SOUTHERN FOREST RESOURCE ASSESSMENT AND LINKAGES TO THE NATIONAL RPA

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ABSTRACT. We developed a Southern Forest Resource Assessment Consortium (SOFAC) in 1994, which is designed to enhance our capabilities to analyze and model the southern forest and timber resources. Southern growth and yield analyses prepared for the RPA via SOFAC indicate that substantial increases in timber productivity can occur given current technology. A survey about NIPF management practices indicates that considerable adoption of increased management intensities is projected to occur. Even higher management intensities were projected on forest industry lands in the South. If these potentials are realized, the region will be able to provide adequate pine timber supplies at reasonable constant real prices in the future. Hardwood timber supply will be scarcer, as reflected in increasing real prices, despite having almost 50% more standiig inventory that softwoods.
KEY WORDS. timber supply, modeling, NIPFs, management intensity, South

INTRODUCTION

Timber supply analyses are one of the most challenging and controversial research efforts performed by public and private researchers: Timber supply is one of the fundamental bases that firms use to site and build new manufacturing forest products manufacturing capacity. Timber supply analyses also inform most private investment decisions in planned regeneration practices, as well as intermediate stand treatment decisions. Projected timber supply shortages have been used as the principal argument for most of our public forestry programs. And tiiber supply and forest conditions heavily influence the capacity for most other commodity and environmental outputs or values that are provided by forests.

U.S. timber supply is analyzed in the decennial national Renewable Resources Planing Act (RPA) timber assessments and their periodic updates (i.e., Haynes et al. 1995, USDA Forest Service 1988). The RPA timber analyses have generated keen interest by public and private sectors every time they are released. All forest resources become relatively scarcer with increasing population alone. Demands for housing, other commodities, amenities, and environmental benefits have provided additional upward pressure on timber prices. This scarcity, coupled with increasing uncertainty, has made timber supply analyses and modeling more important for public and private decision making.

In response to demands for more timely and more localized information about southern timber supplies, the Southern Forest Resource Assessment Consortium (SOFAC) was organized in 1994. This cooperative effort has included 16 forest products firms or consulting organizations, two states, four USDA Forest Service Southern Research Station Research Work Units. and eight universities. SOFAC is designed to enhance our capabilities to analyze and model the southern forest and timber resource sector. Member firms and states have contributed more than $100.000 per year, and the Economics Research Work Units and Southern Research Station have contributed about $50,000 annually. Initial research efforts, which were performed by cooperating universities, focused on

developing appropriate models for southern forests and-timber markets. We have developed **timber** supply models that can analyze timber markets trends at the subregional (survey unit) level. We also have gathered better information that can be used in southern or national timber supply models, integrated southern with international models, and examined questions such as the effects of urbanization or investment levels on southern timber supplies. More recently, we have developed forecasts of management intensities on nonindustrial private forest **(NIPF)** lands, and cooperated with the forest industry on a related analysis of their lands. Based on the identified management intensities, we also have estimated the potential growth and yield levels that are likely to be realized on industrial and **NIPF** lands.

The SOFAC efforts in the South are currently being coordinated with the national timber supply analyses for the 1999 **RPA**. The national RPA inputs and projections will be used to drive the timber trend projections for the country, including the two broad Southeast and South Central regions. These **RPA** projections will then be broken down into state level and survey unit projections by the **SOFAC** models. The national **RPA/TAMM** (Timber Assessment Market Model) suite of models will use the same inputs and assumptions as the **SOFAC/SRTS** (Subregional Timber Supply) model. Communication among the national and southern researchers, as well as southern practitioners, should enhance satisfaction with the timber supply models, assumptions, and results. Some of these cooperative efforts--(1) **SOFAC(SRTS)/RPA(TAMM)** timber supply. modeling; (2) southern management intensity classes; and (3) growth and yield by intensity classes--are described below.

SUBREGIONAL TIMBER SUPPLY (SRTS) MODEL

The Subregional Timber Supply (SRTS) model is an economic simulation tool used to examine timber Supply issues. It allocates aggregate harvest level requests to individual survey units in the South and projects future timber inventories and prices. SRTS projects timber supply for every year given assumed trends in forestland areas, future harvests, and price and inventory elasticities. The model requires forest inventory data (area, volumes, growth, and removals); assumed harvest and acreage trends; and input parameters like supply and demand price elasticities, inventory elasticities, and harvest weights for age classes and management types (Pacheco et al. 1997).

SRTS models competitive market conditions in a homogenous timber region consisting of numerous subregions. SRTS models supply as a function of **stumpage** price and beginning period inventory. Demand is a function of **stumpage** price and a demand shifter. While the market price is determined by the aggregate harvest and inventory changes, inventory is modeled separately in the subregions. Regional price changes are applied to. respective regions, and along with subregional inventory changes determine the change in subregional **harvests**.

SRTS's inventory **algorithm** uses the average survey unit net annual growth by species, management types and age classes, and advances volumes during the projection through the age classes. Harvest allocation across management types and age classes is based on either initial harvest across age classes, inventory across age classes, oldest first rule or their weighted combination. One year's worth of the unharvested acres (e.g., 1/10 of the 10 year age class cells) moves to a higher age class in each period. Growth is determined by applying average growth per acre by age class.

SRTS has been used to project timber inventory, removals, and prices for 12 southern states from 1990 to 2020. Between 1990 and 2020, the SRTS model indicated that based on the RPA projections, southern softwoods removals would increase by 24% and hardwood removals by 39% (Pacheco et al. 1997). During that projection period, private southern softwood inventory would decrease substantially. At the same time prices would substantially increase, at a rate much higher than the inflation rate. Although hardwood inventory and prices appeared more stable as a result of a large inventory and growth, it is predicted that in about a decade hardwood inventory would begin to decrease and prices would begin to rise more rapidly.

These projections were updated in September 1997, yielding similar results. The projections indicate softwood inventory decreases, harvest increases and price increases. Between 1990 and 2015 so&wood real stumpage prices were predicted to increase by 3.1% annually. During the same period, hardwood real stumpage prices were projected to increase by 4.7% annually (Cubbage and Abt 1998). These new SERTS runs indicate that softwood would still be in short supply, accompanied, by rapidly increasing prices and significant inventory declines. Higher hardwood removal levels exceeded growth and caused prices to rise rapidly.

NIPF FOREST MANAGEMENT PRACTICES AND INTENSITY

As part of our southern timber supply efforts, we also needed forecasts on the types &forest management practices and the intensity of management that is likely to occur in the future. As a contributor to the RPA modeling efforts, the American Forest & Paper Association (AF&PA) surveyed forest industry management practices and intensities in the country. Similarly, we surveyed the state foresters in each of the 13 southern states to obtain their estimates of the likely management practices and management intensities on NIPF lands in the future. To inform their responses, we also provided current data regarding each of the management practices or land area description, based on the most recent FIA survey.

Our survey results project changes for NIPFs between now and 2020 (Moffat et al. 1998). Planted pine area is projected to increase 7% in the South, largely at the expense of natural pine area, which is projected to decrease by 6%. The average percentage distribution of acres in the other three forest types is projected to remain fairly steady for the next 22 years. However, the responses indicate that significant shifts will occur among individual stands after harvest. By 2020, the state foresters estimated that 62% of the harvested planted pine acres would be retained in the same type; 19% of natural pine acres; 36% of pine hardwood acres; 88% of upland hardwood acres; 93% of bottomland hardwoods; and 37% of nonstocked acres. These changes imply shifts among forest types, but not loss of forest lands. The shifts will result in small changes in overall distribution of forest management types, but large variations on actual sites after harvests.

Management intensity is projected to increase dramatically for all forest types over the next 22 years. as shown in Table 1. The greatest increases are in the pines, with bottomland hardwoods showing the next highest increase. If realized, these increases in management intensity will represent the largest changes in forest management ever experienced in the South. They also will do much to prevent timber supply shortages that have been projected based on current management practices.

Table 1. Projected Change in NIPF Management Intensity From Now to the Year 2020 for the South'

	Planted Pine	Natural Pine	Mixed Pine Hardwood	Upland Hardwood	Bottomland Hardwood
Very Intensive	+ 22	+ 14	na	n a	na
High Intensity	na	+ 17	+ 9	+ 5	+12

On average, the state foresters responded that they believe that only a modest amount of forest land will be withdrawn from timber management, but this varied considerably for individual states. The least amount of projected land area removal came from the pines (-1% for planted pine; -2% for natural pines). Larger areas were projected to be withdrawn from the other forest types--9% less for both pine-hardwood and upland hardwood stands, and 11% less for bottomland hardwood stands.

Clearcutting as a method of final harvest was projected to decrease significantly in the Southeast and increase slightly in the South Central (Table 2). The differences among regions were notable. We can only guess at the causes, but believe they could be attributed to a slight shift to even-aged management in the South Central compared to its historical focus on uneven age management, and , a much greater shift away from even age management in the Southeast, prompted by landowner desires, public opinion, greater population growth, and environmental pressures. Further investigation into these projections would be advisable.

Table 2. Projected Change in Clearcutting as the Method of Final Harvest in the South

	Planted Pine	Natural Pine	Mixed Pine Hardwood	Upland Hardwood	Bottomland Hardwood
Southeast	- 11	- 19	- 23	- 42	- 40
South Central	+ 3	+ 3	+ 1	- 3	+ 1

MANAGEMENT INTENSITY AND YIELDS

As part of the SOFAC/RPA modeling efforts, we also developed the basic southern yield tables by management intensity classes. This again was done as a cooperative effort between personnel in SOFAC, the RPA timber analysis staff, as well as with forest industry representatives with AF&PA. Most growth and yield analyses were based on the TAUYIBLD model, developed at Virginia Polytechnic Institute and State University (Amateis et al. 1995). The natural stand yields were developed as part of the SRTS model inputs, and are based on empirical FIA data.

TAUYIBLD is a-stand-level growth and yield model for unthinned and thinned loblolly pine plantations. The data used in the development of the model were collected throughout the most of natural range of the species. A system of three dynamic equations guiding height-age, survival and basal area development constitutes the core of the model. The performance of the model was evaluated using independent data from unthinned and thinned loblolly pine stands, indicating that the model generates reliable estimates of stand-level yields for many management scenarios.

Southern pine plantation yields were developed for a variety of Management Intensity Classes (MICs). Management treatments include genetically improved stock, fertilization, competing vegetation control and thinning. TAUYIELD simulates thinning explicitly. The other management

treatments had to be analyzed by adjusting the site index values in TAUYIELD or they had to be developed outside the model.

In brief, the results from the SOFAC/RPA/forest industry analyses of southern pine growth and yields indicated that projected plantation yields were much greater than historical FIA data--up to 80% (for MIC 5/6) to 287% (for MIC 10) more than the current empirical data for average sites at age 25. Projected yields also were much greater than those used at the start of the projections in the last RPA/ATLAS modeling efforts, although the ATLAS yields were increased over time in those projections as part of the approach to normality adjustments. Current MICs 7 through 10 have much larger potential productivity increases. Such productivity increases, if realized, could easily prevent any timber shortages in the medium term, say from 20 15 or 2020 to 2040. Whether we can achieve such large increases is a crucial question.

Table 3. TAUYIELD and SRTS/FIA Projected Growth and Yield Data for Selected Management Intensity Classes, Wood Volume Inside Bark (cubic feet per acre)

MIC\Age	10	15	20	25	30
MIC 5/6	544	1737	2951	3848	4309
MIc7	682	2094	3498	4504	4963
MIC 8	682	2094	3798	4817	5282
MIC 9	843	2511	4425	5519	5956
MIC 10	1117	3245	4997	6132	6598
SRTS/FIA	501	1014	1526	2140	2754
ATLAS	281	1042	1754	2153	2527

Assumes Site Index of 70 at base age 25, and Planting Density of 600 TPA. Site classes range from MIC 5/6: regular seedlings; MIC 7: 2nd generation seedlings; MIC 8: MIC 7+fertilizer; MIC 9: herbicides +fertilizer; MIC 10: all of above + midrotation herbicides and fertilizer.

CONCLUSIONS

The USDA Forest Service and the Southern Forest Resource Assessment Consortium (SOFAC) are cooperating to produce an integrated national and southern timber analyses as part of the 1999 RPA timber assessment. These efforts stemmed from desires to achieve a consensus view of the timber supply situation in the country, and to involve all the groups that rely on the RPA documents for making public and private decisions. Southern timber supply models are being used to complement the national models, and the lead Forest Service researchers in the Pacific Northwest are cooperating with Forest Service and academic forest economists in the South. Forest industry is participating in the model development through subcommittees in AF&PA, as well as through SOFAC. Two states have contributed as members to SOFAC, and the 13 southern state foresters have provided input:; via a survey regarding NIPF forest management practices.

This cooperative effort has been successful at gathering and developing consensus on inputs for the national RPA timber assessment. We have developed the SRTS mode!, which can disaggrega: national projections inro subunits in the South, as well as complementary models at several otr..

institutions. This relative success in cooperative timber supply modeling still must withstand other tests, however. The data collected suggest that higher. management intensities are well within our grasp using given technology for softwoods. And these higher management intensities are projected to be widely applied on industrial and even on NIPF lands. If these optimistic projections are indeed realized, we could ameliorate or even eliminate projected southern softwood timber supply problems, and may even lead to projections of a surfeit of softwoods in the South. The long history of NIPF "underproductivity" and the fairly large change from current practices still must make us cautious about blindly accepting the NIPF survey results and management intensity findings. Nor are we sure how to accurately model the timber market feedbacks for forest investments. The policy implications of projected timber surpluses--such as allowing more regulation or less timber harvest from public lands-also are contentious. Whether we will actually achieve the potential timber growth increases across the many acres projected is moot. Growth and yield models still tend to be more optimistic than actual yields in the field, which are reduced by gaps in plantations, roads, streamside zones, hardwood competition, crowding, etc. These and other questions will continue to make our timber supply modeling and analyses interesting for years to come. Stay tuned for future developments.

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