Global Perspectives on Intensively Managed Plantations: Implications for the Pacific Northwest

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ABSTRACT

Because of structural changes in the forest sector, the world increasingly relies on intensively managed plantations for its industrial timber supply. Pacific Northwest (PNW) forests are not immune to these same pressures. Increases in the availability of cheaper plantation-grown timber from other regions (e.g., the southern United States) will reduce the profitability of PNW forestry unless offsetting management actions are taken. But much of the land in the PNW has no better use, so it likely will remain forested, able to support a competitive forest products industry. Technological innovation can support profitable forestland ownership even if timber prices fall.

Keywords: intensively managed plantations; Pacific Northwest

Although humans have been planting trees for thousands of years, modern intensively managed forest plantations (IMFPs) have only recently become a significant component of industrial timber supply (Figure 1). Worldwide, forest plantations supplied an estimated 35% of the industrial roundwood consumed in 2000 and are projected to contribute 44% of industrial roundwood needs by 2020. Forest plantations have already substituted for a large percentage of industrial production in some countries, e.g., New Zealand, Chile, and Brazil (Food and Agriculture Organization [FAO] 2000).

Four principal factors are driving this increase in the importance of plantation forests:

• depletion of natural forests and the concomitant increase in the price of standing timber;
• increased value of environmental services associated with the remaining natural forests, both public and private;
• technical innovation that permits both greater productivity from plantation forests and manufacturing processes and engineered wood products compatible with the properties of plantation-grown timber; and
• financial and organizational innovations that have led to the creation of timberland-focused investment entities, attracting both private-equity capital via timberland investment advisory organizations and public-equity capital through timber real estate investment trusts (TREITs).

This article provides an account of each of these factors. We are particularly concerned that the potential role of technical innovation has been systematically underappreciated, so we discuss this factor in greater length than the others. We also explore the potential to increase the supply of industrial timber from plantations and conclude that future plantations could (1) supply all of the anticipated growth in forest products demand and (2) offset about half of the current harvests from natural forests.

What do these developments mean for the Pacific Northwest (PNW)? The PNW will face vigorous competition from other locations where the economic and biological conditions for timberland investment are favorable. Despite these competitive threats, the PNW has some innate advantages. By wisely playing to these advantages, forestry—particularly IMFPs—can thrive long into the future.

Structural Change in the Forest Sector

Why do we have IMFPs at all? They arise from long-term changes in the structure of the forestry enterprise.

Timber depletion has driven much of this change. The depletion story has two chapters, one based on the need for land to grow crops, and a second based on the internal dynamics of the forest sector. Binkley (1997) provides a more detailed account.

In the first chapter, trees impede agriculture, so forests are cleared and turned into cropland. Conversion of the most productive sites leaves submarginal land in forestry. Eventually, management intensification of agriculture is a cheaper source of incremental yield than is further land conversion, and the forestland base stabilizes. Indeed, technical progress in agriculture may lead to farmland returning to forest, as it did in New England during the late 1800s (Raup 1966). The transition back to forestry will be particularly rapid where misguided agricultural subsidies do not artificially support...
the value of land in crops. Contrast, for example, the relatively favorable climate for plantation establishment on marginal agricultural lands in such free-market economies as Australia's and New Zealand's with the relatively lower returns in the United States, where crop subsidies greatly distort rural land markets.

Overlayed on the changes in the forest associated with agricultural conversion is the second chapter: the internal dynamics of timber depletion. While the mathematics are complicated [Berk (1979) and Sedjo and Lyon (1990) provide good accounts], the logic is simple. Consider a country that “disCOVERS” a large old-growth resource and places it in private ownership. The people of that country want wood products, and the owners of the forests start cutting the trees to supply those needs. The timberland owners determine the rate of harvest by weighing the advantage of cutting the trees today against the benefits of holding them another year. By definition, there is no net accretion of merchantable inventory in an old-growth forest—unlike plantations, old-growth forests are losing merchantable volume through death, disease, and natural catastrophe as fast as they are growing. Under these circumstances, the only reason a timber owner would hold trees is if the real price of the timber increases (indeed, if the real price increases at the rate of interest that is available in some alternative investment of comparable risk). As a result of this logic, during the period that society is harvesting old-growth (as the United States was during most of the last century), real timber prices must increase for market equilibrium to be achieved. And timber prices did, in fact, evolve in this way, with real increases averaging about 4% per year before World War II and 2% thereafter, with a noticeable recent flattening in the trends (Binkley and Vincent 1988).

What keeps timber prices from rising forever? Two factors do: (1) consumers and producers economizing on timber use and (2) adjustments on the supply side (Binkley 1993).

As timber becomes more expensive, people find ways to economize on its use. This adjustment takes many forms. For example, early in the 1900s, American cities built sidewalks from lumber; they now use concrete. Over the last century, the population of the United States has doubled and the GDP has increased seven-fold, yet softwood timber consumption has remained roughly constant.

Production adjusts to higher prices as well. Sawmills have become more efficient, so they use less timber per unit of lumber production. Although the data series is not long and is limited to one location, it appears that sawmills are becoming more efficient at about 1.3% per year (Binkley 1993). This record of technical achievement is remarkable when one stops to consider that humans have been turning round logs into square lumber for at least 3,000 years, and we are still finding more efficient ways to do so!

Not only are traditional wood products being more efficiently produced, but whole new kinds of wood products are emerging that use less and lower-quality wood to replace traditional products. For example, oriented strandboard (OSB), a substitute for structural plywood in flooring and sheathing, is manufactured by chipping small trees and gluing the resultant strands back together in a multilayered mat of oriented pieces. In the last 20 years—half a Douglas-fir rotation—OSB has rapidly taken market share from plywood and will soon dominate the market for structural panels (Haynes 2003).

As a second example, wooden I-joists are substituting for $2 \times 10$ dimensional lumber. Wooden I, fabricated with a web of OSB (as noted above, itself a substitute for plywood) and a flange of either machine-stress-rated or laminated veneer lumber (itself a substitute for sawn lumber) have captured nearly 45% of the floor-joint market (International Wood Markets Research Inc. 2000). This system uses 36–46% less wood overall (Spelter et al. 1997). More significantly, it can be manufactured from small-diameter logs and not the large sawlogs required for $2 \times 10$s.

Adjustments on the supply side are the second factor. As timber prices rise, it becomes economical to produce more timber. The first management activities are such simple ones as keeping fires from burning down the trees. But, once timber prices rise far enough, it becomes economical to invest in growing trees. Indeed, once the idea of investing in growing trees takes hold, the concept of technical innovation in this activity becomes attractive. At the moment, specific yields for IMFPs are increasing at perhaps 3% per year—a bit in excess of the rate for most agricultural commodities. In short, timberland investors are now fully rewarded for their efforts by the biological growth of the trees and do not have to count on timber prices rising to provide an adequate return on capital.

The emergence of environmental consciousness has accelerated the transition to IMFPs. People now value forests not only for the trees alone. Increases in population and per-capita income drive increases in the demand for environmental services. The depletion of natural forests reduces the supply of these same services. Price signals are not available to indicate scarcity, so in a market economy these services are systematically underproduced and overconsumed. Once the mismatch between supply and demand becomes great enough, governments step in, particularly to increase the supply of these services. They do so by (1) taking natural forests out of timber production and devoting them to parks and re-

Figure 1. Landscape view of intensively managed Douglas-fir plantations in western Oregon. Photo courtesy of Margo Stoddard.
serves, and (2) regulating timber production on private lands. Both activities reduce the quantity and increase the cost of timber supplied from natural forests and further open the door for plantation-grown wood.

Sustained-yield forestry requires a large standing inventory in relation to annual output. As a consequence, forests in general and plantations specifically are among the most capital-intensive activities known (Binkley 1994). Because of this fact, evolution of the forest sector requires efficient allocation of capital to the tree-growing part of the business. The last two decades have seen the emergence of organizations devoted exclusively to investing capital to create, improve, and capture the value of forestland (Binkley et al. 1996). These organizations include both entities drawing private-equity capital into the sector (timberland investment advisory firms) and ones focused on public-equity capital, particularly TREITs. At the moment, these entities have provided perhaps $20 billion of capital to the sector, or nearly one-third the value of all industrial timberland in the United States.

A Forecast of Global Plantation Timber Supply

To understand the competitive threats faced by the PNW, it is useful to understand how timber supply, especially plantation-based timber supply, might unfold over the next 50 years or so. Of course, any such forecast is wrapped in a shroud of uncertainty, but it is instructive to understand how current structural trends might or might not play out.

To do so, we conducted an informal supply-and-demand analysis. On the demand side, we examined all the recent, credible studies of global demand for industrial roundwood. Remarkably, a simple demand model based on multiplying the current global average per-capita timber consumption by the United Nations median population projection for the world is consistent with the median view of all these, sometimes far more complex, studies. We accept this simple model of demand and focus on the supply side.

We imagine that current planting rates continue, but that plantation technologies progress in keeping with past trends. Our simulation is based on a simple yield model that incorporates technological improvement. The results (Figure 2) assume that technology improves at a rate of 3% per year for new plantings, followed by an additional technological boost to the established plantations of 1.5% per year. These improvements increase plantations to 73% of the industrial supply by the year 2025. The estimates of “natural forest supply” are calculated as a residual value of total consumption less plantation supply, with the assumption that trees planted for human use are likely to be exploited before natural forests. If plantations continue on the basis of past trends (Figure 2), both in planting rates and in technology, then (1) the full increase in demand for industrial timber can be accommodated by these new forests, and (2) the demand on the “natural forests” of the world will decline dramatically, to perhaps half of today’s level.

Of course, these results depend on numerous assumptions, any one of which may turn out not to be true, with material impacts on the results. Nevertheless, the results are instructive—plantation technologies have the fundamental potential to alter forest-sector economics.

Conclusions: Implications for the PNW

What do these trends mean for the PNW?

• The demand on natural forests in the region is likely to decline, due not just to environmental restrictions but also to the availability of lower-cost plantation substitutes.

• The profitability of forestland ownership in the PNW will be pressed by the availability of low-cost plantation timber from other regions—the southern United States and elsewhere. There appears to be no shortage of capital or land to establish competing plantations.

• Logical responses include reducing growing costs through the application of plantation technologies. Technological innovation can support profitable forestland ownership even in the face of any modest downward pressure on timber prices that might be anticipated. The key is to take advantage of the region’s innate favorable features, including its low investment risk, skilled and well-educated workforce, and good access to global markets.

Let’s examine each of these conclusions in more detail.

The Decline of Industrial Demand on Natural Forests. The response of forest managers to the Endangered Species Act has dramatically reduced harvests on both public and private lands. Implementation of rules for streamside management and wetlands has caused additional areas to be removed from timber production. Customers are demanding that forest practices be certified as “sustainable.” Taken together, these developments have not only reduced harvests, but also increased costs and greatly complicated harvest planning.

These are logical and rational responses to changes in societal values, but they present the challenge of maintaining very high standards of environmental stewardship while producing timber at competitive prices. The scope for adaptation in natural forests is very limited. At the same time, environmental rules per se are not a great challenge to plantation-based timber production, but changes in the rules—particularly changes that operate on a far shorter time scale than the timber production cycle—challenge the capacity of forest managers to react.

Pressure on the Profitability of PNW Forests. Plantation profitability must be viewed on a global and risk-adjusted basis.
One recent study takes this perspective (Neilson and Manners 2003). This study examines the growing costs, the internal rate of return (IRR) on investments, and risks related to plantation establishment in a variety of locations. Based purely on the IRR criterion, intensively managed Douglas-fir in the PNW ranked 47th out of the 96 regions and species combinations for which benchmark growth and cost data were collected. When “country tree fund investment attractiveness” ratings were considered, however, PNW investments ranked in the top one-third of the 96 alternatives evaluated. This improved ranking was due to the favorable political and economic climate of the region.

Competitors—both those in the southern United States and those offshore—tend to have three key advantages: significantly lower input costs (especially labor and land), significantly higher yields, and significantly compressed time frames for merchantability (e.g., pulp rotations as low as 7 years, and solid wood rotations as low as 15 years). Not only are the higher yields material to plantation investments, but the shorter time frames allow new technology to be tested and deployed more rapidly.

**Using Technology to Offset Competitors’ Cost Advantages.** Given the competitive disadvantages associated with long growing periods and relatively high input costs, the challenge is to use technology to, at a minimum, keep the competitive gap from expanding. Regrettably, the nation’s forestry R&D system remains unfocused on addressing these threats. As the forest sector disintegrates, with timberlands separated from the forest sector and pulp manufacturing separated from paper production, the challenges for forest sector R&D have grown more pointed. Despite the apparently high returns on investments in R&D, such structural factors as the public-good nature of innovation have lead to underinvestment in this critical area. New players are not supporting R&D to the extent that the integrated forest products companies did, and here is considerable evidence that even those latter levels of expenditure were too low. Perhaps a new structural model is warranted where, for example, technology providers finance their research by selling the technology products they create, rather than by seeking grant funding. Under such a model, the key problem is finding the capital to fund the development of these technology products, and private venture capital may be one source.

While the PNW must now compete with lower-cost regions, the region has some significant favorable attributes. Foremost of these advantages is the fact that considerable land in the PNW is apt to stay in forestland because it has no better use—it is too steep for farm and too distant from population centers to develop. If forestry in the PNW plays to these advantages, maintains its ability to innovate, and employs leading-edge plantation technologies—from genetics to final products—it will prosper long into the future.

**Note:** The analysis in this article is based on models containing many assumptions, including, but not limited to, growth rates, harvest levels, timber prices, production costs, and liquidity. Any or all of these assumptions may turn out to be incorrect, and the future may be materially different from what this article depicts. Nothing in this article should be interpreted as a guarantee of future returns. Timberland investing has the potential for loss as well as for profit. The results from observations on information available to us at this time, but we make no warranty of its accuracy or reliability. The conclusions reflect the views of the authors and may or may not be consistent with the positions held by their employers.

**Literature Cited**


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