TIMBER SUPPLY IN SOUTHWEST VIRGINIA [1/]

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Abstract.--The purpose of this paper is to: 1) describe some of the important factors influencing economic roundwood supply in southwest Virginia, and 2) discuss how to use these factors to forecast stock supply. Recovery costs, landownership characteristics, and general market conditions are important factors to consider in a supply analysis of southwest Virginia. These factors can be integrated using process analysis. The process analysis approach considers the component costs of the roundwood production process, namely, stumpage, harvesting, and hauling costs, to develop a regional roundwood supply schedule. Projections of stock roundwood supply can be made by incorporating estimates of regional roundwood demand.

Keywords: stock roundwood supply, process analysis

INTRODUCTION

The Appalachian mountains of Virginia are not only rich in coal but also hardwood timber. The nine counties of southwest Virginia (fig. 1) contain 1.77 million acres of commercial forest land and approximately 44 million cords of pulpwood and 8.4 billion board feet of sawtimber. Recently, public and private groups in the region expressed an interest in expanding the forest products industry. A supply analysis of primary wood products, emphasizing the economic availability of roundwood, would provide decision makers with resource data useful for planning the expansion.

The analysis would determine the economic stock supply of roundwood. Haley and Cooney (1982) defined economic stock supply as "... that portion of the resource for which product sales revenues equal or exceed all the costs incurred in bringing the products to market." In other words, stock roundwood supply refers to the volume of logs that could be delivered, given recovery costs and log prices.

The purpose of this paper is to: 1) describe some factors influencing the economic stock supply of roundwood in southwest Virginia, and 2) discuss how to use these factors to forecast stock supply.

FACTORS INFLUENCING SUPPLY

Several factors are frequently mentioned in the literature concerning roundwood supply. They are:

1. current recovery costs and primary product prices,
2. expectations of future costs and prices,
3. opportunity costs,
4. institutional factors, such as forest taxation,
5. landowner characteristics, and
6. general market conditions.

The first five factors are related to recovery costs. The last factor represents the conditions under which primary wood products are bought and sold.

Recovery Costs

Harvesting and hauling costs are key components of recovery costs. These components depend on site conditions, primarily stocking, operability, and accessibility. Site conditions, in turn, influence the choice of harvesting system and the extent of roundwood distribution.

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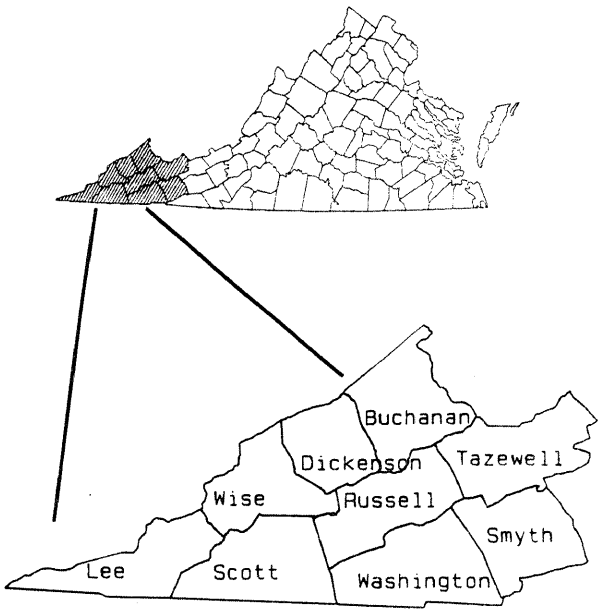

Figure 1.--Study area in southwest Virginia.

Forest Survey statistics for southwest Virginia indicate that 69 percent of the hardwood growing stock exists on slopes greater than 40 percent (U.S.D.A. 1985). The economic ability to log these tracts is sensitive to log and stumpage prices. Feasible harvest operations on steep slopes, for a given hauling distance, require higher log prices (or lower stumpage prices) to cover added costs.

Hauling costs increase in direct proportion to the distance between the woods and the mill. The distance that a specific primary product can be hauled, like harvest feasibility, is sensitive to its delivered price. Hauling distance increases with log price, for a given logging chance and stumpage price.

Hauling distance does not appear to be a problem for sawlogs in southwest Virginia. There are 32 sawmills in the region, and at least two mills per county (Frame and White 1986). A higher market value for sawlogs, relative to pulpwood, also allows longer, feasible hauling distances.

There are few delivery points for pulpwood and lower priced primary products, and those that exist are located primarily in the region's southern counties. Regional harvest statistics[3/] for 1984 indicate that less than one percent of the pulpwood volume originated in the counties of Buchanan, Dickenson, and Tazewell; the counties farthest from pulpwood delivery points. These statistics imply that pulpwood timbersheds falling within the region may be restricted in size and location. They also indicate that the economic stock supply of lower priced products is largely dependent upon hauling distance.

[3/] Harvest statistics are compiled by the Virginia Division Forestry from forest products tax data.

Landowner Characteristics

Several forest landowner characteristics influence stumpage supply; for example, lack of knowledge regarding roundwood markets and forest management, absentee ownership, the forest landowner's alternative rate of return, and size of forest holding. Numerous surveys of nonindustrial private forest (NIPF) landowners have found that size of forest holding is a major determinant of both timber sale frequency and forest management intensity (Straka 1981). Size of holding can also be associated with the landowner's alternative rate of return and management objectives.

Private forest landownership predominates in southwest Virginia (table 1). NIPF landowners account for the largest percentage of holdings, with only 12 percent of this acreage in ownerships of 400 acres or more (VDF 1982). Coal and land holding companies control most of the corporate forest lands. Though a few companies are pursuing forest management programs, it's possible that roundwood supply from most corporate lands will be sporadic, and coincident with increases in mining activity.

Table 1.--Area of commercial forest land by ownership.

OWNERSHIP	ACREAGE	PERCENT
National Forest	175,555	9.9
Other Public	45,517	2.6
Forest Industry	24,512	1.4
Farmer	470,551	26.6
Misc. Private Corporate	372,034	21.1
Misc. Private Individual	678,734	38.4
TOTAL	1,765,903	100.0

General Market Conditions

Prevailing market conditions are important to supply analyses. As defined, the economic stock supply of roundwood is, in part, a function of primary product prices. Where demand for a pri-

mary product is weak, market equilibrium price and quantity may be relatively low. This is the case for pulpwood in some southwest Virginia counties; low pulpwood prices combined with high recovery costs make it unprofitable to harvest and deliver large quantities of pulpwood from these counties.

Established roundwood markets exist in southwest Virginia. Table 2 shows the types and numbers of wood processing facilities existing as of 1985. On average, local sawmills procure 50 to 60 percent of their sawlogs from within the nine county area, and 69 percent within the counties where they're located (TVA 1984). Although empirical evidence is unavailable, discussion with procurement foresters indicates that the sawlog market is fairly competitive. Therefore, if the availability of sawlogs decreases, prices will likely increase.

Table 2.--Wood processing facilities in southwest Virginia. (Source: Frame and White (1986))

PROCESSING FIRMS	NUMBER OF FACILITY
Dimension	3
Furniture	1
Millwork	1
Misc. Wood Product	8
Oriented Strandboard (OSB)	1
Post & Pole Yard	1
Pulpwood Concentration Yard	2
Pulp & Paper	1
Veneer Concentration Yard	1
Sawmill (Annual BDFT Prod.)	
> 2,000,000	3
1,000,000 to 1,999,999	1
500,000 to 999,999	2
100,000 to 499,999	5
0 to 99,999	9
Unidentified	12
TOTAL	52

The market for pulpwood in the southern counties of the region is due primarily to an OSB plant in Dungannon, Virginia and a pulp and paper mill in Kingsport, Tennessee. No information is available on the timbersheds of these mills. The importance of these mills in the pulpwood market allows them oligopsonistic powers. These powers are reflected by the reported ability to set pulpwood delivery quotas. In addition, historical pulpwood price data show that prices have been stable; further indication of oligopsonistic powers.

The veneer log market is fairly minor; approximately 1.3 million board feet of veneer logs were harvested in 1984, compared to 13.8 million board feet of sawlogs. Recently, yellow-poplar (Y-P) peeler logs have been demanded by North Carolina mills for use as core stock in quality hardwood veneer.

STOCK SUPPLY PROJECTIONS

Stock supply projections, in this paper, are annual forecasts of roundwood supply. Stock supply is limited by the existing physical timber inventory and occurs in the time period during which all factors of production are fixed. The economic stock supply of roundwood can be determined over time given annual forecasts of primary product supply and demand.

An economic stock supply schedule represents the recovery costs of producing alternative quantities of roundwood. Recovery costs include stumpage, harvesting, and hauling costs; the costs of inputs used to deliver logs to the mill. The marginal recovery costs associated with an additional quantity of delivered roundwood can be translated into a stock roundwood supply curve (fig. 2). This curve shows the relationship between roundwood prices and economically recoverable volume.

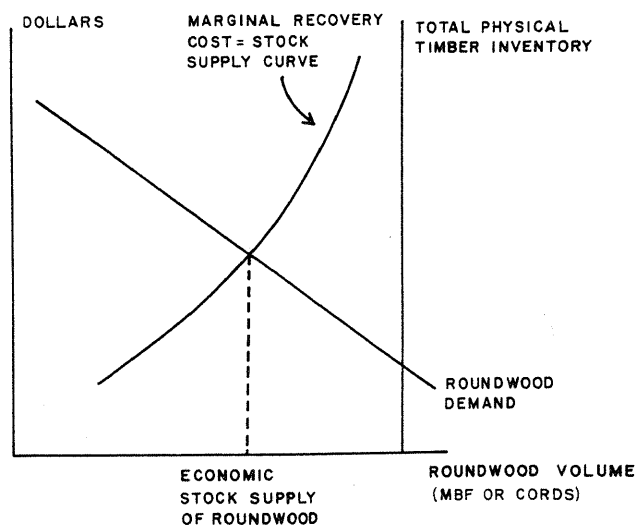

Figure 2.--The stock supply and demand for roundwood and the economic stock supply (Source: Haley and Cooney, 1982).

Estimating Stock Supply

Process analysis can be used to estimate the economic stock supply of roundwood. This tech-

nique analyzes production capabilities using an optimization or simulation description of the relationships between production inputs and outputs. Roundwood supply can be estimated by considering the interrelationships between the finished product (delivered logs) and the stages of processing (procurement, harvesting, and hauling).

To implement process analysis, the region's forests are grouped by biologic, physiologic, and economic characteristics into "homogeneous supply response cells" (Marty 1969). Each response cell represents incontiguous blocks of forest land and timber inventory which respond similarly to management inputs and operate under similar economic conditions and constraints.

Forest Survey data for southwest Virginia are used to form the response cells. Recovery costs are derived from the characteristic of each response cell. These costs equal the sum of stumpage, harvesting, and hauling cost estimates.

Harvesting costs are estimated as a function of average volume per acre, timber size, and site operability. A survey of contract and independent loggers, procurement foresters, and forest operations specialists could be used to gather harvesting cost data for a range of site conditions.

Hauling costs are a function of hauling distance. A problem arises because the response cells are not geographically defined. This problem can be handled in one of two ways. An average hauling distance, by roundwood product, could be used. This approach, however, assumes delivery points are located evenly throughout the region; an invalid assumption for pulpwood in southwest Virginia. The second method would involve determining distance distributions for broad cover types. These distributions would indicate the percentage of acreage in a response cell located a certain distance from a delivery point. The latter method, though more difficult to develop, would reflect more accurately the volume available in a timbershed.

NIPF behavior can be described by assuming they act as profit maximizers, since selling stumpage may be influenced by expected harvest profitability. Stumpage price expectations and the alternative rate of return therefore are factors in harvest profitability. Duerr's (1960) simple financial maturity model can be used to mimic NIPF and corporate forest landowner behavior.

Duerr's model is based on the opportunity cost of postponing harvest one year. If harvest revenue in period t is greater than or equal to the discounted expected harvest revenue in period t+1, then the stand would be harvested. The model can be manipulated to yield the stumpage price at which a landowner would sell timber; this price equals the producer's stumpage cost and also defines a stumpage stock supply curve.

The stock supply schedule is constructed with the above cost estimates. First, response cells are arranged in order of increasing costs. Cumulative volume, for each response cell, is then determined by summing the volumes in cells with lower costs. The stock supply schedule is created by the recovery cost-cumulative volume pairs. The schedule indicates the volume of roundwood available, on a regional basis, over a range of delivered log prices.

Incorporating Market Conditions

Projections of stock roundwood supply over time, or the market clearing quantities of roundwood, require a model incorporating both supply and demand relationships. Primary wood product demand in southwest Virginia is assumed to be price insensitive for pulpwood and downward sloping for sawlogs.

Pulpwood demand is likely to be price insensitive because of processing facility investment costs and the time frame involved. Pulp and paper and OSB mills require high capital investments relative to raw material costs, and involve high fixed operating costs. In the short-term, these mills are concerned with a steady supply of pulpwood to assure continual operation. Pulpwood demand therefore can be linked to mill capacity; studies in Virginia and elsewhere indicate this is a reasonable assumption.

Sawlog demand is competitive, that is, the quantity of sawlogs demanded is price sensitive, increasing with decreasing log prices. Factors in secondary wood products markets, such as, pallets and furniture, should also be considered when estimating sawlog demand. Demand function estimation, for sawlog or pulpwood, may be difficult because regional data are often inadequate. Other studies of roundwood demand in Virginia may be adaptable to the region.

Stumpage demand can be derived using the residual value concept. Stumpage price for a response cell will equal the difference between the regional roundwood price and the cell's harvesting and hauling costs. All cells where residual stumpage price exceeds stumpage cost would be eligible for harvest.

SUMMARY

Three factors are important to roundwood supply in the nine counties of southwest Virginia: recovery costs, landowner characteristics, and market conditions. Harvesting and hauling costs influence the economic feasibility of cutting and delivering roundwood, given stumpage and delivered log prices. Landowner characteristics relate to roundwood supply through harv-

est decision behavior; willingness to sell stumpage depends on stumpage price expectations and the alternative rate of return. Stumpage, harvesting, and hauling costs taken together are the cost of producing or supplying alternative quantities of roundwood. Finally, demand for sawlogs and pulpwood interacts with supply to determine the stock supply of roundwood.

Roundwood supply schedules can be generated by integrating components of the production process using process analysis. Characteristics of the region's forests are used to estimate the component costs of the roundwood production process - stumpage, harvesting, and hauling costs -and to specify roundwood demand. When updated price, cost, or forest resource data become available they can be easily incorporated into a process analysis model so that revised supply estimates can be made.

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