

ANALYSIS AND REPORTING NEEDS FOR ANNUAL FOREST INVENTORIES IN THE SOUTH¹

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Abstract—The annual forest inventory system essentially eliminates the concept of the periodic inventory. Therefore, the reporting requirements and needs for individual States will change as the South makes the transition to full annual inventories. The Farm Bill and the Forest Service Strategic Plan require both annual reports and 5-year comprehensive, analytical reports. The Southern Research Station Forest Inventory and Analysis unit proposes that the annual reports be brief research notes, supplemented by available hard copy and electronic tabular data. The annual reports will summarize estimates derived from a moving average of five inventory panels. Based on the preceding 5 years of data, succinct analytical reports will focus on status and change in forest resources—with color maps and graphics—and nonproduct-related issues. A statistical report published prior to the analytical report can contain all tabular data, detailed discussions of inventory methods, sampling errors, and definitions. Where the previous full inventory is outdated and cannot be included in moving-average estimates, there will still be a need for interim reports in States that have initiated annual plot measurements.

INTRODUCTION

The annual forest inventory system implemented nationwide by Forest Inventory and Analysis (FIA) essentially eliminates a periodic survey cycle. As a result, reporting requirements must change to accommodate the annual nature of releasing inventory estimates. As all reporting will still be at the State level, individual States in various stages of transitioning to full annual inventories will need to adjust their reporting. In this paper, I will discuss FIA reporting requirements and needs for (1) States still inventoried under a periodic inventory, (2) States in transition to full annual inventories, and (3) States in full annual inventory mode. It will explain how FIA in the South will meet the reporting objectives outlined by the Farm Bill and the Forest Service Strategic Plan.

REPORTING REQUIREMENTS FOR PERIODIC INVENTORIES

For States with a full periodic inventory, the two required reports are statistical reports (regional and State) and analytical reports. Statistical reports that follow the format in Tennessee's recent periodic inventory will add an expanded methods section that addresses differences between the current and the previous inventory procedures. A number of changes in procedure, such as sample designs, volume computation, and merchantability standards, will affect the assessment of change between inventory periods. Reports will clearly identify these changes and, when appropriate, highlight problems that affect trend statistics.

Analytical reports for periodic inventories will be different if the inventory was conducted before or after the merger of the Southern and Southeastern FIA units. States using the format of the previous separate FIA units include Arkansas (1995), Florida (1995), Mississippi (1994), Oklahoma (1993), and Texas (1992). Analytical reports for States inventoried during or after the merger will make a transition toward the new model for analytical reports.

INVENTORY ESTIMATES IN ANNUAL INVENTORIES

The 1998 Farm Bill mandates annual collection of field data for 20 percent of all FIA plots in each Southern State. Several Forest Inventory and Monitoring (FIM) workshops have discussed accurate time-series techniques to estimate current conditions at the scale of a State or sub-State region (Survey Unit). Participants agreed that annual measurement of 20 percent of the FIA plots in each State provides the most current information, but also reduces the sample size to an unacceptable level of accuracy to most users of the data. Therefore, the recommendation is that States in transition from a periodic to an annual inventory use a moving average that includes the last periodic inventory if the data are not too old. The data are considered too old if the period is greater than approximately 3 years.

The assumption is that FIA will measure a total of n plots over a period of m years. We will divide n plots into m approximately equal panels. The proposed target for the South is $m = 5$, and $n/5 = 20$ percent of the plots measured each year.

The inventory statistics in an annual report will use the moving average, averaged over the last m years. When interpreting the results, a user should consider this data an unbiased estimate of conditions. Some trend analyses will have a time-bias; this is not expected to be great if $m = 5$. Actually, the moving average is a familiar concept for those States that required several years to inventory. For example, for the 1997 periodic inventory, Georgia took plot measurements from the fall of 1995 to the spring of 1998.

REPORTING REQUIREMENTS FOR ANNUAL REPORTS

The Farm Bill and the Forest Service Strategic Plan require that States compile and release data in both hard copy and electronic format once per year on a predetermined schedule. FIA considered several options to meet these

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objectives. Electronic format supplemented with simple hard copy would deliver a product more quickly, but would give little credit to analysts and the Research Work Unit. Another option was for State agencies to publish annual estimates, but not all States would publish results equally. Therefore, the primary means of reporting annual inventory results should be through a brief Forest Service publication, such as a research note, supplemented by tabular data available in hard copy and electronic form. Analysts should pursue collaborative reporting efforts between State agencies and the Forest Service.

REPORTING REQUIREMENTS FOR ANALYTICAL REPORTS

The Farm Bill and Forest Service Strategic Plan require that every 5 years the Forest Service produce a complete State analytical report that includes core information covering the current status of the forest resource based upon the previous 5 years of data. More specifically, inventory statistics should use the Moving Average where n is the number of plots measured under the panel system over a period of $m = 5$ years. Also recommended are trends in forest status and condition, timber products output information for each State, and projections for key resource attributes over the next 20 years. To meet these requirements, one comprehensive report could cover all aspects of the forest resource and associated inventory data. Past reports in the South fit this category, but they were timber oriented and lengthy. The advantage is that everything is available in one publication; the major drawback is the long development and publication process required, which is detrimental to the timely objective of the Farm Bill.

The proposed approach is to develop analytical, succinct, 5-year reports focused on the general status and change in the forest resources of each State. A wider audience can be reached with a shorter report providing color maps and graphics, and by more inclusive, nonproduct-related language whenever possible. The analytical report should contain 20 to 25 pages of text, graphics, and maps. The development and publication of a statistical style report should occur prior to the development of the analytical report. The statistical report would contain all of the tabular data, detailed discussion of inventory methods, sampling errors, and definitions. These sections would be excluded in the analytical reports. The major advantage to developing 5-year reports is a short turnaround period, enabling timely reports. Analysts will have more time to write scientific reports on forest resources in each State.

REPORTING REQUIREMENTS FOR INTERIM REPORTS

Before the end of the 5-year cycle, States that have initiated annual plot measurements, but whose previous full inventory is too old, will generate interim reports. Analysts can process two or three panels of inventory data (40 to 60 percent of the full periodic inventory plot total) and then update the estimate annually. For example, Virginia, whose previous inventory was 1992, will soon complete three panels, or 60 percent, of the total periodic inventory. After this estimate, an interim status report will be published on forest resources.

REPORTING FOR GEORGIA'S INVENTORY

Georgia's inventory serves as an example of the reporting process. The design-based estimate used for annual surveys will be the moving average. The State will combine plot measurements from the previous periodic inventory with plots measured in the annual inventory.

The field work for Georgia's 1997 periodic inventory began in November of 1995 and ended in April 1998; all five Survey Unit reports and the State Statistical Report have appeared. The annual inventory effort began immediately after the periodic inventory, and the field work for panel 1 (approximately 20 percent of the periodic inventory plot total) was completed in June of 1999. For Georgia, then, the State-wide measurement interval between a plot measured in panel 1 and the same plot measured in the periodic inventory averaged 1.8 years.

The FIA moving-average estimate for Georgia will combine about 80 percent of the plot network from the 1997 periodic inventory and the 20 percent of plots selected for panel 1.

Let us suppose that the reporting attribute of interest is the average per-acre volume of all live standing trees 5.0 inches in diameter at breast height (d.b.h.) and larger on timberland area in the State of Georgia. The inventory sample to measure live-tree volume was a fixed-radius plot cluster of four points spaced 120 feet apart. Each point served as the center of a 1/24-acre circular subplot used to sample trees 5.0 inches d.b.h. and larger. These sample plots were established without regard to land use or forest cover. Forest and nonforest condition classes were delineated and recorded. FIA defines condition classes by six attributes: land use, forest type, stand origin, stand size, stand density, and major ownership category (Thompson 1998). FIA assigns trees to their respective condition classes.

To determine the average per-acre volume of live trees 5.0 inches d.b.h. and larger, a weighted mean was computed. The equation for mean per-acre live volume is,

$$\bar{y} = \sum_{i=1}^w (y_i w_i) / \sum w_i \quad (1)$$

where, y_i = per-acre volume of live trees 5.0 inches d.b.h. and larger on timberland area sampled by plot i ,

w_i = proportion of total area sampled on plot that sampled timberland area, and

$\sum w_i$ = sum of the proportions of plots that sampled timberland area.

The statistics for computing the standard error were determined using PROC MEANS with the WEIGHT statement and VARDEF=WDF option (SAS Institute 2000).

The Statewide inventory per-acre estimate of all live trees 5.0 inches d.b.h. and larger on timberland as determined by the moving-average estimate (\bar{y}_m) is,

$$\bar{y}_m = n_{2,3,4,5} / N(\bar{y}_{2,3,4,5}) + n_1 / N(\bar{y}_1) \quad (2)$$

where

n_1 = number of plots that sampled timberland in panel 1,

$n_{2,3,4,5}$ = number of plots that sampled timberland in panels 2,3,4, and 5,

$N = n_1 + n_{2,3,4,5}$,

\bar{y}_1 = mean live volume per acre on timberland for panel 1 (equation 1), and

$\bar{y}_{2,3,4,5}$ = mean live volume per acre on timberland for panels 2,3,4, and 5 (eq. 1);

\bar{y}_p = the mean determined by all plots in the periodic inventory that sampled timberland, representing the Statewide inventory per-acre estimate of all live trees 5.0 inches d.b.h. and larger.

Note that in equation 2, the plots in panels 2,3,4, and 5 have not been measured under the annual system, but are considered a valid component of the estimate since the most dated samples were measured in 1995. Figure 1 illustrates the average per-acre volume of live trees 5.0 inches d.b.h. and larger on timberland area for the State of

Georgia for the three separate estimates \bar{y}_1 , \bar{y}_p , and \bar{y}_m . The estimate in the annual report will be \bar{y}_m , and any discussions of change or trend from the previous inventory will be the difference between \bar{y}_m and \bar{y}_p .

DISCUSSION

For the immediate future, as the transition continues toward annual inventories, FIA in the South will deal with data availability and reporting. After implementation of the annual inventories, Southern States will use the simple m -year moving average for reporting of FIA information. The moving average is a reasonable and practical way to analyze and report data. In the future, when more complicated analysis will update inventory statistics, the moving average approach can evaluate whether other estimates are improving the results.

LITERATURE CITED

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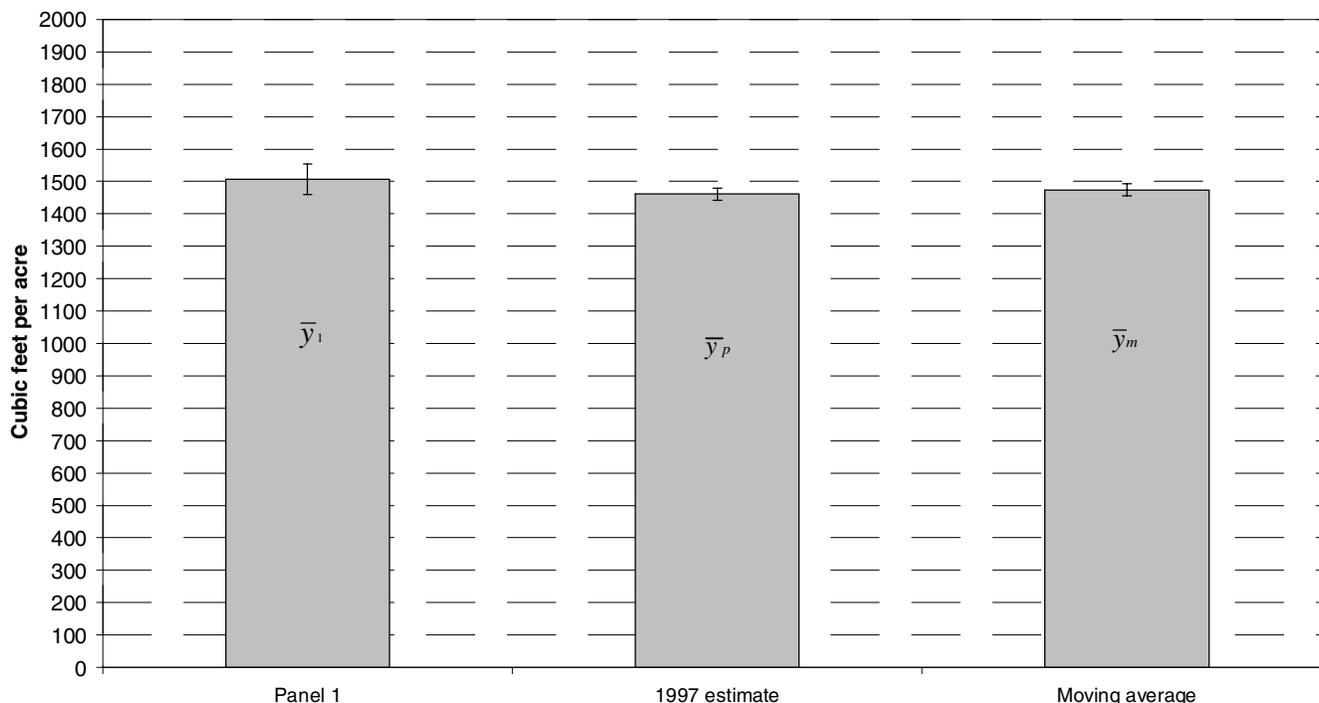


Figure 1—Three estimates of average per-acre volume of live trees 5.0 inches d.b.h. and larger on timberland area for the State of Georgia.