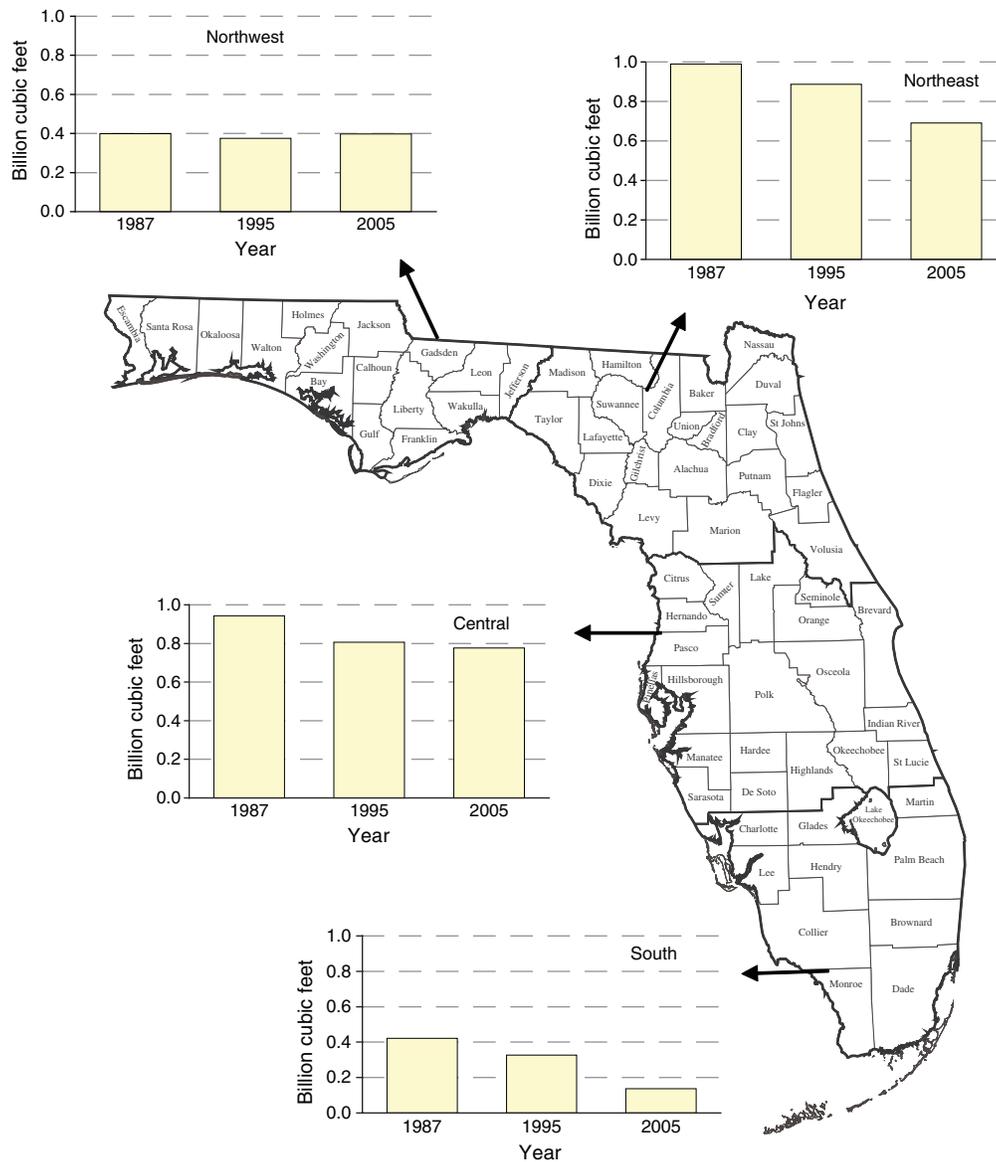


Figure 3: Volume trends of cypress by State (based on available data) and year.



**Figure 4:** Volume of cypress in Florida, by region and year.

hindered accurate analysis of survey data. For example, in contrast to the fixed radius plots of the newest surveys, samples in many of the older surveys were based upon variable radius plots and a 37.5 factor prism for inventory. In addition, in 5 of the 13 southern States administered by the old Southeastern Forest Experiment Station, sample intensity was considerably higher. Instead of the current 5,700 acres per plot sample intensity implemented in annual inventories across the South, samples in Coastal Plain regions of the five southeastern States occurred on every 2,800 acres.

## Conclusions

Between the latest two surveys, area of cypress forest type declined in 8 of 13 States, rose in 3, and there was insufficient data for 2 (Kentucky and Oklahoma). Volume of cypress was up in 8 of 13 States, down in 4, and there was no data in 1 (Oklahoma). Broadscale findings such as these, often are unable to illuminate possible localized countervailing trends in both area and volume. Increases in a few areas of the South offset losses in others and ameliorated totals at the regional or State level. For instance, growth exceeded removals at the State level in Florida, but in south Florida removals were in excess of growth, which poses some concern for continued sustainability of the resource at the former levels of utilization in that part of the State.

Southwide, the cypress resource appears stable. Ultimately, the sustainability of the cypress resource will largely be driven by what happens to it in Florida and Louisiana. Together, these two States contain more than one-half of all cypress acreage and volume in the South. Southwide, one-fourth of the cypress-tupelo area is publicly owned and somewhat less subject to change. Most of the sustainability issues will be related to what happens on the three-fourths of the cypress-tupelo acreage and the cypress volume that is privately owned. The broadscale regional and even State level data do mask declines in some sub-State areas. Even in Florida and Louisiana, sub-State evaluations quickly became weaker due to diminishing sample sizes. There also are some indications that stability of the resource wanes in some sub-State areas.

Ultimately, the constraints of weaknesses at small scales or subsets along with inconsistent availability of surveys with cypress forest type defined, required that the assessment be limited to trends in area and volume and adhere to the more broad State level and Southwide facts regarding the cypress resource. Although growth and removals relationships are in demand, to increase reliability, we focused on trends in total volume, and used area changes as a way of grasping the extent to which changes occur to the cypress resource. In lieu of a publication *per se*, a more concise and highly graphic factsheet format (Greis and Brown 2008) was chosen to quickly portray the status of the South's cypress resource.

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