ANNUAL FOREST INVENTORY: AN INDUSTRY PERSPECTIVE

Roger Lord

ABSTRACT.—The Forest Inventory and Analysis Program serves important public interests by providing credible data for informed public forest policy debates as well as feedback to the forest-based economic market. This feedback, which affects timber price expectations, helps ensure resource sustainability by promoting better investment decisionmaking within the forest products sector. Industry's use of FIA data is illustrated by the types of analysis performed by Boise Cascade Corporation. Key needs include more timely and consistent data across all forestlands, improved spatial resolution, and integration of socioeconomic variables that affect timber availability. Concerns about the implementation of the annual inventory program required by the 1998 Farm Bill, particularly in the western states, are discussed.

IMPORTANCE OF FOREST INVENTORY INFORMATION

After two Blue Ribbon Panel reports and countless other discussions, it should by now be unnecessary to point out the value of the Forest Inventory and Analysis program in monitoring the status and health of the Nation's forests. The program represents the only continuous inventory system that quantifies the condition of forest ecosystems across the United States. The critical information provided by the program can promote informed discussion of public forest policy issues and can serve as the basis for sound business decisions within forest industry.

Public Forestry Issues

The FIA program provides the information base upon which we can intelligently address important public issues such as forest sustainability, ecosystem health, land use, and timber policy.

Intense public debate rages in virtually every region of the country over forestland use and management. In the coastal Pacific Northwest, the spotted owl controversy, old growth protection, and threatened and endangered species continue to focus attention on the management of both public and private timberlands. In the Inland Northwest, forest health and sustainability, roadless areas, and endangered species issues dominate. In the Rocky Mountain States, forest health issues such as the decline of aspen stands in Colorado are debated. In the South, it is the impact of chip mills and clearcutting of hardwood stands as well as wetland protection that has recently drawn the most attention. Wetlands, endangered species, and forest sustainability are important issues in the Lake States, while forest fragmentation, acid rain, and loss of wildlife habitat are important in the Northeast. Finally, on a national scale, the U.S. must address the forest sustainability issue through the internationally accepted forest sustainability criteria and indicators.

Objective forest resource data from the FIA program are essential to developing a fact-based, intelligent discussion of these issues. Yet, FIA data are useful only when they are current, consistent, and reliable. When they are not, public policy debate quickly degenerates into emotions, perceptions, and opinions.

Sound Business Decisions

Business decisions within the forest products sector are often strongly influenced by expectations of future timber prices. The decision to add new manufacturing capacity, or reconfigure or close existing facilities, for example, is essentially an analysis of the expected cost competitiveness of the facility and return on investment. Fiber costs, which can be up to 80 percent of the variable costs of production of some wood products, are key to this analysis. As another example, determining the appropriate level of investment in productivity-enhancing forest management practices also hinges on

expectations of future timber prices. Whether a particular silvicultural practice earns an adequate financial return is highly dependent on the expected increase in value at harvest. Price expectations provide the industry with the market feedback signals it needs to make adjustments to demand (e.g., via changes in mill capacity or development of technology to decrease fiber use) and supply (e.g., through silvicultural investments, genetic research, or development of new supply sources) to maintain competitive raw material costs.

Price expectations depend on changes in the available supply of fiber relative to demand. Accurate projections of future changes in timber prices and availability, in turn, are dependent on accurate, current resource data. To the extent that data are out-of-date and misleading, price expectations will be inaccurate and inappropriate business decisions may be made as a result.

There are obvious public benefits to good business decisions within the industry. Questionable business investments, such as adding new manufacturing capacity in an already supply-constrained woodbasket, may have a negative impact not only on the individual company involved, but also on resource sustainability. Thus, it is in the public interest as well as the industry's interest to maintain current resource inventories.

HOW BOISE CASCADE USES FIA DATA

Current Uses

To understand how FIA data are used by industry, it may be helpful to review the use of that data within one company. Boise Cascade Corporation has timberlands and manufacturing operations in Washington, Oregon, Idaho, Minnesota, Louisiana, and Alabama. Thus, it has direct business interests in FIA data from four of the five program regions. Current use of FIA data within the Timberland Resources department at Boise Cascade can be broken down into four general categories:

- Broad regional resource monitoring
- Detailed woodbasket modeling
- Support of investment analysis
- Regulatory impact assessment

To better understand our general operating environment, Timberland Resources undertakes regional resource studies for the Pacific Northwest, Lake States, and Southern U.S. on a regular basis. In the Northwest and Lake States, we have developed a projection system called *Dynamic Forest Simulator™* to project FIA plot data for up to 20 years using a combination of stand table projection and individual tree diameter growth and mortality modeling. The current model covers California, Oregon, Washington, Idaho, and Montana as well as North Dakota, Minnesota, Wisconsin, and Michigan. Users can select sample plots based on geographic location and plot characteristics, update the plot data to the current year, and project into the future by simulating historical and projected harvest levels. Harvest can be specified by owner, species, and diameter class, or it can default to historic harvest patterns. Using a different approach in the U.S. South, we have looked at the impact of increased silvicultural intensity, urbanization and forest fragmentation, and wetland and coastal zone regulations on future available supply versus biological inventory.

In addition to regional studies, we also undertake more detailed modeling in the woodbaskets where we operate. For example, we have developed linear program-based resource allocation models for our southern woodbaskets in which FIA data are used as the basis for the supply side of the model. The demand side is based on an individual mill database of the primary wood processors within the woodbasket and surrounding area. FIA data are used to predict supply to each mill from within and outside of the designated woodbasket. Marginal wood cost curves (supply curves) are also developed to predict delivered wood cost to each mill.

FIA data also support investment analysis efforts, including financial analysis of both manufacturing investments, and timberland and silvicultural investments. For example, we use FIA data to analyze potential fiber supply and develop delivered fiber cost estimates for proposed manufacturing facilities. FIA data also help set the timber price scenarios for our timberland planning models by which we develop our silvicultural and harvesting plans.

Another use of FIA data is in the assessment of the impact of regulatory changes on timber supply. In the West, much attention has been focused on the scenario analysis in which we looked at the impacts of alternative degrees of riparian and endangered species restrictions on

available timber supplies. In the South, we have examined the implications of wetland and coastal zone management regulations using FIA data.

Future Uses

There are at least two areas of analysis in which we would like to be able to use FIA data in the future. The first is more spatially explicit timber supply analysis. The FIA sample plot framework is only pseudo-spatial at best. Currently, we know only that a plot is representative of forested acres somewhere in the county, but we don't know *where* in the county the represented acreage is. Higher spatial resolution to forest resource data is needed to better address issues of availability such as the impacts of urbanization and land use regulation. Better spatial resolution of the data would also be more helpful in regions with large counties and more scattered forest cover such as the Inland Northwest.

A second area of future need is data to support landscape analysis. Boise Cascade has completed ecosystem management projects in Idaho, Washington, and Minnesota and has successfully classified its fee-owned land base into an ecological classification scheme known as an ecosystem diversity matrix (Haufler *et al.* 1996). This system classifies land into Habitat Type Class (e.g., Warm-Dry Douglas-fir) to describe the potential vegetation type and Vegetative Growth Stage (e.g., Medium Tree, Multi-Story) that describes stand structure. The resulting acreage matrix describes the habitat contribution of company lands and can be projected over time using Boise Cascade's forest planning models. Company fee land, however, is only one component of the ecological landscape. For example, in Idaho, Boise Cascade owns 200,000 acres of the 5.9 million acre Southern Idaho Batholith ecoregion. To fully describe the landscape and depict the contribution of company lands within the context of the entire landscape, we need similar data across other ownerships within the ecological region. Aside from access issues, data in the detail acquired on company lands would be prohibitively expensive to collect across all acres. As an alternative, FIA data, particularly augmented with more spatially explicit remote sensing data, could provide the information base for this type of large landscape analysis.

KEY DATA NEEDS

Current, Consistent, and Comprehensive Data

Current, consistent, comprehensive FIA data are required to meet the challenges of addressing public forest policy and business issues. Data older than 5 years are simply not credible with decisionmakers or the public. Table 1 shows the age of FIA data Boise Cascade regularly uses in analysis. On an acreage-

Table 1.—*Age of key FIA data used by Boise Cascade*

State	Area of timberland (Thousand acres)	Latest survey	Previous survey	Approximate midpoint
Alabama	21,932	1990	1982	1986
Louisiana	13,783	1991	1984	1987.5
Mississippi	18,587	1994	1987	1990.5
Tennessee	13,265	1989	1980	1984.5
Texas	11,774	1992	1986	1989
Minnesota	14,723	1990	1977	1983.5
Idaho	21,427	1991	1981	1986
Oregon-Eastside	2,978	1992	1987	1989.5
Oregon-Westside	6,777	1986	1976	1981
Washington-Eastside	4,008	1992	1980	1986
Washington-Westside	9,581	1991	1979	1985
Total	138,836			
Weighted Avg Date		1990.8	1981.9	1986.4
Weighted Avg Age as of 1/1/2000		9.2		13.6

weighted basis, the average plot is over 9 years old and the average to the last period midpoint (the relevant age for growth and removals estimates) is nearly 14 years. Within the 13 southern states, average age to plot midpoint is about 11 years. Since that time, we estimate that the southern timber harvest has increased by 20 to 25 percent. Harvests in the Pacific Northwest meanwhile have fallen by about 40 percent across all ownerships, and harvesting patterns have changed. Yet these changes are not yet being fully reflected in FIA statistics because of the long cycle times.

However, long cycle time is only part of the problem. We can also no longer afford the delays of sometimes up to 2 to 3 years in the release of FIA data and analysis once field collection has been completed. The value of the data decreases rapidly, perhaps exponentially, with time. As has been demonstrated, particularly by the Southern Station, technology allows significant improvements in data collection, editing, management, and release. These technologies need to be fully exploited. Further, allowing raw field data to sit on the shelf for 6 months or more because of a lack of analysts is difficult to understand given the cost of data collection and value of timely release. Stations should be adequately staffed with analysts to efficiently process and release the data.

Consistency within and between FIA administrative and survey units is also essential, as the Blue Ribbon Panel reports have pointed out. Rarely in my industrial experience is FIA data from only one survey unit or state used. We regularly merge data from two or more states in our analyses. Much time and frustration has been spent uncovering the differences in data collection methods, definitions, and coding between the various FIA data sets.

Finally, it is very important that data provide a wall-to-wall coverage across all ownerships, including National Forests, and all classes of forested land. To understand the ecological condition of our forest resource, we must necessarily have consistent data for all forests regardless of commercial availability for harvest.

Increased Emphasis on New Techniques

Several other papers in this workshop have already covered this topic in some detail. Techniques such as remote sensing and GIS offer potential for both reducing program costs and enhancing the spatial component of the data. More work is needed on growth and change modeling so that FIA statistics can be updated through modeling and perhaps measured less frequently. The Farm Bill also requires that the FIA program develop 20-year projections of forest conditions, yet it appears that little work has been directed to this effort.

Moving Beyond Biological Inventory

From an industrial perspective, I believe we must get beyond the practice of using biological inventory as a measure of timber supply. We can encourage this change by capturing socioeconomic aspects that relate to the availability of inventory for commercial use. The role of FIA in this would be to integrate socioeconomic data into the plot database. For example, linking plot data with measures of urbanization, such as the Rural-Urban Continuum Codes developed by the USDA Economic Research Service or population density statistics from the Bureau of Census, would allow users to take into account population and land use pressures when analyzing resource data. It may also be useful to develop a sub-classification of the timberland definition (e.g., suburban timberland) to take into account factors affecting availability and to draw further attention to the availability issue.

IMPLEMENTATION OF THE FARM BILL

Inequity Between FIA Programs in the Eastern and Western U.S.

The 1998 Farm Bill addressed many of the issues raised previously in this paper and sets forth a framework for an improved FIA program. Boise Cascade, however, is concerned about progress to date in implementing aspects of the annual forest inventory program. To be sure, a great deal of progress is being made as we have seen in the papers presented at this workshop and I do not want to minimize the tremendous amount of work that has been accomplished and change that has already taken place. However, Boise Cascade is particularly concerned about implementation in the West and continued inadequate funding and support from the Chief's Office.

The FIA Program is currently administered by five experiment stations including the Southern, Northeastern, North Central, Rocky Mountain, and Pacific Northwest Research Stations. The lion's share of funding for the FIA program historically has gone to the stations in the East and particularly to the Southern and North Central Stations. Meanwhile, the FIA programs in the West (including the Pacific Northwest and Rocky Mountains) and the Northeast have languished for lack of funding and staff.

The Forest Service's current plan to implement the Farm Bill program only perpetuates this inequity by adopting a base program that calls for measuring 15 percent of the sample plots annually in the East but only 10 percent in the West. This arbitrary decision is more a product of agency politics and culture than science. It makes little scientific or statistical sense from the standpoint of providing the consistent and timely base of forest resource information.

To support this decision, it has been argued that trees grow slower in the West and therefore change is less dynamic. This is fallacious reasoning on at least two counts. First, FIA data refute this argument. Data on net annual growth and timberland acreage by region in Powell *et al.* (1993) indicate that net annual growth per acre of timberland is actually higher in the West than the East (table 2). Per acre growth rates on a cubic foot basis are higher in the Pacific Northwest and Pacific Southwest than they are in the Southern U.S.

Table 2.—*Growth per acre on timberland, by region*

Region	Net annual growth	Timberland	Net annual growth per acre
	MM Ft³	*MM Ac*	*Ft³/Ac/Yr*
Northeast	3,093	79.4	38.92
North Central	2,269	78.4	28.96
Southeast	4,323	84.8	50.98
South Central	5,509	114.5	48.10
Great Plains	98	3.5	27.81
East	**15,292**	**360.6**	**42.40**
Intermountain	2,074	59.1	35.09
Alaska	270	15.1	17.90
PNW	2,904	37.9	76.73
PSW	1,087	16.9	64.30
West	**6,334**	**128.9**	**49.13**

Second and more importantly, tree growth is only one component of change in forest ecosystems and should not dictate inventory intensity. Other forest and landscape-scale change agents make the western forests potentially as dynamic if not more dynamic than many eastern forests. These change agents include changes in harvesting patterns, forest management systems, insect and disease outbreaks, fire, and urbanization and development.

The base FIA program should be defined as that level of effort that ensures that the desired national standard of statistical accuracy is achieved in each region and state. The starting point should be the annual sample size required for a scientifically acceptable estimate at state level using only that year's data. Science should set the base program effort in each state, not politics.

I want to be very clear that I am not arguing for a reallocation of static funding from the Southern and North Central Stations to the other Stations. The point of the Blue Ribbon Panel reports as well as the Farm Bill legislation was that the FIA program was inadequate nationwide and needed to be raised to a higher standard of consistency, comprehensiveness and timeliness. This is true in every region. All FIA units need to be brought up to a new, higher, common level of performance. This is essentially a funding issue and there is little evidence that the FIA program has received the called-for level of priority from the U.S. Forest Service Chief's Office. Despite its national importance and broad support, the FIA program represents only about 1 percent of the agency's budget.

Partner funding through the state forestry agencies is another area of concern to Boise Cascade. Differences in agency focus and landownership patterns between the states in the West and East bring into question the feasibility of reliance on state funding. For example, given that 70 percent of the forest land in Idaho is federally owned, is it reasonable to expect the state Department of Lands to partner with the FIA program at the same level as another state where 95 percent or more of the timberland is privately owned? Finally, we believe that securing and maintaining consistent, continuous funding from 40 or more state

legislatures will greatly complicate the task of providing a stable and capable FIA program.

The annual FIA system holds promise to at last bring the program up to the level of quality envisioned by the two Blue Ribbon Panels, the National Association of State Foresters, and other stakeholders. Progress is being made but the annual program has not yet been embraced nationwide and there appear to be many technical questions and funding inequities that have yet to be addressed. Industry will continue to monitor closely how the Forest Service resolves these important issues and truly begins implementing a consistent nationwide program.

LITERATURE CITED

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ABOUT THE AUTHOR

Roger Lord is Senior Forest Economist, Timberland Resources Planning and Development, Boise Cascade Corporation, Boise, ID.