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# Status and Trends: Profile of Structural Panels in the United States and Canada

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## Abstract

This paper provides an overview of the North American (United States and Canada) structural panel industry, which consists of softwood plywood and oriented strandboard (OSB). The paper describes the evolution of overall capacities, effective capacity utilization, and manufacturing costs. As part of that, it describes changes in industry operating parameters such as wood use and yield, employee productivity, adhesives usage, and energy consumption. The major end-use markets for these commodities and market share trends are described as they evolved over time. Trends in foreign trade are also covered. Softwood plywood capacity peaked in 1989 at around 24 million m$^3$ (27 billion ft$^2$) and has since dropped to 16 million m$^3$ (18 billion ft$^2$). By contrast, OSB capacity has grown almost continuously and reached 23 million m$^3$ (26 billion ft$^2$) in 2006, on its way to about 26 million (29 billion ft$^2$) by 2008. Productivity as measured by output capacity per employee is about four times higher in an OSB plant than in a plywood mill. Since its inception, OSB product recovery (yield) has also improved by about 15%. These are two major reasons why OSB manufacturing costs are about 25% lower than those for plywood. Given OSB's higher profitability, most of the investment in the sector has been directed into that branch. The cyclical nature of structural panel demand combined with the tug and pull between plywood and OSB capacities have led to considerable cyclical volatility in prices and profits. Over the past 20 years, OSB has largely taken over the sheathing portion of the market for structural panels. Overall, the construction of new buildings and their upkeep and improvement are the largest market for structural panels in the United States. In 2003, about 23.3 million m$^3$ (26.3 billion ft$^2$) of structural panels were used for sheathing and exterior siding in these markets. The use of plywood for sheathing in walls is now rare, somewhat higher in roofs, and highest in flooring. To adapt to the competition, plywood manufacturing has evolved toward more industrial uses and higher grades of panels where its appearance and properties give it an edge that offsets its higher costs. Based on analysis of existing market shares of other materials, it is theoretically possible that structural panel consumption could be increased by about 40% over current levels. This would have represented an additional 9.5 million m$^3$ (10.7 billion ft$^2$) of structural panel consumption in 2003. Imports are an increasing part of supply, with Brazil, Chile, and Canada supplying growing amounts of plywood while Brazil and Europe augment major import flows of OSB from Canada.

Keywords: structural panel industry capacity, oriented strandboard, plywood, employment, concentration ratios, resin use, wood use, historical evolution, end-use demand.

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## Units of Measure

This report is international in scope. Accordingly, we have used the International System (SI) of units. However, we often accompany these with customary American measures to facilitate understanding by those not accustomed to SI units. All dollar amounts are U.S. currency. Measurements in billions ($10^9$) also use the U.S. system. All square feet are 3/8-in. basis.

Some conversions used in this report are as follows:

| | Multiply by | To get |
|---|---|---|
| **Volume** | | |
| 1,000 ft$^3$ | 28.315 | m$^3$ |
| m$^3$ | 35.315 | ft$^3$ |
| 1,000 ft$^2$, 3/8-in. basis | 0.885 | m$^3$ |
| m$^3$ | 1.130 | 1,000 ft$^2$ (3/8-in.) |
| gal | 3.785 | L |
| L | 0.264 | gal |
| **Area** | | |
| 1,000 ft$^2$ | 93 | m$^2$ |
| 1 m$^2$ | 10.75 | ft$^2$ |
| **Equivalence of volume of natural gas with energy** | | |
| 1,000 ft$^3$ | 1.08 | GJ |
| GJ | 0.926 | 1,000 ft$^3$ |
| 1,000 ft$^3$ | 102 | therms |
| therm | 0.098 | ft$^3$ |
| **Mass** | | |
| lb | 0.453 | kg |
| kg | 2.2 | lb |
| **Length** | | |
| in. | 2.54 | cm |
| cm | 0.394 | in. |

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# Status and Trends: Profile of Structural Panels in the United States and Canada

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## Introduction

The term "structural panels" refers to oriented strandboard (OSB) and softwood plywood. Their main use is in lightweight construction where they provide the rigid envelope that ties the other structural elements of wood-framed buildings together. High strength, stiffness, and resistance to moisture are the main performance criteria.

Originally, this function was performed by 12-in.-wide boards, but when moisture-resistant phenolic resins became available in the 1930s, 4-ft-wide plywood panels made of sheets of veneer became more economical. In turn, plywood was challenged by "strandboard" technology that began to appear around the late 1970s. Since then, the market has been dominated by the interplay of these two products.

Generally, OSB panels are intrinsically less costly to make. Plywood has the advantage of familiarity and appearance together with some properties, thickness swelling in particular, that are considered superior by many. The tension between the lower costs of OSB versus the perceived advantage of plywood has contributed to big cyclical swings in structural panel markets. This process typically unfolds when prices are high and investment is mostly funneled into the more profitable OSB segment. The ensuing capacity surge often exceeds immediate needs, causing a glut that drives prices down. Plywood prices follow to stay in the game, but its higher manufacturing costs lead to mounting losses that eventually cause reductions in capacity. The reduced supply then restores producer pricing power and the cycle repeats. Illustrative are the yearly changes over the past 20 years in overall structural panel capacity in which gains are mostly the result of new OSB plants, whereas losses are predominantly the result of plywood mill closures (Fig. 1).

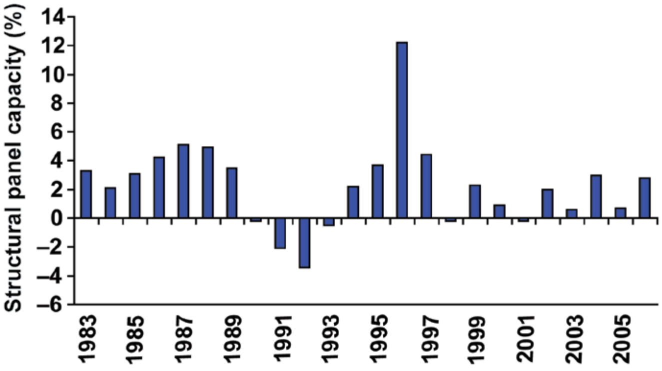

**Figure 1—Yearly changes in North American structural panel capacity, 1983–2006.**

This report explores the structure and evolution of this dynamic sector of the forest products industry and describes its capacities, input requirements, ownerships, end-use markets, and comparative economics.

## Capacity and Cost Data

Capacity and cost-related data in this report were obtained from diverse sources.

Capacity and employment data were obtained from company announcements and trade association releases augmented by periodic surveys conducted by the authors.

Production and trade data are those reported by the trade group APA–The Engineered Wood Association (Adair 2004).

Information on equipment attributes was obtained from vendors, again augmented by personal contacts and published trade reports.

Wood, adhesives, and other input usages were obtained from published trade reports and articles as well as through inquiries with vendors and producers.

We devised a model to track mill costs, the elements of which were obtained from the above sources of information together with prices obtained from chemical and timber market reports and data from the Bureau of Labor Statistics on prevailing wages. We validated our resulting cost estimates by reference to partial information on costs available from public company financial reports. For revenue modeling, we used prices reported by trade price reporting services (Random Lengths Publications, Inc. 2005; Madison's Canadian Lumber Reporter 2004; RISI 2005).

Profit margins were derivatives of the above two data streams. Accordingly, our estimates of profit margins are analytical constructs whose intent is to illustrate underlying trends in profitability. They shadow, but are not necessarily the same as, profit margins reported in financial filings of any particular company or industry.

# OSB

## Capacity

The Appendix lists North American (United States and Canada only) structural panel plant locations by capacity (in 1,000 m$^3$) and ownership from 1990 to the present.

Oriented strandboard capacities are calculated on a basis of year-round operation except for major holidays, meaning approximately 360 days per year. This omits downtime for scheduled and random curtailments due to maintenance, breakdowns, installations of new equipment, log shortages, and damage due to occasional hurricanes or fires.

To determine the capacity-reducing effects of such normal and unavoidable stoppages, we analyzed downtime notices from January 2003 to January 2006, as relayed by the information broker Random Lengths. This period is representative of a normal operating environment because interruptions due to adverse market conditions were negligible. To further narrow the scope of curtailments to those that have their basis in purely technical causes, we also omitted closures tangentially related to market conditions, such as extended halts (lasting over 2 weeks) due to strikes or log shortages. We counted a total of 90 stoppages for maintenance, the average number of days for which was 6.1. These occurred at 43 sites. Therefore, the norm per plant was 2.1 stoppages over a 25-month period, or one stoppage per plant per year of 6.1 days duration.

Similarly, we found 30 instances of stoppages due to other random causes, averaging 7.6 days at 17 sites. It is problematic to translate this into an industry average because not all companies announce these events, and so the proper numerator is unknown. As an approximation, we took the 49 plants that reported curtailment for any reason as the basis of the stoppage rate, which comes to 0.6 per site over 25 months, or 0.3 per plant per year lasting an average of 7.6 days. We can normalize this to 2.3 days (7.6 × 0.3) lost per plant per year for the industry as a whole.

Based on these calculations, normal scheduled and unscheduled stoppages take effective capacity down to approximately 97.6% of the nameplate number (1 – (6.1 + 2.3)/360), a value that applies to the annual rate only because downtime for maintenance tends to be seasonal around the Christmas and New Year holidays.

A further depressing influence on capacity estimates is the entry of new plants. Such mills undergo a shakedown period that can last for over a year during which technical problems are sorted out. Although we have truncated nameplate capacities for startup years to account for a partial year of operation, we had no way of knowing each mill's startup experience and thus its initial effective capacity. This phenomenon was a more notable drag on apparent capacity utilization in the industry's early years when each new plant added a sizeable increment to total output capacity.

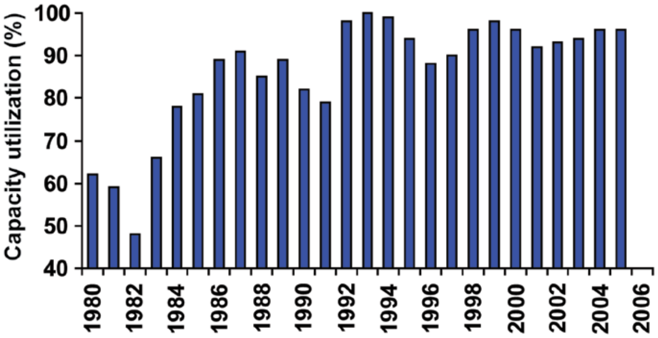

**Figure 2—North American OSB capacity utilization, 1980–2005.**

Figure 2 reviews historical rates of production as a percentage of capacity, or capacity utilization. As the industry matured, production tended to approach the full nameplate level, actually achieving it in 1993. From 1992 to 2005, the capacity utilization rate averaged 94.8%, close to but less than our calculated effective capacity of 97.6%. This was due mostly to cyclicality evidenced in operating rates as low as 88.5% in the economically challenging year of 1996 and again at 91.8% in 2001. In each instance, these troughs were followed by crests. In 2005 the rate rose to 96.5%, or essentially full use of effective capacity, given that our estimates of effective capacity contain some statistical uncertainty.[1]

Capacity growth initially stems from the addition of new plants, but another important source is technology change that enables the work rate of existing capital stock to increase ("capacity creep").

The occurrence of this is best understood if we picture an OSB plant as a series of linked process centers, any of which can act as the overall bottleneck. However, in general plants are designed around their presses whose capabilities are the primary indicators of plant capacities. Besides its physical dimensions, the productivity of a press is determined by the press cycle defined as the amount of time it takes to process each batch of panels. This consists of dead time during which the press is loaded or unloaded and effective time during which heat and pressure are applied. Mat moisture content, press pressure and temperature, rates of press closure and decompression, and adhesive formulations are among the variables that have to be optimized to obtain the shortest press cycle time consistent with minimum required properties and low percentage of degrade.

When "structural particleboards" first appeared, press times in excess of 5 min were often the norm. This subsequently

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[1] We note that typical industry budgeting figures are based on 350 days per year.

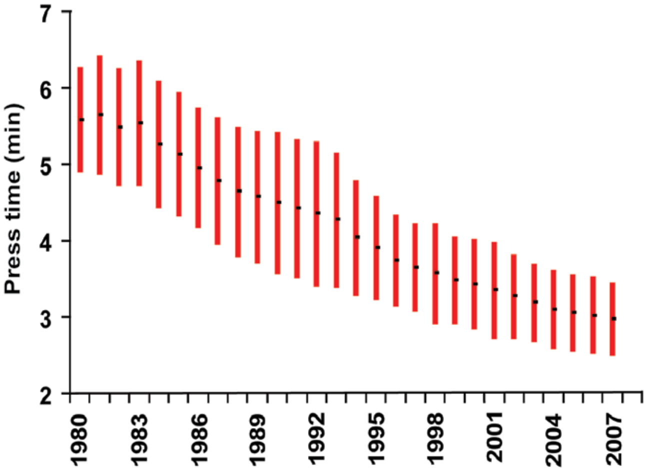

**Figure 3—Average OSB batch press times, ±1 standard deviation, 1980–2007.**

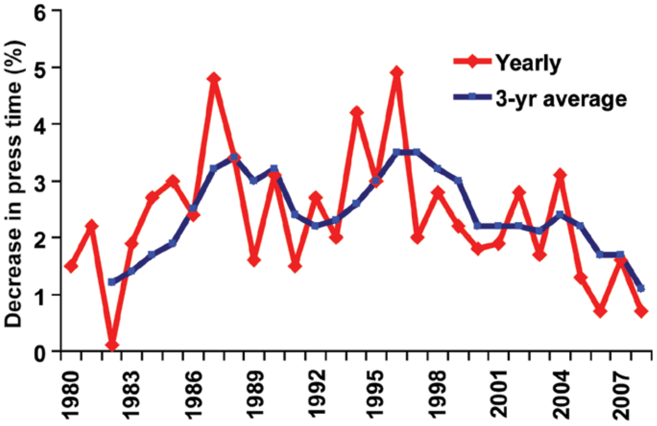

**Figure 4—Annual decrease in OSB press times, 1980–2008.**

has been reduced, as can be approximated[2] by comparing each plant's evolving nameplate capacity with its press capacity per load, which in most cases stayed constant. From more than 5 min at the beginning, average contemporary total press cycles have dropped to approximately 3 min (Fig. 3). Press dwell times are lower still for continuous presses (just over 1 min).

Such advances in adhesive technology as faster curing agents and quicker reacting resins have contributed to shorter press cycles. Heat transfer has also been accelerated through optimization of mat moisture content gradients and in some cases by spraying water onto mat surfaces. Dead times too have been shortened through improvements in press-loading mechanics.

Faster speeds in continuous presses are due in part to the absence of dead time. More recently, press times have shortened about 30% to 50% by acceleration of heat transfer into the mat through the use of "pre-heaters," in which a mixture of hot air and steam injected into the mat raises its temperature to a precise target just prior to pressing (Schletz 2005).

These trends have been a notable feature of OSB technological development, but should not necessarily be extrapolated indefinitely because of limits on how quickly resins cure, how fast heat can be transmitted to mats, and how long press cycles have to be maintained to prevent high internal steam pressure from blowing panels apart. Figure 4 illustrates a recent gradual slowing in the rate of change in press times. Yearly reductions that averaged 2.5% to 3.5% in the mid-1990s have decelerated to just over 2% in the 2000s and are likely to slow to 1% by 2008, based on the most recent press dimensions and plant capacities. Steam injection may yet be applied to batch presses, but to date has mainly been used where exceptionally thick panels are made. Preheaters are harder to apply to batch presses because the variable waiting times before pressing would likely cause resin pre-cure problems. Barring new developments in these areas, overall capacity gains in the future are more likely to be linked either to new plants or to physical enlargements of existing presses.

## Industry Concentration

The high investment required for an OSB plant favors ownership by well-capitalized companies. This has resulted in a high level of ownership concentration. In 1995, we counted 16 firms (some of which were co-owned) owning one or more mills. Among these, the top 6 accounted for 75% of the total. In 2006, the number of firms fell to 15 and the share of the top 6 had risen to 78% (Table 1). The increase stemmed from mergers and from shedding of OSB plants by some downsizing companies. The 2006 concentration ratio would be about 2% higher if the capacities of co-owned mills were assigned to their parent firms.

## Employment

The properties of OSB are primarily determined by process variables rather than the grade of the wood. The relative homogeneity of OSB flakes and their small size simplifies sorting and handling, lending itself to automation and the need for fewer workers. On average, an OSB plant is staffed by about 130 to 140 people. This has increased little over the years despite the greater expansion in capacity of individual plants. As a consequence, the output per employee has tripled, from less than 1 million ft$^2$ a year (0.885 thousand m$^3$) to 3 million ft$^2$ (2.7 thousand m$^3$) (Fig. 5). Total employment rose from just under 1,000 in 1977 to over 9,400 in 2006. The average number of employees per OSB plant was 136 in 2006 compared with 125 in 1977. The plants with the highest output per employee are found in British Columbia and Alberta, whereas the older, smaller plants in the northern United States have the lowest.

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[2] Capacity/press load (m$^3$) × min/h × h/day × days/year divided by effective capacity (m$^3$)/year.

**Table 1—OSB capacity ownership**

| Firm | Capacity[a] (×1,000 m$^3$) 1995 | 2000 | 2006 |
|---|---|---|---|
| Louisiana Pacific | 3,915$^1$ | 6,440$^1$ | 6,505$^1$ |
| Weyerhaeuser | 1,503$^2$ | 3,553$^2$ | 4,130$^2$ |
| Georgia Pacific | 1,196$^3$ | 1,845$^3$ | 2,695$^5$ |
| Potlatch | 1,082$^4$ | 1,115 | – |
| Norbord | 815$^5$ | 1,590$^4$ | 3,743$^3$ |
| Huber | 721$^6$ | 1,250$^5$ | 2,120$^6$ |
| Grant | 570 | 1,220$^6$ | 1,280 |
| International Paper | 545 | 955 | – |
| McMillan Bloedel | 370 | – | – |
| Ainsworth | 350 | 935 | 2,925$^4$ |
| Forex | 305 | – | – |
| Martco | 260 | 300 | 453 |
| Langboard | 215 | 211 | 450 |
| Malette | 200 | – | – |
| Longlac | 160 | – | – |
| Tolko | – | 545 | 1520 |
| Slocan | – | 470 | – |
| Canfor | – | – | 635 |
| Peace Valley[b] | – | – | 620 |
| Voyageur | – | 400 | – |
| Willamette | – | 350 | – |
| Tembec | – | 200 | – |
| Kruger | – | 160 | 170 |
| Footner[b] | – | 30 | 810 |
| Jolina Capital | – | – | 270 |
| Total | 12,367 | 21,569 | 28,276 |
| Top 6 share | 75% | 74% | 78% |

[a] Superscripts 1 to 6 indicate the rating of the company in the particular year.
[b] Joint venture

## Wood Use

We investigated wood use by analyzing company announcements regarding wood input. We also conducted surveys in 1997 and 2005. Finally, we analyzed data from the 2004 survey of wood purchase receipts reported by the Forest Resources Association (2000–2004). From these we gathered the data displayed in Figure 6, showing cubic meters of wood input per cubic meter of board output.

The variability among mills is large. This partly reflects ambiguity in the data, which were given in a variety of units. Green tons and cords are most common in the United States while cubic meters are standard in Canada. Placing them on a common basis required assumptions about wood moisture content, specific gravity, log size, and bark content that may not match a given mill's circumstances. Though this increases variability between plants, the errors should largely cancel for the group, leaving a good indication of average levels. Taken as a whole, the data show generally higher yields for OSB made from denser pine wood, due to lower compaction ratios, and a downward trend consistent with known advances in several process elements.

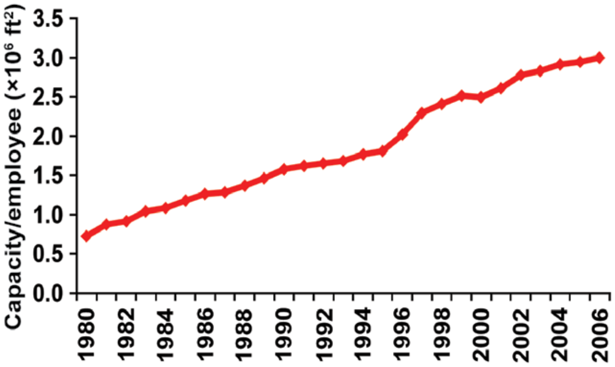

**Figure 5—Average annual capacity per employee in OSB plants, 1980–2006.**

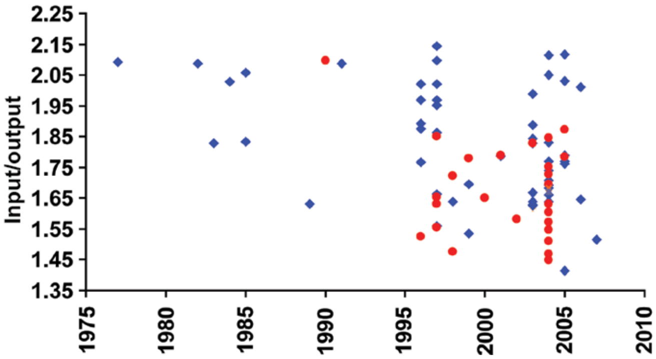

**Figure 6—Cubic meters of wood input per cubic meter of OSB output, 1977–2007. Blue diamonds signify northern (aspen) mills, red dots southern (mostly pine) mills.**

Wood yield efficiency is given by volume in–volume out factors at the various stages of processing, which can be summarized as

$$\text{Yield} = (LT \times FI \times DD \times CO \times PT \times SA \times DG)$$

where

LT is (1 – fractional loss to log trim and kerf)
FI (1 – fractional loss to fines)
DD (1 – fractional loss to drying)
CO (1 – fractional loss to panel compaction)
PT (1 – fractional loss to panel trim)
SA (1 – fractional loss to sanding)
DG (1 – fractional loss to degrade and rejects)

Refinements of OSB technology have boosted yields in most of these areas. Log trim and kerf losses declined when long-log ring and disk flakers displaced 3-ft-wide disk flakers that were the norm among early mills. Ring flakers also tend to produce fewer fines.

Heat conditioning higher density hardwoods and frozen logs improved yields of uniform flakes. It also reduced resin use and permitted lower density boards. Dull knives are another cause of fines, and ampere meters attached to flakers that measure the current being drawn provided a timely way to monitor and replace dull knives.

In flake drying, the predominant three-pass dryers employ very high temperatures. This volatilizes some of the material and promotes breakage. Single pass and conveyor dryers used by a growing number of plants allow lower temperatures, thus reducing the risk of fire, flake breakage, and volatilization, along with lowering volatile organic compound (VOC) emissions.

For acceptable bonding between flakes, OSB panels need to be compressed beyond the original density of the wood, which results in volumetric loss in yield. However, longer flakes are stronger and stiffer than short flakes. Initially, flake lengths were in the 6- to 9-cm (2.5- to 3.5-in.) range to facilitate flake passage through the three-pass dryer environment. Around the 1980s, however, mills adopting single-pass and conveyor dryers began making 15-cm (6-in.) flakes. Longer flakes increase panel strength-to-weight ratios, allowing lower panel densities and reduced wood use.

Less panel trim has also contributed to wood savings. Continuous presses effectively eliminate trim at two of the four panel edges. Also, as batch presses were made bigger, the ratio of the periphery to the finished panel size decreased. We can track the impact of these changes by calculating the ratio of a 9-cm-wide (3.5-in.-wide) peripheral band to finished panel size from known press dimensions (Fig. 7).

These assorted improvements support the downward trend in wood use observed in our sample, and averaging data over several discrete intervals provides a clearer view (Fig. 8). On the whole, the wood input to panel output ratio declined from nearly 2 in 1977 to 1985 to 1.65 in 2000 to 2007, about a 15% improvement in yield.

## Wax and Resin Use

The third major class of inputs to OSB production is wax and resins. Wax helps the resin adhere to the wood and improves water repellency. It is normally applied in a concentration of 1% to 1.5% by oven-dried (OD) weight (Table 2).

Most OSB plants in North America use phenol formaldehyde (PF) for adhesive. The industry initially used wide wafers, but their large shape tended to block the even spread of resin. To improve coverage efficiency, the resin was applied in powdered form so that some loose powder would eventually spread to surfaces that were initially shielded as the wafers tumbled in the blender. When narrower strands came into use, the necessity for this declined, and liquid PF became predominant because liquid resin is cheaper. Some plants still use powdered resin, usually in a range of 1.9% to 2.7% by OD weight, with an average in our sample of 2.3%. The dosage of liquid PF varies according to the grade of the board, but around 3.5% by OD weight is the norm for sheathing.

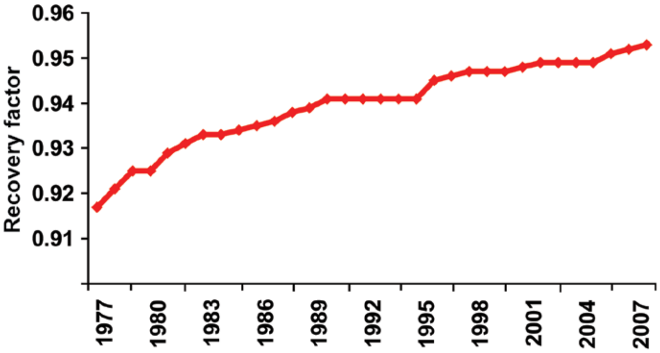

**Figure 7—Composite trim recovery factor for all OSB plants, 1977–2007.**

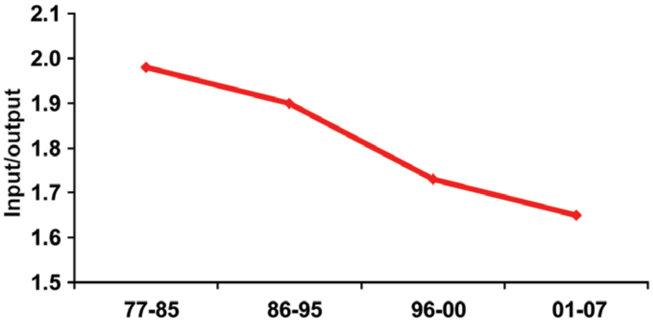

**Figure 8—Composite OSB industry wood input–product output ratio, 1977–2007.**

**Table 2—Average OSB resin and wax consumption**

| | | Average consumption of weight percentage of oven-dried wood | | |
|---|---|---|---|---|
| | | | Core | |
| Resin type | Samples | Face | PF[a] | PMDI[b] |
| Powder PF | 9 | 2.30 | 2.35 | – |
| Liquid PF | 11 | 3.82 | 3.66 | 2.28 |
| Wax | 20 | 1.14 | 1.14 | – |

[a]PF, phenol formaldehyde.
[b]PMDI, polymeric diisocyanate.

Isocyanate resin is used for premium-grade boards such as I-beam webs and flooring. Isocyanate cures faster and tolerates higher mat moistures, so it is also used in some cases to speed production of sheathing. However, its cost per weight is higher and it has a tendency to stick to the press platens. Therefore, it is mainly used in the core layers of boards. Its application rate is about 2% per OD weight for normal commodity type products, but much higher for specialty items such as siding. It accounts for about 5% of overall resin use.

## Energy Use

The large amount of residue in the form of dried fines, trim, and wet bark creates a ready source of fuel. One way bark residues have been employed is to pyrolyze them in a

**Table 3—Average OSB energy use, 1997 and 2005**

| | RTO/RCO[a] | | No RTO/RCO | | |
|---|---|---|---|---|---|
| Year | Samples | Energy use | Samples | Energy use | All mills |
| | | Natural gas ($ft^3$/1,000 $ft^2$) | | | |
| 1997 | 5 | 1.10 | 8 | 0.06 | |
| 2005 | 8 | 0.56 | 4 | 0.06 | |
| | | Electricity (kWh/1,000 $ft^2$) | | | |
| 1997 | 5 | 150 | 8 | 130 | |
| 2005 | 8 | 141 | 4 | 119 | |
| | | Diesel (gal/1,000 $ft^2$) | | | |
| 1997 | 13 | | | | 0.24 |
| | | Propane (gal/1,000 $ft^2$) | | | |
| 1997 | 13 | | | | 0.30 |

[a]RTO, regenerative thermal oxidizers; RCO, regenerative catalytic oxidizers.

low-oxygen environment, creating synthetic gas, which then provides fuel for a secondary combustion chamber to supply heat to the conditioning vats and the presses. Dry fines and trim are mostly burned directly to provide heat for the dryers. Accordingly, most OSB plants were self-sufficient for heat energy, using natural gas or heating oil mainly as backup. Electricity to power equipment and liquid fuels to run rolling stock were the main purchased energy needs.

This changed around 1990 with tightened U.S. emission standards, which made it necessary to install energy intensive regenerative thermal oxidizers (RTOs) to incinerate VOCs and other emissions. In our 1997 survey, we found the use rate of natural gas to be 1.3 GJ/$m^3$ (1.1 thousand $ft^3$/1,000 $ft^2$) of output (Table 3) in the mills that employed such equipment. Where such equipment was not used, gas purchases were insignificant. Electricity use was also slightly higher among the first group than among the second at 170 compared with 160 kWh/$m^3$ (150 versus 141 kWh/1,000 $ft^2$).

In our 2005 survey, the gas-use rate had abated to under 0.7 GJ/$m^3$ (560 $ft^3$/1,000 $ft^2$). This decrease likely reflects the use of lower energy consuming regenerative catalytic oxidizers (RCOs). In locations using other means of emissions control, natural gas use continued to be minimal.

Propane and diesel usage were about the same for mills and not a large cost at 1 and 1.3 L/$m^3$ (0.24 and 0.30 gal/1,000 $ft^2$) of output.

## Equipment Suppliers

Equipment to the OSB industry is provided by a large number of vendors, but the number of suppliers for specific machinery is concentrated. These companies are also the source for much of the engineering research and development that has enabled the industry to grow. Table 4 contains a partial listing of some key suppliers for four equipment types. The list is not a count of all individual pieces of machinery but just the predominant vendor at a site.

## Costs and Profitability

In rough order of importance, wood, adhesives, labor, energy, and wax constitute the main direct OSB manufacturing costs. General overhead and capital depreciation are the fixed components. Since OSB is priced mostly in U.S. dollars, Canadian firms have exchange rates as an added variable to consider when comparing revenues or costs with their U.S. counterparts. Table 5 contains historical unit costs of these items.

Labor costs include direct wages and indirect peripheral expenses. They reflect underlying wage increases of about 3.7%/year and growth in indirect benefits of about 7%/year over the period. These are partly offset by yearly productivity gains of about 2.3%, consistent with recent average industry gains for existing plants.

Wood costs are based on delivered prices of aspen in Minnesota. For cost calculations, we employed a usage rate of 1.8 $m^3$/$m^3$ of board, or a recovery rate of about 55%.

Resin and wax costs reflect a resin use rate of 23 kg/$m^3$, or 3.6% by OD weight, and 8 kg/$m^3$ of wax, or 1.2% by OD weight. Prices are based on costs of phenol and formaldehyde as reported in Chemical Market Reporter, a price reporting publication.

Energy usage is based on an operating VOC incinerator unit at about 0.9 GJ/$m^3$ (0.75 thousand $ft^3$/1,000 $ft^2$).

These prices and usage rates were used to generate the costs shown in Table 6 for a 390 thousand $m^3$/yr (440 million $ft^2$) benchmark mill located in the northcentral United States.

Revenues were based on 7/16-in. northcentral sheathing prices, adjusted for discounts and product mix and converted to a 3/8-in. basis. The difference between these two data streams yields estimates of pre-tax margins. When compared with a sample of reports from company annual financial filings, these cost and revenue estimates show a standard deviation of 2.5% from those numbers.

The volatility in margins characteristic of OSB over much of its existence is evident in Table 6 for which the revenue side is mainly responsible. This stems partly from the industry structure, which has relatively few but high-volume plants, involving major capital investments in excess of U.S. \$100 million. As such they are designed to run around the clock, seven days a week, which leaves little room to expand output once a plant is fully operational. With little slack capacity and up to a 2-year lag in getting a new plant built, the ability to meet demand surges is limited. Especially over the 2003 to 2005 period, the result was a relatively fine balance between highly inelastic supply and similarly inelastic demand. When demand got ahead of supply, staggering price increases ensued followed eventually by equally apocalyptic collapses once the disequilibrium reversed.

**Table 4—North American OSB equipment suppliers, by period of installation**

| Installation period | No. machinery sites by supplier | | | | |
|---|---|---|---|---|---|
| | Flakers | | | | |
| | CAE | Pallmann | Hombak | Others | Unknown |
| 77–84 | 17 | 0 | 4 | | 10 |
| 85–94 | 18 | 2 | 0 | | 2 |
| 95–07 | 26 | 4 | 0 | | 7 |
| Total | 61 | 6 | 4 | 0 | 19 |
| | Formers | | | | |
| | Siempelkamp | Schenk | CMC Tex | Others | Unknown |
| 77–84 | 2 | 5 | 0 | 4 | 20 |
| 85–94 | 7 | 7 | 0 | | 8 |
| 95–07 | 12 | 7 | 1 | | 17 |
| Total | 21 | 19 | 1 | 4 | 45 |
| | Dryers | | | | |
| | MEC | Büttner | Koch | Others | Unknown |
| 77–84 | 6 | 0 | 0 | 5 | 19 |
| 85–94 | 8 | 2 | 1 | 5 | 6 |
| 95–07 | 6 | 8 | 5 | 4 | 15 |
| Total | 20 | 10 | 6 | 14 | 40 |
| | Presses | | | | |
| | Siempelkamp | Dieffenbacher | W I W | Others | Unknown |
| 77–84 | 11 | 3 | 4 | 2 | 11 |
| 85–94 | 7 | 4 | 3 | 0 | 8 |
| 95–07 | 15 | 4 | 3 | 1 | 14 |
| Total | 33 | 11 | 10 | 3 | 33 |

**Table 5—Approximate costs of various OSB manufacturing inputs for a northcentral U.S. location, 2000–2006**

| | Cost (US$/unit) | | | | | | |
|---|---|---|---|---|---|---|---|
| Cost item | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Wood ($m^3$) | 30 | 28 | 28 | 32 | 36 | 46 | 44 |
| (cord) | 68 | 65 | 64 | 72 | 81 | 104 | 100 |
| Labor (h) | 21.7 | 22.7 | 23.9 | 25.1 | 26.2 | 27.5 | 28.3 |
| Liq PF (kg) | 0.79 | 0.83 | 0.82 | 1.15 | 1.17 | 1.39 | 1.26 |
| (lb) | 0.36 | 0.38 | 0.37 | 0.52 | 0.53 | 0.63 | 0.57 |
| Wax (kg) | 0.82 | 0.82 | 0.82 | 0.87 | 0.88 | 1.01 | 0.97 |
| (lb) | 0.37 | 0.37 | 0.37 | 0.4 | 0.4 | 0.46 | 0.44 |
| Nat gas (GJ) | 4.1 | 4.9 | 3.8 | 5.3 | 6.1 | 7.6 | 7.4 |
| (thousand $ft^3$) | 4.5 | 5.2 | 4.1 | 5.8 | 6.6 | 8.2 | 8.0 |
| Electricity (kWh) | 0.036 | 0.043 | 0.045 | 0.055 | 0.058 | 0.060 | 0.062 |
| Diesel (L) | 0.26 | 0.25 | 0.23 | 0.28 | 0.35 | 0.48 | 0.53 |
| (gal) | 1.00 | 0.95 | 0.88 | 1.05 | 1.35 | 1.84 | 2.00 |

Table 6—OSB costs and revenues for benchmark northcentral U.S. mills, 2000–2006

| | Cost (US$/m³) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Direct costs** | | | | | | | |
| Wood | 56 | 54 | 53 | 60 | 67 | 85 | 82 |
| Labor | 20 | 20 | 20 | 21 | 21 | 22 | 22 |
| Resin | 18 | 19 | 19 | 26 | 27 | 32 | 29 |
| Wax | 6 | 6 | 6 | 7 | 7 | 8 | 7 |
| Energy | 11 | 13 | 12 | 15 | 17 | 19 | 19 |
| Supplies | 14 | 14 | 14 | 15 | 15 | 15 | 15 |
| Total direct | 125 | 125 | 124 | 144 | 154 | 181 | 175 |
| **Fixed costs** | | | | | | | |
| General | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Depreciation | 23 | 21 | 20 | 21 | 20 | 20 | 20 |
| Total fixed | 29 | 27 | 26 | 27 | 26 | 26 | 26 |
| Total costs | 154 | 153 | 150 | 171 | 180 | 207 | 201 |
| Company annual reports | – | 151 | 144 | 170 | 187 | 208 | – |
| Revenues | 192 | 149 | 149 | 276 | 349 | 299 | 264 |
| Company annual reports | – | 157 | 158 | 273 | 356 | 315 | – |
| Margin | 19% | –2% | –1% | 38% | 49% | 31% | 24% |
| Company annual reports | – | 4% | 8% | 38% | 47% | 34% | – |

Costs were relatively stable until 2003 when rising energy costs, and to a lesser extent, wood prices began to affect operations. Total costs increased by approximately a third between 2002 and 2005. Figure 9 contrasts estimates for eastern Canada and the southeast United States with the northcentral benchmark, using similar input parameters wedded to local wood and labor rates and adjusted to U.S. dollars in the case of Ontario. The substantial rise in Ontario costs reflects in large part the influence of the latter variable. The relative rise of northcentral to southeastern costs reflects the more rapid escalation of wood prices in the Great Lake states. The generally rising trends shared by all regions mainly mirror the inflation in energy and petroleum-derived adhesives.

As 2006 unfolds, it is evident that the current cycle is well into its downward phase. This reflects diminished prospects for demand on the one hand, as rising interest rates are beginning to slow house building, and increased supply on the other, as capacity, motivated by the previous high margins, begins to be brought on line.

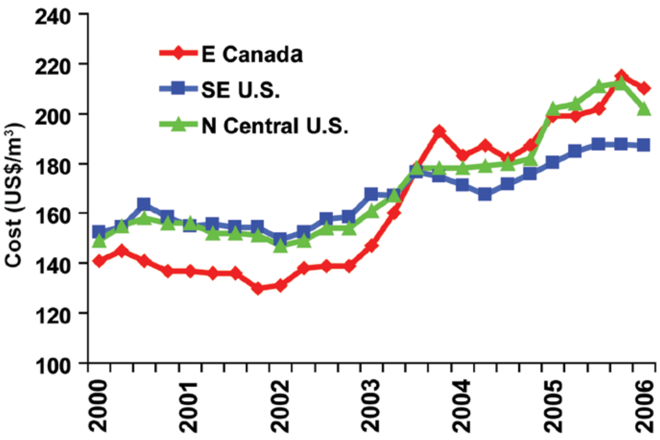

Figure 9—Oriented strandboard (OSB) regional costs, 2000–2006.

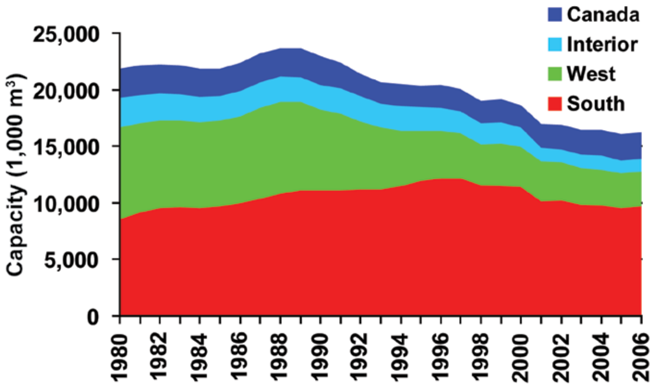

Figure 10—Softwood plywood capacity, 1980–2006.

# Plywood

## Capacity

Since the advent of OSB, plywood capacity has been in decline (Fig. 10). Plywood has traditionally depended on larger and higher grade logs. Beginning in the 1970s, declining availability and rising cost of such logs undercut plywood's economics. Faster lathe charging and peeling have lowered the limits on acceptable bolt sizes. Newer mills built largely in the South have adapted to smaller logs, enabling capacity there to hold up better. However, even that region's capacity has begun to fade due to pressures from OSB and imports. Among the regions we studied, the Canadian branch of the industry has had the most success in maintaining its capacity base.

Perhaps more surprising than its decline has been plywood's resilience. One helpful development in that regard was the growth of engineered laminated veneer lumber (LVL) assembled from sheets of veneer. This allowed a plywood operation to extract more value from a portion of its veneers than would have been possible from panel production alone. However, this diverts a portion of the wood from going through the entire process, confounding capacity utilization calculations. Plywood operations are normally constrained

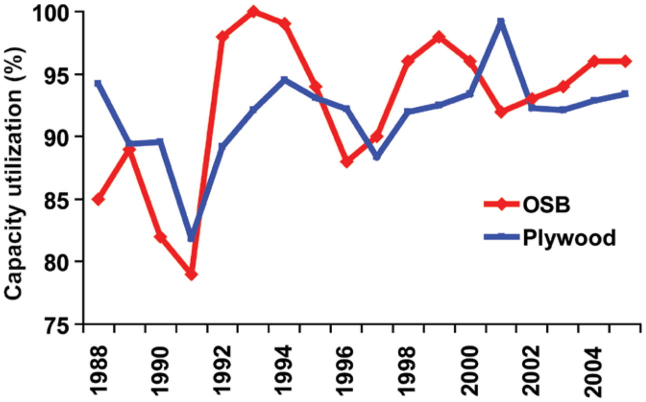

**Figure 11—North American plywood and OSB capacity utilization, 1988–2005.**

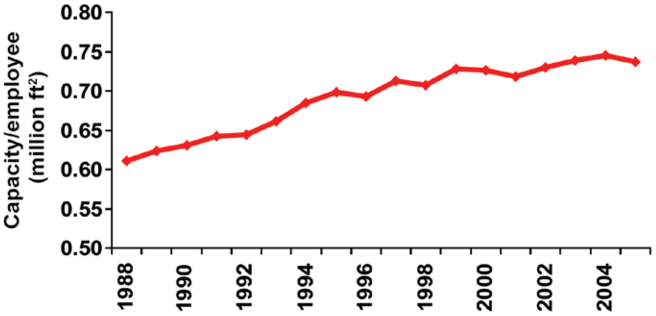

**Figure 12—Average annual capacity per employee in plywood plants, 1988–2005.**

**Table 7—Plywood capacity ownership, 2005**

| Firm | Share of capacity (%) |
|---|---|
| Georgia Pacific | 31 |
| International Paper | 9 |
| Weyerhaeuser | 8 |
| Boise Cascade | 7 |
| Roseburg | 5 |
| Tolko | 4 |
| West Fraser | 4 |
| Canfor | 3 |
| Hood | 2 |
| Plum Creek | 2 |
| Martco | 2 |
| Scotch Plywood | 2 |
| Hunt Plywood | 2 |
| Timber Products | 1 |
| Emerald Forest Products | 1 |
| 26 Others | 18 |
| Top 6 share | 63 |

by their dryers, and if that capacity is partly used for wood that does not get made into plywood, then utilization appears lower than it actually is. In that context, we note that average plywood capacity utilization has been lower than that of its OSB counterparts over the period 1988 to 2005 at 91.6% compared with OSB's 93.4%. By and large, however, their cyclical movements have tended to coincide (Fig. 11).

## Industry Concentration

Plywood industry concentration is not as high as OSB's, but it has been an issue in the past. In 1973, the largest producer (Georgia Pacific) split in two (Georgia Pacific and Louisiana Pacific) to effect a reduction in industry concentration. By 2005 the latter had exited the plywood business in favor of OSB, leaving the former again as the dominant entity, though the significance of that is lessened in the context of rising OSB and imported Brazilian plywood volumes. A total of 41 firms compose the North American softwood plywood universe among which the top six account for 63% (Table 7).

## Employment

Veneers have traditionally been graded according to visual criteria. That and the large size of each sheet necessitate considerable handling and sorting. It follows that labor input is also high. Staffing of plywood mills varies depending on a plant's product focus. The more specialty product-oriented a plant is, the greater the number of process steps that are involved. Overall, capacity per employee is about 0.7 million ft$^2$ (0.6 thousand m$^3$) per year (370 ft$^2$ (0.3 m$^3$)/h), up from about 0.61 ft$^2$ (0.5 thousand m$^3$) per year (305 ft$^2$ (0.27 m$^3$)/h) 17 years ago (Fig. 12). Among regions, southern mills have the highest productivity per employee at about 450 ft$^2$ (0.4 m$^3$) per h due to their greater emphasis on commodity sheathing. Industry employment declined from 44,000 in 1988 to about 24,600 now.

## Wood Use

In a full-process plywood mill, wood use efficiency depends in large measure on the size of the bolt being peeled. The larger the bolt, the smaller the share of roundup waste. Similarly, the residual core makes up a smaller proportion of the bolt. Other major generators of waste residues are the clipper, where defects along part of the ribbon of peeled veneer cause a good deal of otherwise sound wood to be lost, and the trim saws where panels are squared. Unlike the growing press sizes in OSB, plywood presses remain at the 4- by 8- or 4- by 10-ft dimensions where the trim loss is relatively high. One major point of departure from OSB is the much smaller compaction factor. Whereas an OSB panel has to be compacted by 30% to 40% to assure adequate bonding, plywood panels experience very little compaction, and thus veneers can be cut thinner than would otherwise be the case. Wood-use efficiency estimates are muddied by the diversion of some veneers to LVL, as also by the inflow of green veneer from outside vendors.

Overall, among our combined sample of 33 mills, we found the wood input needed to make a cubic meter of plywood to be 1.87 m$^3$, or a yield factor of about 54%. We saw little difference between our 1997 and 2005 samples, but both showed a high variability with a standard deviation of ±7%.

## Resin Use

Liquid PF is the resin of choice in plywood manufacturing. Since the specific surface area to be bonded (the combined surfaces of the veneers relative to the surface of the panel) is smaller than for OSB, requirements for resin are also lower. On the other hand, as glue spreads cannot be tailored for specific areas, the overall coverage has to be based on the needs of the most deficient parts. Veneers have rougher surfaces and are variable in moisture and thickness, which necessitates greater resin usage than would be needed under ideal conditions. Resin application rates are varied mostly on a seasonal basis or in response to bonding problems detected at the hot press, although development in real time measurement of veneer attributes and controlling glue spread accordingly has been under development (Faust and Rice 1987).

Glue usage is measured by the weight of the resin solution in kilograms (pounds) per 1,000 ft$^2$ of glueline. Typical gross spreads (including waste) range from 11 to 18 kg (25 to 40 lb) per 1,000 ft$^2$ of a single glueline, depending on wood species, veneer quality attributes, ambient temperatures, and method of application specific to a mill. Everything else being the same, on a normalized 3/8-in. basis, the amount needed depends on the number of gluelines in an assembly, the panel thickness, and the panel mix. The actual PF resin solid content by weight of mixtures is usually on the order of 25% to 27%, the bulk of the rest being water with smaller amounts of glue extenders, fillers, and caustic soda. For a hypothetical product mix shown in Table 8, the average resin solids consumption would come to 11 kg (24 lb) per 1,000 ft$^2$ (3/8-in.).

The method of application also affects use. In its early history, the industry used manually fed rollers to coat the veneers with glue. This method resulted in high waste for veneers of uneven thickness because resin coverage would be inadequate over the thinner sections; as a result the entire piece would have to be discarded. Some older mills today still use such systems, but the bulk of the high-volume operations use automated spray or curtain-coating systems. An alternative method used by some mills is to foam the glue mixture and lay it down in parallel lines. This reportedly results in more even coverage and less resin use.

We measured resin usage by dividing the reported solids equivalent weight of purchase receipts by annual production. This resulted in an average rate of use of 12 kg (26 lb) of PF resins per 1,000 ft$^2$ (3/8-in. basis) of panel production. Along with that, 2 kg (5 lb) each of extenders and fillers were used. By comparison, OSB requires approximately 20 kg (44 lb) of PF resin solids when applied in liquid form.

**Table 8—PF resin use rates by panel assemblies**

| Item | 1 | 2 | 3 | Total |
|---|---|---|---|---|
| Plies | 3 | 4 | 5 | |
| Panel thickness (mm) | 9.5 | 11.9 | 19.1 | |
| Number of gluelines | 2 | 3 | 4 | |
| Spread/1000 ft$^2$ glueline | | | | |
| (lb) | 40 | 40 | 40 | |
| (kg) | 18 | 18 | 18 | |
| Resin solids | 27% | 27% | 27% | |
| Resin in spread | | | | |
| (lb) | 10.8 | 10.8 | 10.8 | |
| (kg) | 5 | 5 | 5 | |
| Total resin in panel | | | | |
| (lb) | 21.6 | 32.4 | 43.2 | |
| (kg) | 9.8 | 14.7 | 19.6 | |
| Use per 1000 ft$^2$, 3/8 in. | | | | |
| (lb) | 21.6 | 25.9 | 21.6 | |
| (kg) | 9.8 | 11.7 | 9.8 | |
| Output percentage | 20 | 60 | 20 | |
| Plant average | | | | |
| (lb) | 4.3 + | 15.6 + | 4.3 = | 24.2 |
| (kg) | 2.0 + | 7.0 + | 2.0 = | 11.0 |

## Energy Use

Most plywood mills peel their own veneers from roundwood, and some of the residues offer a ready supply of fuel. This furnishes much of their heating needs, and as in OSB, outside energy purchases are mainly limited to electricity and fuels for rolling stock. Mills that are primarily lay-up operations of veneer bought from outside suppliers tend to have large natural gas purchases for veneer drying, as do plants that employ RTOs. Natural gas usage on the average was nearly double in a plant running an RTO than in one that was not, according to our 1997 results. The usage intensity, however, was lower than for a similar OSB operation. Overall, natural gas among all responding mills averaged 0.39 ft$^3$ per 1,000 ft$^2$ in 2005, little changed from 0.34 in 1997 (Table 9).

Electricity usage was similar to an OSB plant's, ranging from 133-to-146k = kWh/1,000 ft$^2$ in our two surveys.

Diesel and propane usage each averaged about 1 L (0.26 gal) between our two surveys.

# Costs and Profitability

Table 10 contains a historical perspective on input costs for a benchmark plywood operation with values for a Louisiana/east Texas location. The most notable difference between this and Table 5 is the wood component. Bigger log sizes and higher grade requirements mean that wood costs about twice as much as the type of wood that is sufficient for OSB production.

Table 11 applies these costs to usage rates for a 200 thousand m$^3$ (230 million ft$^2$) per year, 260 employee, mostly sheathing-oriented plywood mill. Labor costs are based on both hourly and salaried staff and include all employee benefits. Consistent with the higher labor requirements, labor costs are about three times higher than those for OSB.

Wood costs are based on a conservative 51% yield and typical delivered sawlog prices in Louisiana and east Texas. In contrast to most OSB plants, an added element that partially defrays these costs is revenue generated from salable residues (chips and cores).

Another difference is depreciation, as most plywood mills are 30 or more years old and thus have less capital costs to write off. This can be a double-edged sword, however, because if a mill remains technologically stagnant, it tends to get shut down.

Figure 13 plots these combined costs in relation to those for a southern OSB mill. The differential has remained relatively steady in percentage terms but climbed in absolute terms and in recent years has been about \$80/m$^3$ (\$70/1,000 ft$^2$) in favor of OSB.

**Table 9—Average plywood energy use, 1997 and 2005**

| | RTO[a] | | No RTO | | Total | |
|---|---|---|---|---|---|---|
| Year | Samples | Energy use | Samples | Energy use | Samples | Energy use |
| | | Natural gas (ft$^3$/1,000 ft$^2$) | | | | |
| 1997 | 4 | 0.62 | 15 | 0.23 | 19 | 0.34 |
| 2005 | | na | | na | 14 | 0.39 |
| | | Electricity (kWh/1,000 ft$^2$) | | | | |
| 1997 | 4 | 146 | 15 | 135 | 19 | 138 |
| 2005 | | na | | na | 13 | 146 |
| | | Diesel (gal/1,000 ft$^2$) | | | | |
| 1997 | | | | | 19 | 0.16 |
| 2005 | | | | | 14 | 0.32 |
| | | Propane (gal/1,000 ft$^2$) | | | | |
| 1997 | | | | | 19 | 0.20 |
| 2005 | | | | | 14 | 0.25 |

[a] Regenerative thermal oxidizers.

Profit margins have followed the cyclical movements of OSB, but generally have been lower. For the 2000 to 2006 benchmark period, the average benchmark southern OSB margin was 26% compared with 12% for plywood.

# Structural Panels

## Trade

The largest share of trade in plywood and OSB takes place between the United States and Canada. In 2005, the United States supplied 77% and 74% of total Canadian plywood and OSB imports, respectively. Similarly, Canada supplied 94% of U.S. OSB imports, although only 24% of plywood imports. For Canada, U.S. destinations represented the majority of shipments, as only a small part goes to Europe and Asia. United States panel exports, on the other hand, are more diverse as Canada accounts for only 28% and 65% of U.S. plywood and OSB foreign sales.

Historically, Canada had been the leading exporter of plywood to the United States. However, in 2003, Brazil took over the top spot. Starting in 1998, the U.S. dollar rose sharply against the Brazilian real, resulting in increased U.S. purchasing power. This created an opportunity for Brazilian plywood manufacturers to gain a foothold in the American market. Imports from Brazil increased from 511 thousand m$^3$ (578 million ft$^2$) in 2003 to 1.128 million m$^3$ (1.275 billion ft$^2$) by 2004. In 2002, however, the real plateaued and since 2004 has appreciated significantly. For a period, the rise in plywood prices masked this effect. The average 2002 price of southern plywood (15/32 in.) rose from \$247 to \$398 in 2004, a 61% increase (Fig. 14, right scale). This in turn was similar to the rise in reals, which went from 721 in 2002 to 1169 in 2004 (Fig. 14, left scale). In 2005, however, the average price fell

**Table 10—Approximate costs of various plywood manufacturing inputs for a southern U.S. location, 2000 to 2006**

| | Cost (US$/unit) | | | | | | |
|---|---|---|---|---|---|---|---|
| Cost item | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| Wood (m$^3$) | 66 | 59 | 62 | 64 | 65 | 70 | 70 |
| (ccf[a]) | 187 | 167 | 175 | 180 | 185 | 198 | 198 |
| Labor (h) | 18.7 | 19.7 | 20.6 | 21.7 | 22.9 | 23.9 | 24.7 |
| Liquid PF (kg) | 0.81 | 0.83 | 0.85 | 1.18 | 1.20 | 1.41 | 1.27 |
| (lb) | 0.36 | 0.38 | 0.38 | 0.53 | 0.54 | 0.64 | 0.58 |
| Fillers (kg) | 0.26 | 0.28 | 0.28 | 0.28 | 0.29 | 0.29 | 0.27 |
| Extenders (lb) | 0.12 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.12 |
| Natural gas (GJ) | 4.1 | 4.9 | 3.8 | 5.3 | 6.1 | 7.6 | 7.4 |
| (1,000 ft$^3$) | 4.5 | 5.2 | 4.1 | 5.8 | 6.6 | 8.2 | 8.0 |
| Electricity (kWh) | 0.040 | 0.039 | 0.040 | 0.055 | 0.055 | 0.057 | 0.058 |
| Diesel (liter) | 0.26 | 0.25 | 0.23 | 0.28 | 0.35 | 0.48 | 0.53 |
| (gal) | 1.00 | 0.95 | 0.88 | 1.05 | 1.35 | 1.84 | 2.00 |

[a] Hundred cubic feet.

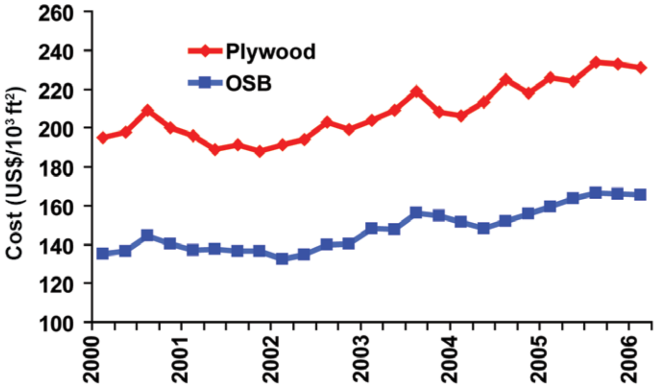

**Figure 13—Plywood (Southwest) and OSB (Southeast) total manufacturing costs, 2000–2006.**

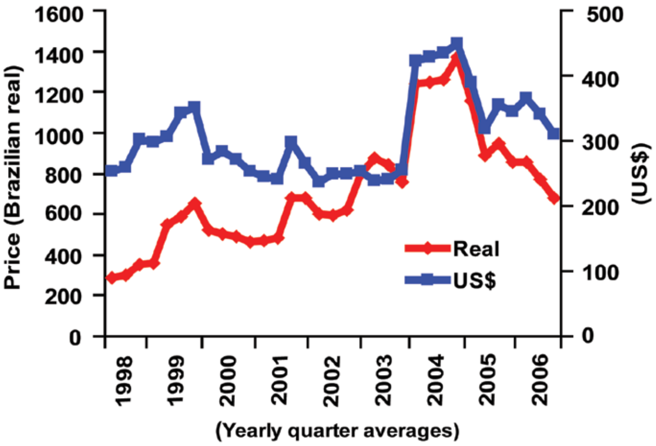

**Figure 14—Average southern plywood prices, 1998–2006.**

**Table 11—Plywood costs and revenues for benchmark Southern U.S. mill, 2000–2006**

| | Cost (US$/m$^3$) | | | | | | |
|---|---|---|---|---|---|---|---|
| Cost item | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Direct costs** | | | | | | | |
| Wood | 130 | 116 | 121 | 125 | 128 | 137 | 137 |
| Residues | –18 | –17 | –17 | –17 | –18 | –18 | –18 |
| Labor | 52 | 54 | 55 | 58 | 60 | 62 | 63 |
| Resin | 12 | 12 | 12 | 16 | 17 | 20 | 18 |
| Extenders | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Energy | 13 | 13 | 13 | 18 | 19 | 21 | 22 |
| Supplies | 20 | 20 | 21 | 21 | 21 | 22 | 22 |
| Total direct | 210 | 199 | 208 | 223 | 229 | 244 | 246 |
| **Fixed costs** | | | | | | | |
| General | 7 | 6 | 6 | 6 | 6 | 7 | 7 |
| Depreciation | 10 | 9 | 9 | 8 | 8 | 8 | 8 |
| Total fixed | 17 | 15 | 15 | 15 | 15 | 15 | 15 |
| Total costs | 227 | 214 | 222 | 237 | 244 | 259 | 261 |
| Revenues | 238 | 233 | 220 | 289 | 356 | 316 | 285 |
| Margin | 5% | 7% | –1% | 18% | 32% | 18% | 8% |

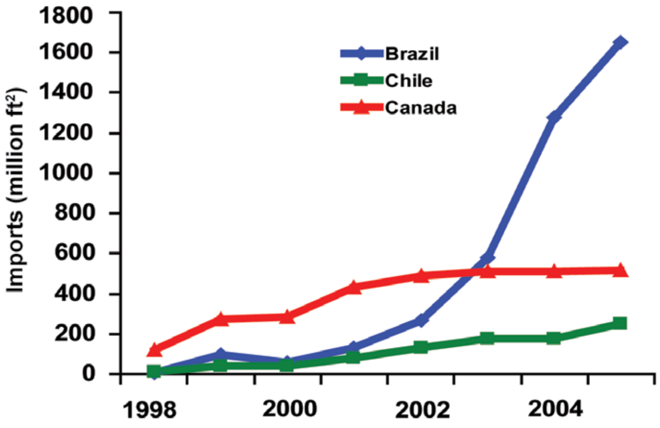

**Figure 15—U.S. plywood imports, 1998–2005.**

to $351, which translates to 855 reals, resulting in a 27% drop as opposed to a 12% decline in dollars. In addition, when the United States imposed an 8% tariff on Brazilian plywood in July of 2005, the effective total price for Brazilian exporters dropped an even greater 33%.

These developments have naturally altered Brazilian plywood competitiveness. In the quarter prior to the tariff, the United States imported 588 million ft$^2$ of non-Canadian plywood. In the quarter after, U.S. imports fell to 411 million ft$^2$, a 30% decline. Overall, in 2005, U.S. plywood imports from Brazil increased 14% from 2004, the smallest increase in 5 years.

In addition to domestic market share losses, the United States also lost markets in Europe to Brazilian competition. Over a decade ago, U.S. exports to Europe were about 0.9 million m$^3$ (1 billion ft$^2$) a year. By 2004, this had fallen to just 5 thousand m$^3$ (6 million ft$^2$). With a weaker dollar favoring the United States, this doubled in 2005, but to a still trivial 10 thousand m$^3$ (12 million ft$^2$).

Chile has also become a force in the plywood sector as the removal of tariffs in 2002 through the United States–Chile Free Trade Agreement increased its competitiveness. Chile's U.S. exports rose from almost nothing in 1998 to over 175 thousand m$^3$ (200 million ft$^2$) in 2005 (Fig. 15). However, the global rise in copper demand and prices, a product of which Chile is a major supplier, has boosted the currency, lessening Chilean competitiveness in other goods.

Similarly, with the depreciation of the dollar against the Brazilian real and the 8% tariff that the United States has imposed, the U.S. demand for Brazilian plywood should moderate in the short term.

## Margin–Capacity Use Relationships

For the most part, softwood plywood and OSB are interchangeable commodities that compete in the same markets mostly on the basis of price. As a result, their pricing trends follow similar patterns, albeit at different levels because of differences in cost and felt value (Fig. 16).

Prices for basic commodities in general are determined by demand–supply balances. Plywood and OSB prices have exceptionally volatile histories largely because of inelastic supply and demand in the short run (2 years or less). On the supply side, the long lag in building new plants and the absence of much reserve capacity once a plant reaches its full potential limits the ability to meet surges in demand. On the consumption side, the highly cyclical and seasonal housing market promotes variability in demand while the paucity of ready alternatives limits user options. These make markets somewhat inflexible and prices subject to wide swings.

In general, manufacturing costs determine basic pricing trends in an industry while the demand–supply balances influence how far prices are above or below costs. The most readily available measure of supply tightness is the previously discussed capacity utilization rate. Table 12 summarizes North American combined OSB and plywood capacity and production and capacity utilization, along with OSB variable costs, prices and margins for 1988 to 2005.

When we collect the data in Table 12 into groups based on four levels of capacity utilization and average the utilization rates and margins within each group, we get the data summarized in Table 13 and illustrated in Figure 17. We empirically fitted the curve to the data in Figure 17 embodied in the following equation:

$$\text{Margin} = (\text{Capacity Utilization})^{23} \div (\text{Capacity Utilization} - 0.61)$$

The data and the derived formula show a strong tendency to rise exponentially as the capacity utilization rate approaches 1. This translates to different effects on margins and prices over different levels of capacity use. That is, at higher levels of slack capacity, a given change in supply or demand has less effect on price than when the same occurs when capacity is tight.

This relationship can be used in either static or dynamic planning exercises to gauge the likely market effects of changes in supply or demand. For a static example, at capacity utilization of 0.95, a firm contemplating building a new mill that would decrease the aggregate utilization rate to 0.93 could determine the expected effect on margins. At 0.95, the expected margin given by the formula is 90% (90% over average industry variable costs). At 0.93, the expected margin drops to 59%. If industry average variable costs at the time are $160, then the price under the first scenario would $304 (160 × 1.9), while under the second it would be $254 (160 × 1.59). Part of the firm's decision rests upon whether the gain in volume and sales is enough to offset the loss in margin the firm's other plants would have to bear. A dynamic elaboration of that would take into account expected changes in manufacturing costs, demand, market

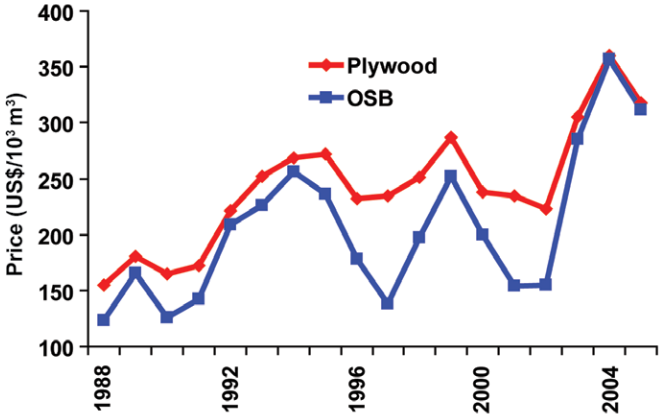

Figure 16—Southern plywood and northcentral OSB prices, 1988–2005.

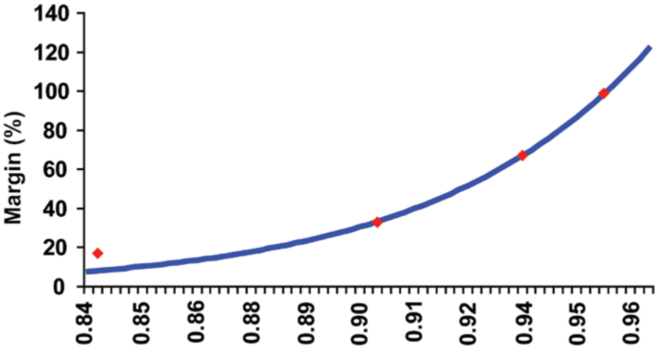

Figure 17—Oriented strandboard (OSB) margin–structural panel capacity utilization relationship. Blue line signifies fitted relationship; red diamonds signify observed values.

Table 12—Structural panel capacity and production and U.S. OSB costs and prices, 1988–2005

| Year | Capacity (million m³) | Production (m³) | Utilization rate | Prices ($/m³) | Variable costs ($/m³) | Margin (%) |
|---|---|---|---|---|---|---|
| 1988 | 30.5 | 28.1 | 0.921 | 123 | 117 | 5 |
| 1989 | 31.2 | 27.9 | 0.893 | 166 | 123 | 35 |
| 1990 | 31.3 | 27.4 | 0.875 | 126 | 117 | 8 |
| 1991 | 30.7 | 24.9 | 0.810 | 142 | 113 | 26 |
| 1992 | 29.7 | 27.2 | 0.917 | 209 | 115 | 83 |
| 1993 | 29.6 | 27.9 | 0.945 | 226 | 121 | 86 |
| 1994 | 30.2 | 29.0 | 0.959 | 256 | 124 | 106 |
| 1995 | 31.3 | 29.3 | 0.935 | 236 | 135 | 76 |
| 1996 | 35.1 | 31.8 | 0.906 | 178 | 130 | 37 |
| 1997 | 36.7 | 32.7 | 0.892 | 138 | 139 | 0 |
| 1998 | 36.6 | 34.3 | 0.937 | 197 | 140 | 40 |
| 1999 | 37.4 | 35.6 | 0.951 | 252 | 130 | 94 |
| 2000 | 37.7 | 35.7 | 0.946 | 200 | 130 | 53 |
| 2001 | 37.8 | 34.5 | 0.912 | 154 | 128 | 20 |
| 2002 | 38.5 | 35.7 | 0.928 | 155 | 130 | 20 |
| 2003 | 38.8 | 36.2 | 0.932 | 285 | 147 | 94 |
| 2004 | 39.8 | 37.8 | 0.948 | 357 | 146 | 145 |
| 2005 | 40.1 | 38.2 | 0.951 | 312 | 159 | 96 |

growth, and other firms' capacities while the new mill is being built.

# End Use

## Life Cycle Context

The evolution of products in markets is usually described in terms of a life cycle framework, which traces a pathway of growth, maturation, and possible decline. It begins with a product's emergence and early struggle to get accepted, which involves developing and testing a product, gaining code and regulatory approvals, building the first installations, cultivating a market, and so forth. This is followed by a growth spurt once its advantages are recognized and the product gains critical market size and acceptance. At the point where most market participants have adopted the innovation, normally around a 75% market share, the growth rate slows. Depending on the absence or advent of a better alternative, at that point it can stabilize or reverse.

Plywood and OSB have been engaged in these markets over the past 30 years. Plywood reached its zenith in the early 1970s when larger old-growth timber in the U.S. West was either exhausted or its availability restricted. This provided an opportunity for a composite-based alternative, first manifested in waferboard, which then morphed into OSB. To view the evolution of these products in this context, we created general approximations to the changing size of their market, represented by a combination of housing starts and gross domestic product, converted to panel equivalents. The production volumes of these products were then compared in ratio form to these benchmarks, resulting in the curves depicted in Figure 18.

Plywood had a long history prior to the period depicted in the charts, but its use as a structural building material began in earnest only around the 1930s. Accordingly, its introductory phase lasted about two decades. Similarly, structural particleboards bonded with phenolic resins date back to the 1950s but it was not until about 30 years later that the technology was refined to the point that it could be said to have broken out of its nascent phase.

Plywood's rapid market acceptance took place in the 1950s and 1960s and reached maturity by the late 1960s. It held there for about two decades, at which point it began to give way to OSB. The latter's own rapid growth phase can be dated from the early 1980s to the present. It is now nearing mature product status, but appears to have a market share residual growth potential of around 25% to 30% before it maxes out and its fluctuations become more directly tied to changes in its markets. This is somewhat less than the plywood residual share because of industrial uses where appearance is an important criterion and OSB is at a disadvantage.

With that as background, we examine current knowledge about the status of these products in their end-use markets.

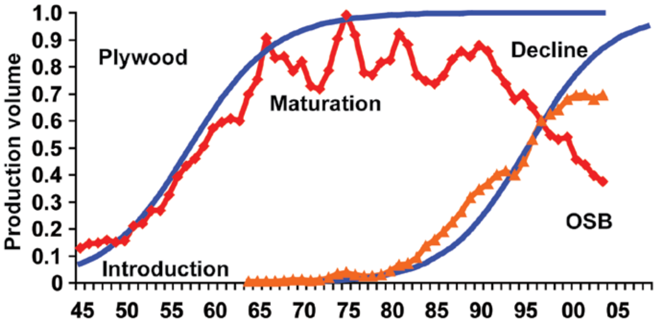

**Figure 18—Stages of plywood and OSB life cycle evolution, 1945–2005.**

**Table 13—Structural panel capacity utilization and U.S. OSB margins (price-variable cost), by capacity utilization class, 1988–2005**

| Capacity utilization (%) | Number | Average utilization (%) | Average margin (%) |
|---|---|---|---|
| <89 | 2 | 84.2 | 17 |
| 89–91.9 | 5 | 90.4 | 33 |
| 92–94.9 | 8 | 93.7 | 67 |
| >95 | 3 | 95.4 | 99 |

This discussion focuses principally on current and potential use of structural panels for sheathing (including underlayment) and exterior siding applications. Not included are structural panel uses in industrial, packaging and shipping, and miscellaneous uses and the use of engineered lumber products.

## Structural Panel Demand

The construction of new buildings and their upkeep and improvement form the largest market for structural panels in the United States. Three recently completed studies enumerated the types and amounts of wood products used in 2003 to build new residential structures, to repair and remodel residential structures, and to build, alter, and renovate low-rise nonresidential buildings (Wood Products Council 2005a; Wood Products Council 2005b; McKeever and others 2006).

Overall, an estimated 33.8 million m$^3$ (38 billion ft$^2$, 3/8 in.) of structural panels were consumed in the United States in 2003 for all uses (Table 14). Of this, nearly one-half (49%) was for new residential construction (single family houses, and multifamily apartments). Total residential construction, which includes new construction and repair and remodeling but excludes manufactured housing, accounted for 63% of all structural panel consumption, low-rise nonresidential buildings 6%, and all other uses 31%. OSB was the structural panel in greatest demand. In 2003, nearly 20 million m$^3$ (22 billion ft$^2$) were consumed for all uses, compared to 13.8 million m$^3$ (16 billion ft$^2$) of softwood plywood.

## New Residential Construction

New residential construction is the biggest market for wood building products in general, and for structural panels in particular. In 2003, an estimated 16.4 million m$^3$ of structural panels were used to build new single-family and multifamily houses, of which about three-fourths was OSB (Table 14). New and planned increases in structural panel capacity, specifically OSB capacity, have caused some concern regarding possible markets for this added production. New residential construction, although already a large market for structural panels, can potentially absorb large additional volumes. To estimate how much more could be absorbed, we examined recent trends in market shares for major sheathing and siding applications in new single-family and new low-rise multifamily houses in 1995, 1998, and 2003 (Table 15).

Structural panels are the principal sheathing product in new residential floors, exterior walls, and roofs. Exterior siding, once an important use for structural panels, has eroded in recent years. Fascia and soffits and webs for wood I-joists also provide additional opportunities, but are relatively small and were not quantified here.

For flooring, structural panels had 49% of the single-family and 41% of the multifamily sheathing market in 2003 (Table 15). Shares in both were down from 1995 when 55% and 54% of all floors had structural panel sheathing. The declines were due to increases in concrete slab floor systems and nonstructural panel floor underlayment. The concrete slab is both a foundation and first-story floor system. Typically little if any wood is used in conjunction with concrete slabs. In recent years, nonstructural panels have also gained market share as underlayment over concrete slab floors to provide a more uniform surface for finished flooring. The percentage of concrete floors varies, but is typically around one-third of total floor area for single-family houses. Multifamily use of concrete slabs is usually higher.

Oriented strandboard has steadily eroded softwood plywood's share of the floor-sheathing market. Since 1976, OSB has increased from a negligible share to 61% in 2003 of the plywood–OSB mix. The share in multifamily houses has stabilized at around 55%. In the absence of any other structural sheathing products, any additional increases in structural panel market share must come at the expense of concrete slab floors.

In floor systems, we estimated the market potential for structural panels to be nearly 3 million m$^3$ (3.4 billion ft$^2$) for single-family houses and 0.4 million m$^3$ (0.5 billion ft$^2$) for multifamily buildings (Table 15). Market potential is defined here as the sum of the amounts of lumber and nonstructural panels currently being used as sheathing, converted to the equivalent amounts of structural panels, plus the amount of structural panels that would be required to displace concrete. Although unlikely, displacement of concrete slabs by a framed and sheathed wood floor system, or a "hybrid" wood sheathed–wood slab floor system, would result in 2.5 million m$^3$ (2.8 billion ft$^2$) of the additional structural panel demand.

**Table 14—Structural panel consumption in the United States, 2003**

| End use | Construction (million m$^3$) Softwood plywood | OSB | Total | Market share (%) |
|---|---|---|---|---|
| Residential construction[a] | | | | |
| New | 4.5 | 11.9 | 16.4 | 49% |
| Repair & remodel | 3.7 | 1.2 | 4.9 | 14% |
| Total residential | 8.2 | 13.1 | 21.3 | 63% |
| Nonresidential construction[b] | | | | |
| New & additions | 1.3 | 0.3 | 1.6 | 5% |
| Alterations | 0.4 | 0.1 | 0.5 | 1% |
| Total nonresidential | 1.6 | 0.4 | 2.0 | 6% |
| Total buildings | 9.8 | 13.4 | 23.3 | 69% |
| Total all other[c] | 4.0 | 6.5 | 10.5 | 31% |
| Total | 13.8 | 19.9 | 33.8 | 100% |

[a] Excludes manufactured housing.
[b] Low-rise structures of four or fewer stories only.
[c] Includes industrial, packaging and shipping, and miscellaneous uses.
Source: Adair 2004.

In wall sheathing, structural panels had 67% of the single-family and 60% of the multifamily markets in 2003 (Table 15). This was significantly higher than previous years. In 1995, only about one-half of walls were sheathed by structural panels. Foamed plastic, once a major competitor, has lost share since 1995. It now has only a 12% share in single-family homes and 6% in multifamily units. In fact, walls with no sheathing at all have a greater share than foamed plastic in multifamily dwellings.

Trends in OSB use compared with softwood plywood have paralleled those in floor sheathing, but at a higher level. OSB's share of the single-family structural panel sheathing market increased from 63% in 1995 to 85% in 2003. Conversely, OSB use in multifamily houses fell from 77% to 69% during the same time period.

Overall market potential for structural panels in single-family and multifamily wall sheathing was estimated to be nearly 2.2 million m$^3$ (2.5 billion ft$^2$) in 2003 (Table 15). The single-family wall sheathing market accounted for nearly 94% of this potential.

In roof sheathing, structural panels are by far, and have been for many years, the product of choice. In 2003, structural panels accounted for 98% of the single-family and 99% of the multifamily roof sheathing market (Table 15). Small residual amounts of lumber sheathing are used, primarily under tile or metal roofs, as are slight amounts of other sheathing products.

**Table 15—Wood products use and market potential for structural panels in new residential construction, 2003**

| Sheathing application and building product | Single Family | | | | | | Multifamily | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Incidence of use (%) | | | 2003 | | | Incidence of use (%) | | | 2003 | | |
| | 1995 | 1998 | 2003 | Area covered (milllion $m^2$) | Amount used (1,000 $m^3$) | Structural panel potential (1,000 $m^3$) | 1995 | 1998 | 2003 | Area covered (million $m^2$) | Amount used (1,000 $m^3$) | Structural panel potential (1,000 $m^3$) |
| **Floors** | | | | | | | | | | | | |
| Structural panels | | | | | | | | | | | | |
| Softwood plywood | 31 | 28 | 19 | 87.3 | 1,570.2 | – | 24 | 26 | 19 | 11.6 | 198.2 | – |
| OSB | 24 | 31 | 30 | 134.7 | 2,455.8 | – | 30 | 29 | 22 | 13.6 | 244.4 | – |
| Total | 55 | 59 | 49 | 222.0 | 4,025.9 | – | 54 | 55 | 41 | 25.1 | 442.6 | – |
| Lumber | (a)[a] | 2 | (a) | 2.2 | 41.7 | 41.6 | (a) | (a) | (a) | (a) | (a) | (a) |
| Nonstructural panels[b] | 9 | 11 | 13 | 58.6 | 425.4 | 730.0 | 7 | 10 | 16 | 9.8 | 67.4 | 142.5 |
| Concrete slab[c] | 35 | 28 | 37 | 117.8 | – | 2,226.6 | 39 | 35 | 43 | 15.3 | – | 280.1 |
| Total | 100 | 100 | 100 | 400.6 | 4,493.1 | 2,998.2 | 100 | 100 | 100 | 50.3 | 510.0 | 422.6 |
| **Walls** | | | | | | | | | | | | |
| Structural panels | | | | | | | | | | | | |
| Softwood plywood | 19 | 12 | 10 | 46.5 | 596.4 | – | 10 | 17 | 18 | 4.6 | 57.0 | – |
| OSB | 33 | 47 | 57 | 274.7 | 3,433.5 | – | 33 | 44 | 42 | 10.3 | 131.5 | – |
| Total | 52 | 60 | 67 | 321.1 | 4,029.9 | – | 43 | 61 | 60 | 14.9 | 188.4 | – |
| Foamed plastic | 29 | 21 | 12 | 56.0 | 704.5 | 703.0 | 34 | 15 | 6 | 1.6 | 20.4 | 20.3 |
| All other | | | | | | | | | | | | |
| Lumber | (a) | 2 | 1 | 4.6 | na[b] | 57.2 | (a) | 3 | 6 | 1.4 | na | 17.7 |
| Fiberboard | 6 | 8 | 4 | 20.0 | na | 250.4 | 5 | 5 | 10 | 2.5 | na | 31.8 |
| Foil-faced kraft | 3 | 4 | 5 | 24.7 | na | 310.4 | 1 | 4 | 3 | 0.6 | na | 8.0 |
| Cement, gypsum board | 2 | 1 | 2 | 9.7 | na | 121.1 | 8 | 6 | 6 | 1.5 | na | 18.8 |
| Total | 11 | 15 | 12 | 58.9 | 745.6 | 739.2 | 14 | 18 | 24 | 6.0 | 76.7 | 76.3 |
| None[d] | 8 | 4 | 10 | 46.8 | – | 587.2 | 9 | 5 | 9 | 2.3 | – | 29.2 |
| Total | 100 | 100 | 100 | 482.8 | 5,479.9 | 2,029.3 | 100 | 100 | 100 | 24.9 | 285.6 | 125.9 |
| **Roofs** | | | | | | | | | | | | |
| Structural panels | 62 | 73 | 76 | | | | 80 | 72 | 70 | | | |
| Softwood plywood | 37 | 26 | 24 | 126.4 | 1,711.4 | – | 19 | 28 | 30 | 10.8 | 153.9 | – |
| OSB | 61 | 72 | 74 | 381.8 | 5,055.0 | – | 75 | 70 | 69 | 24.8 | 361.3 | – |
| Total | 98 | 99 | 98 | 508.1 | 6,766.4 | – | 94 | 98 | 99 | 35.6 | 515.2 | – |
| All other | | | | | | | | | | | | |
| Lumber | 1 | 1 | 1 | 4.9 | na | 65.1 | 1 | (a) | 1 | 0.2 | na | 2.6 |
| Other | (a) | (a) | 1 | 5.5 | na | 73.1 | 5 | 2 | (a) | 0.1 | na | 0.8 |
| Total | 1 | 1 | 2 | 10.4 | 138.4 | 138.1 | 6 | 2 | 1 | 0.2 | 3.3 | 3.4 |
| None | (a) | (a) | (a) | 1.9 | – | 25.9 | (a) | (a) | (a) | (a) | – | 0.1 |
| Total | 100 | 100 | 100 | 518.5 | 6,904.8 | 164.0 | 100 | 100 | 100 | 35.9 | 518.5 | 3.5 |
| **Siding** | | | | | | | | | | | | |
| Structural panels | | | | | | | | | | | | |
| Softwood plywood | 4 | 1 | 1 | 3.5 | 68.9 | – | 2 | 2 | (a) | 0.1 | 1.7 | – |
| OSB | 5 | 2 | 3 | 10.6 | 182.5 | – | 2 | 3 | (a) | 0.1 | 1.0 | – |
| Total | 9 | 3 | 3 | 14.1 | 251.4 | – | 4 | 5 | 1 | 0.1 | 2.7 | – |
| Lumber | 7 | 6 | 5 | 21.1 | 552.2 | 375.2 | 2 | 7 | 2 | 0.3 | 8.8 | 6.2 |
| Hardboard | 6 | 8 | 3 | 13.7 | 192.4 | 244.7 | 5 | 8 | 6 | 1.2 | 17.3 | 22.0 |
| All other | | | | | | | | | | | | |
| Vinyl, metal | 29 | 32 | 27 | 113.5 | na | 2,021.4 | 41 | 35 | 43 | 9.3 | na | 163.8 |
| Masonry, stucco | 48 | 47 | 61 | 254.2 | na | 4,525.7 | 48 | 43 | 43 | 9.2 | na | 164.3 |
| Other | 1 | 4 | 1 | 3.5 | na | 61.4 | (a) | 4 | 6 | 1.2 | na | 21.7 |
| Total | 78 | 84 | 88 | 371.2 | – | 6,608.5 | 89 | 82 | 92 | 19.7 | – | 349.8 |
| **Total** | 100 | 100 | 100 | 420.1 | 996.0 | 7,228.3 | 100 | 100 | 100 | 21.5 | 28.8 | 378.0 |
| Total, all applications | – | – | – | – | – | 12,419.9 | | | | | | 929.9 |

[a] Less than 0.5%, 50,000 $m^2$, or 50 $m^3$.

[b] Particle board and MDF

[c] Includes lightweight concrete.

[d] Includes structural insulated panels (SIPs).

Sources: Wood Products 1999a, 2005a; Wood Products Promotion Council 1996.

As in other sheathing applications, the use of OSB has grown at the expense of softwood plywood. In single-family houses, OSB now has a 75% share of the structural panel roof sheathing market. OSB market share has fallen recently in multifamily houses from 80% in 1995 to 70% in 2003.

Little market potential exists for structural panels in roof sheathing. Displacing lumber and other assorted sheathing materials would result in a net gain of less than 0.2 million $m^3$ (0.2 billion $ft^2$).

Wood products play a very small role in siding. Only about one-tenth of the new residential market was wood in 2003 (Table 15). Structural panels captured just 3% of the single-family and 1% of the multifamily siding markets. The rise in popularity of vinyl and metal siding experienced during the 1970s and 1980s has given way to a renewed interest in masonry and stucco. In 2003, nearly 60% of the exterior residential siding market was masonry–stucco siding products.

Softwood plywood and OSB siding use was nearly equal in single-family construction (1% and 3%, respectively), and equal in multifamily construction (less than 1% each) in 2003.

Since structural panels had such a small market share in 2003, the potential is large. Capturing the lumber and hardboard markets would result in a gain of 0.6 million $m^3$ (0.7 billion $ft^2$). Capturing the non-wood siding market is improbable, but could result in a gain of nearly 7 million $m^3$ (7.8 billion $ft^2$) (Table 15).

Overall, we estimate maximum market potential for structural panel sheathing and siding in new residential construction to be 13.3 million $m^3$ (15 billion $ft^2$) in 2003. Achieving this potential will be difficult at best. Exterior siding use is 57% of the total, or 7.6 million $m^3$ (8.6 billion $ft^2$) (Fig. 19). Because vinyl and brick have such low maintenance, convincing consumers to use structural panel siding would be a marketing challenge.

Floors have the second highest potential at 3.4 million $m^3$ (3.8 billion $ft^2$) or about one-fourth of the potential. Nearly all of this is dependent on replacing concrete slab-on-grade floor systems. About one-half of new houses are built with wood floor systems on either a basement or crawlspace foundation. The remaining one-half has either a slab-on-grade or other type of floor system. In terms of floor area, more than one-third of all floors are concrete slab. Slab-on-grade floors are very popular in the southern United States because they are perceived to be a solution to environmental concerns over excessive moisture and insect and disease problems. Home owners must be convinced that modern wood floor systems perform as well as concrete and are a viable alternative to the slab-on-grade floor system. Anecdotal evidence from the Hurricane Katrina disaster indicates that houses with wood floor systems on crawlspace foundations weathered the storm better than those with slab-on-grade floor systems. This has led some to believe building codes in flood-prone areas will be modified to mandate wood-intensive crawlspace construction in lieu of slab on grade.

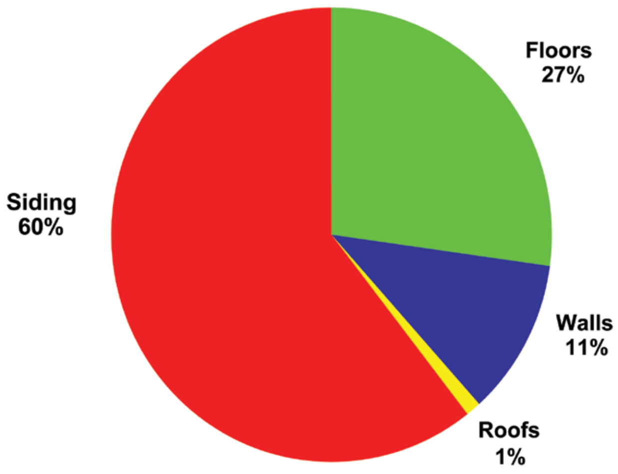

**Figure 19—Structural panel market potential, new residential construction, 2003.**

Exterior wall sheathing accounts for 2.2 million $m^3$ (2.5 billion $ft^2$), 16% of total potential. About 34% of this potential is dependent on replacing foamed plastic wall sheathing with structural panels, 38% on replacing all other types of wall sheathing, and 29% on sheathing currently unsheathed walls.

Roof market potential is negligible.

Additional potential exists in the fascia and soffit, and wood I-joist markets. Currently, about 7% of OSB production is classified as “other,” which primarily consists of webbing for I-joists (Adair 2004).

In terms of construction type, new single-family construction accounts for 93% of total new residential potential. Achievement of all or part of this potential will be difficult and will require concerted promotional efforts, research into improved products, competitive pricing, and changes in building codes or building practices to more fully utilize the added structural panel potential.

## Residential Repair and Remodeling

The residential repair and remodeling market is second only to residential construction in the amounts of structural panels consumed annually. In 2003, 4.9 million $m^3$ (5.5 billion $ft^2$) of structural panels were consumed. However, the percentage breakdown between softwood plywood and OSB is about 75/25, just the opposite of OSB (Wood Products Council 2005b). This reversal is due most likely to home owners’ preference for more traditional wood products. As with residential construction, the repair and remodeling market too holds significant potential to increase the use of structural panels. To estimate how much more could

**Table 16—Wood products use, and market potential for structural panels in residential repair and remodeling, 2003**

| Sheathing application and building product | Incidence of use (%) | | 2003 | | |
|---|---|---|---|---|---|
| | 1997 | 2003 | Area covered (1,000,000 $m^2$) | Amount used (1,000 $m^3$) | Structural panel potential (1,000 $m^3$) |
| **Floors** | | | | | |
| Structural panels | | | | | |
| Softwood plywood | 75 | 74 | 59 | 899.9 | – |
| OSB | 22 | 20 | 16 | 273.2 | – |
| Total | 97 | 94 | 75 | 1,173.1 | – |
| Lumber | 3 | 6 | 5 | 78.2 | 77.9 |
| Nonstructural panels[a] | na[b] | na | –[c] | – | – |
| Concrete slab[d] | na | na | – | – | – |
| Total | 100 | 100 | 80 | 1,251.3 | 77.9 |
| **Walls** | | | | | |
| Structural panels | | | | | |
| Softwood plywood | 54 | 55 | 53 | 681.2 | – |
| OSB | 26 | 30 | 29 | 377.2 | – |
| Total | 80 | 86 | 82 | 1,058.3 | – |
| Foamed plastic | 7 | 5 | 5 | 60.7 | 60.6 |
| All other | | | | | |
| Lumber | na | na | – | – | – |
| Fiberboard | na | na | – | – | – |
| Foil-faced kraft | na | na | – | – | – |
| Cement, gypsum board | na | na | – | – | – |
| Total | 13 | 9 | 9 | 115.9 | 115.6 |
| None | na | na | – | – | – |
| Total | 100 | 100 | 95 | 1,234.9 | 176.2 |
| **Roofs** | | | | | |
| Structural panels | | | | | |
| Softwood plywood | 63 | 70 | 103 | 1,360.2 | – |
| OSB | 24 | 23 | 34 | 470.0 | – |
| Total | 87 | 93 | 138 | 1,830.2 | – |
| All other | | | | | |
| Lumber | na | na | – | – | – |
| Other | 13 | 7 | 11 | 145.3 | 144.8 |
| Total | 13 | 7 | 11 | 145.3 | 144.8 |
| Total | 100 | 100 | 148 | 1,975.5 | 144.8 |
| **Exterior siding** | | | | | |
| Structural panels | | | | | |
| Softwood plywood | 7 | 5 | 28 | 563.1 | – |
| OSB | 2 | (a) | 2 | 36.8 | – |
| Total | 9 | 6 | 31 | 599.8 | – |
| Lumber | 7 | 11 | 59 | 797.0 | 1,156.6 |
| Hardboard | 5 | 2 | 9 | 122.4 | 171.6 |
| All other | | | | | |
| Vinyl, metal | 68 | 60 | 315 | – | 6,190.4 |
| Masonry, stucco | 6 | 17 | 87 | – | 1,713.1 |
| Other | 5 | 5 | 26 | – | 515.3 |
| Total | 79 | 81 | 429 | – | 8,418.7 |
| Total | 100 | 100 | 527 | 1,519.3 | 9,746.9 |
| **Total, all applications** | – | – | – | – | 10,145.8 |

[a] Includes particleboard, hardboard, hardwood plywood, and cement/gypsum board.

[b] na, not available.

[c] Less than 0.5%, 50,000 $m^2$, or 50 $m^3$.

[d] Includes lightweight concrete.

Sources: Wood Products Council 1999b, 2005b.

be absorbed, we examined recent trends in market shares in 1997 and 2003 for major sheathing and siding applications.

In 2003, structural panels captured 94% of floor sheathing (Table 16). The share was down slightly from 1997. These percentages are higher than for new residential construction because data on the use of concrete slabs for additions were not available. Lumber sheathing accounted for the remaining 6% of sheathing material.

Softwood plywood use for floor sheathing was nearly three times that of OSB, most likely due again to home owner's preference for more traditional wood products.

We estimated market potential for structural panels in floor systems to be only 78 thousand m$^3$ (88 million ft$^2$) in 2003. The potential would be higher if data for concrete slab floors were available (Table 16).

In the exterior wall sheathing market, structural panels captured an 86% share in 2003, up from 80% in 1997 (Table 16). Foamed plastic was the second most preferred sheathing product at 5%. Lumber and all other products combined accounted for the remaining 9%. The use of foamed plastic has declined since 1997 and appears to be following the same trend exhibited in new residential construction.

Softwood plywood captured about two times the structural panel market share as did OSB in 2003, similar to floor sheathing shares.

Overall market potential for structural panels in wall sheathing was estimated to be nearly 176 thousand m$^3$ (200 million ft$^2$) in 2003 (Table 16).

Structural panels captured 93% of the roof sheathing market in 2003, up 6% from 1997 (Table 16). Only small amounts of lumber and other miscellaneous sheathing products were used. Sheathing products for repairs and maintenance are often selected to match those already in the existing structure. Older houses typically use more lumber and plywood than OSB.

Softwood plywood was used three times more often than OSB for roof sheathing in 2003 (Table 16).

Displacing other sheathing materials would result in an increase of 145 thousand m$^3$ (165 million ft$^2$) for structural panels (Table 16).

Wood products play a small but important role in the exterior siding market, with structural panels accounting for 6% of exterior siding, lumber 11%, and hardboard 2%. Much of this was most likely used to match existing siding on the house (Table 16). Vinyl and metal siding captured 60% in 2003. Much of this was for re-siding existing houses. Masonry, stucco, and miscellaneous siding materials accounted for the remaining 21%. Nearly 95% of all structural panel siding used was softwood plywood, and OSB played a very minor role.

Since structural panels had a small market share in 2003, their potential market share is large. Capturing the lumber and hardboard markets would result in a gain of 1.3 million m$^3$ (1.5 billion ft$^2$) (Table 16). Capturing the nonwood siding market, principally vinyl and metal, is unlikely, but would result in a gain of an additional 8.4 million m$^3$ (9.5 billion ft$^2$). Overall, a potential market of 9.7 million m$^3$ (11 billion ft$^2$) exists for structural panel exterior siding in residential repair and remodeling.

In summary, we estimated maximum market potential for structural panel sheathing and siding use in residential repair and remodeling to be 10.1 million m$^3$ (11.4 billion ft$^2$) in 2003 (Table 17). Exterior siding accounted for nearly all of the potential at 9.7 million m$^3$. As with new residential construction, achieving the market potential for structural panels is largely dependent on convincing consumers to switch from nonwood siding products to structural panels.

## Nonresidential Buildings

Nonresidential construction is the third major component of the U.S. construction market for wood products. In 2003, the construction value of all nonresidential buildings was $283 billion. Low-rise buildings of four or fewer stories had construction valued at $269 billion (McKeever and others 2006).

Nonresidential buildings are a diverse lot. Our analysis is limited to low-rise nonresidential buildings because high-rise buildings with five or more stories are severely restricted by the building code from using wood as a framing or structural material.

Nonresidential buildings use a mixture of wood and nonwood building materials and building methods. The choices of materials and methods used are dependent on many factors including building type, location, and size, cost differentials between competing materials, state and local building codes, architectural styles, and others. Also, wood may be used in specific applications even though the buildings may not be primarily built with wood, or specific applications may use wood more frequently than other applications.

The construction of new nonresidential buildings holds great potential for expanding the use of wood. In 2003, concrete and metal construction continued to dominate the nonresidential building construction market, accounting for nearly 80% of total construction. In recent years, wood-framed construction (defined as buildings with predominately wood-framed exterior walls, regardless of materials used in other applications) has made modest gains against concrete- and steel-framed construction. Additional gains are possible.

The greatest potential for increasing wood market share in new nonresidential construction is to increase the share of wood-framed buildings at the expense of concrete- and

**Table 17—Wood products use and market potential for structural panels in low-rise nonresidential construction, 2003**

| Sheathing application and building product | Amount used (1,000 $m^3$) | Structural panel potential (1,000 $m^3$) |
|---|---|---|
| **Floors** | | |
| Structural panels | | |
| Softwood plywood | 128.0 | 314.3 |
| OSB | 38.3 | 378.4 |
| Total | 166.3 | 692.8 |
| Lumber | na | – |
| Nonstructural panels[a] | 0.9 | 4.3 |
| Concrete slab | – | – |
| Total | 167.2 | 697.1 |
| **Walls**[b] | | |
| Structural panels | | |
| Softwood plywood | 362.3 | 885.5 |
| OSB | 91.3 | 1,110.2 |
| Total | 453.6 | 1,995.7 |
| Lumber | na | – |
| All other | 4.5 | 16.6 |
| None | na | – |
| Total | 458.1 | 2,012.3 |
| **Roofs** | | |
| Structural panels | | |
| Softwood plywood | 735.6 | 922.4 |
| OSB | 175.2 | 1,273.1 |
| Total | 910.8 | 2,195.4 |
| Lumber | na | – |
| All other | 23.0 | 18.9 |
| Total | 933.8 | 2,214.4 |
| **Exterior siding** | | |
| Structural panels | | |
| Softwood plywood | 36.3 | 93.5 |
| OSB | 9.6 | 128.0 |
| Total | 45.9 | 221.5 |
| Lumber | na | – |
| Hardboard | 1.0 | 0.2 |
| All other | na | – |
| Total | 46.9 | 221.7 |
| **Total, all applications** | | |
| Structural panels | | |
| Softwood plywood | 1,262.2 | 2,215.7 |
| OSB | 314.4 | 2,889.7 |
| Total | 1,576.6 | 5,105.3 |
| All other sheathing | 29.3 | 40.1 |
| Total | 1,606.0 | 5,145.4 |

na, not available.

steel-framed buildings. Realistically, however, very little wood will ever penetrate the foundation and ground-level nonresidential floor market. Also, if wood were to replace concrete and metal, the usage rate (volume of wood used per square feet of floor area) would not be expected to exceed current wood usage rates for applications that are principally built from wood. So market potential is defined for nonresidential construction as the incremental amounts of wood that could be used if all concrete- and steel-framed buildings were built like wood-framed buildings. For example, in 2003, roof systems in small,[3] wood-framed office buildings in the U.S. Midwest averaged about 2.50 $m^3$ of structural panels per 100 $m^2$ (2.63 $ft^2/ft^2$) of finished floor area. Roof systems in small, concrete-framed office buildings averaged 0.75 $m^3$ of structural panels per 100 $m^2$ (0.79 $ft^2/ft^2$) of finished floor area. Thus, wood-framed office buildings used 235% more structural panels per 100 $m^2$ of floor area for roofs than concrete-framed buildings. The structural panel potential for roofs would then be the total finished floor area in concrete buildings multiplied by 1.75 $m^3$. A realistic limit to the maximum potential would be the amounts of these products that would be used if concrete and metal upper story floors, exterior and interior walls, roofs, and siding were built principally with wood at current wood usage rates.

In 2003 an estimated 1.6 million $m^3$ of sheathing materials and exterior siding were used in the construction of low-rise nonresidential buildings (Table 17). Of this 98% was structural panels. Roofs accounted for more than one-half at 0.9 million $m^3$ (1 billion $ft^2$). This is because many concrete-framed buildings have all wood or a combination of wood and steel roof systems. Exterior siding used just 2% of all structural panels.

An additional 5.1 million $m^3$ (5.8 billion $ft^2$) of structural panels could have been used in 2003 if all concrete- and steel-framed buildings had been built as wood-framed buildings (Table 17). Overall, less OSB is used in concrete- and steel-framed buildings than softwood plywood. But because OSB has a higher usage rate than softwood plywood in wood-framed buildings, market potential for OSB is greater by nearly 0.7 million $m^3$ (0.8 billion $ft^2$). Roofs had the greatest incremental market potential, accounting for 43% of total potential. Walls were a close second at 39%.

These potentials have to be placed in context of the limitations imposed by building and fire codes and embedded user preferences. Building codes in the United States place limits on the use of wood framing especially in nonresidential buildings. Building area, height, and intended usage ("occupancy") determine whether or not all, or part, of the building can be wood-framed and sheathed.

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[3] Buildings with less than 4,645 $m^2$ (50,000 $ft^2$) of finished floor area.

The International Building Code is now the dominant model code in the United States. It defines area and height limits for each building by occupancy and by various types of structural assemblies. However, area and height limits can be substantially increased through the addition of automatic fire protection sprinklers, the use of firewalls to subdivide large buildings, and through the provision for substantial frontage to the building to enable easy firefighting access. Using the most aggressive assumptions regarding sprinklers, use of fire-rated assemblies and building frontages to capture the maximum code-allowable gain for wood, we determined that almost 64% of total constructed nonresidential value could have been framed in wood in 2003. This results in a potential incremental increase in structural panel consumption of nearly 3 million m$^3$ (3.3 billion ft$^2$). This is about 40% below the estimated structural panel market potential if all concrete- and steel-framed buildings were built similarly to wood-framed buildings, but is a more realistic objective.

## Total Potential for Structural Panels

The construction of new single-family houses and multifamily apartment buildings, their repair and remodeling, and new low-rise nonresidential buildings hold potential for increasing the use of structural panels. In 2003 about 23.3 million m$^3$ (26.3 billion ft$^2$) of structural panels were used for sheathing and exterior siding in these end-use markets. We estimated an additional potential 28.6 million m$^3$ (32.3 billion ft$^2$) if all sheathing and siding applications that didn't use structural panels in all residential construction were converted to structural panels, and if concrete- and steel-framed nonresidential buildings were built using the same techniques as wood-framed buildings (Table 18).

Much of this potential is dependent on consumer preference, particularly in the single-family construction and residential repair and remodeling exterior siding markets. Low- and no-maintenance products dominate exterior siding and will probably continue to do so. It is difficult to determine what part of the maximum market potential for structural panels is realistically achievable, given the environment set by various building and fire codes and building types where wood use would be incompatible with the structure's purpose. However, if through concerted promotion and research efforts, one-half of the residential floor, wall, and roof potential, one-fourth of the residential siding potential, and four-tenths of total nonresidential potential (based on building code analyses) had been achieved, structural panel consumption would have been an additional 9.5 million m$^3$ (10.7 billion ft$^2$) in 2003.

# Conclusions and Implications

This report is written at a time when the business cycle for housing and its dependent industries, such as plywood and OSB, is in the midst of a down phase. Four years of strong economic growth, stimulated by extraordinarily easy credit, have seen the prices of several classes of assets, such as real estate, inflate significantly. The growth in economic activity has also begun to push on the limits of capacity for some raw material sectors such as energy and metals. The resulting rise in prices in these sectors is beginning to spill over into the general economy in reaction to which central banks worldwide, and in the United States specifically, have been raising interest rates. This has begun to brake a credit-driven sector like housing, similar to the average response in five previous U.S. credit-tightening cycles (Fig. 20).

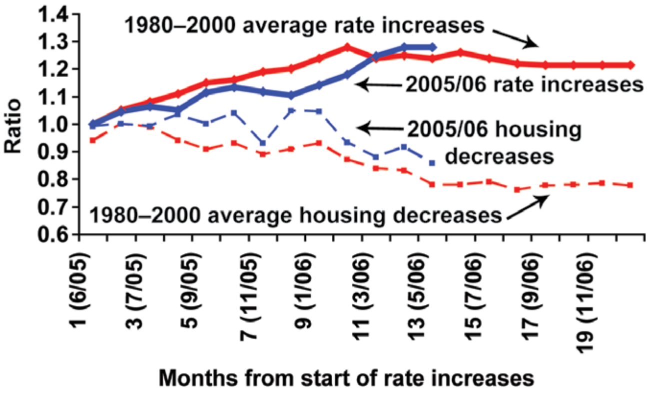


**Figure 20—Historical and current interest rate increases and one-family housing starts declines.**

**Table 18—Total market potential for structural panels, 2003**

| | Market potential (million m$^3$) | | | | |
|---|---|---|---|---|---|
| | Residential construction | | | | |
| Application | New single family | New multi-family | Repair & remodeling | New non-residential | Total |
| Floors | 3.0 | 0.4 | 0.1 | 0.7 | 4.2 |
| Walls | 2.0 | 0.1 | 0.2 | 2.0 | 4.3 |
| Roofs | 0.2 | 0.0 | 0.1 | 2.2 | 2.5 |
| Siding | 7.2 | 0.4 | 9.7 | 0.2 | 17.6 |
| Total | 12.4 | 0.9 | 10.1 | 5.1 | 28.6 |

In this cycle, interest rates as represented by 10-year U.S. Treasury notes had effectively touched bottom in June 2005 and for the past 12 months have been gradually rising. By the standards of previous business cycles, as well as from hints by bank officials, the rate-boosting campaign should be nearing an end, but significant rate cuts appear to be still about 6 to 12 months away. As the illustration shows, the drag from the higher rates typically inhibits construction for 6 or so months and then keeps activity at those depressed levels for 6 to 12 more. Only when rate-cutting begins anew does housing activity get restimulated.

Given the strong dependency on construction described in previous sections, this means that consumption of structural panels will almost certainly decline in 2006 and also in 2007, just as about 5.75 million to 7.6 million m$^3$

(6.5 billion to 8 billion ft$^2$) of new OSB capacity over the period 2006 to 2009 is set to come on line. The consequence will be excess capacity for several years and, as suggested by Figure 17, depressed margins.

Given these prospects, industry participants have several options. One is to postpone or abandon some of the planned expansions. The ability to do this, however, is constrained because construction on many projects has already begun. On some others, contractual obligations have been entered into. By our estimates, eight plants, accounting for 6 million m$^3$ (6.7 billion ft$^2$) of capacity, fall into these categories, leaving a relatively small fraction with the option to bail out. A related option is to convert some capacity from commodity sheathing to specialty or other products. At least two existing sheathing mills are slated for conversion to siding and another is being retrofitted with a press capable of making thicker panels destined to be made into oriented strand lumber (OSL). Additionally, one new facility's design incorporates a press offering the option to make OSL. This could alleviate some of the excess capacity but almost certainly not enough to avoid an oversupply condition for several years.

The second option is to hope that enough older plants retire to offset the influx. Some of this is almost certain to happen. As of 2005, about 60% of U.S. plywood output was of sheathing-grade panels, which will bear the brunt of the impact of falling prices. Given the higher costs associated with plywood, some of this capacity would seem destined to exit. But plywood economics are buoyed by the growing need for LVL. In some respects, sheathing is a co-product of LVL-grade veneer production. The need for such material might motivate companies to keep plywood plants operating, much as some softwood sawmills continue in times of weak markets to supply pulp chips for more critical pulp operations.

That leaves a third option, which is to try to grow the market. As discussed in the section on potential for structural panels above, the greatest latent demand for panels is in siding. Siding is a competitive market where the amount of maintenance over a product's lifetime, its installation costs, and its appearance are the main considerations. Vinyl, aluminum, steel, brick, and stone, as well as wooden boards, fiber-cement boards, hardboard, plywood, and OSB are the main siding products.

On a cost continuum, wood-based panels occupy low- to mid-level positions along with vinyl and fiber-cement. Among structural panels, OSB siding is somewhat more cost competitive whereas plywood offers a more natural appearance. Both are vulnerable to moisture problems. Vinyl is regarded as the most maintenance-free product at this price range, and fiber-cement sidings also often come with a 50-year warranty. This suggests a need for research on the micro- and nanostructure of wood that would enable the production of natural wood fiber sidings with durability and moisture-resistant properties similar to vinyl- and cement-based products. Improvements in panel shrinkage properties could also open opportunities in other uses such as concrete forming.

Alternatively, North American producers could try to widen their marketing horizons to export markets. This is an opportunity in which currency exchange rates are critical. In part because of a large and persistent balance of trade deficit, the U.S. dollar has been weakening and is apt to weaken more as part of a necessary rebalancing of global trade flows. This affords an opportunity to U.S. producers to gain in overseas markets. Historically, the domestic market has been so large that U.S. producers have been content to focus solely on it, and most trade flows in recent years have been in the incoming direction on the import side of the ledger. North American and overseas panel size standards also differ, which means that a plant geared for 4- by 8-ft panels would have to sacrifice some volume to make smaller metric sizes. However, some far-seeing managers have built OSB plants with an extra size increment to allow seamless manufacturing of metric-sized panels without any loss in volume. Unfortunately, many of these plants were built in Canada, where the exchange rate trends are not as favorable. Still, the prospect of a weaker dollar should help reduce the trade imbalance in structural panels and reduce some supply pressure.

The trends described herein also have significant ramifications for forest management. The decline in plywood output means that the market for larger peeler logs from big trees has shrunk. Similar products that can be made from small pulpwood-sized bolts means that the price premium enjoyed by bigger trees may decrease, shifting the economically optimum tree-growing rotations to shorter intervals. On the other hand, woodland managers have a new and growing utilization option for their harder to use, low-density tree species. Aspen, red maple, yellow poplar, sweetgum, sycamore, box elder, and other fast-growing, pioneer-type tree species can now generate revenue from OSB plants seeking these kinds of materials as input to their product.

## Literature Cited

Adair, Craig. 2004. Regional production and market outlook—structural panels and engineered wood products, 2004–2009. APA Economics Report 170. Tacoma, WA: APA – The Engineered Wood Association. 59 p.

Faust, Timothy D.; Rice, J.T. 1987. Effects of variable glue application rate on bond quality and resin consumption. Forest Products Journal. 37(7–8):64–70.

Forest Resources Association. 2000–2004. Annual Pulpwood Statistics Summary Report. Rockville MD: Forest Resources Association.

Madison's Canadian Lumber Reporter. 2004. Madison's Canadian lumber directory–45th ed. Vancouver, British Columbia: Madison's Canadian Lumber Reporter.

McKeever, David B.; Adair, Craig. 1998. Wood products used in new nonresidential building construction, 1995. Tacoma, WA: APA – The Engineered Wood Association. 60 p.

McKeever, David B.; Adair, Craig; O'Connor, Jennifer. 2006. Wood products used in the construction of low-rise nonresidential buildings in the United States, 2003. Tacoma, WA: APA – The Engineered Wood Association. 65 p.

Random Lengths Publications, Inc. 2005. The big book. Eugene, OR: Random Lengths Publications, Inc.

RISI. 2005. Crow's Weekly Market Report. Boston: RISI. http://www.risiinfo.com/corporate/

Schletz, Klaus-Peter. 2005. Mattenvorwärmung von Siempelkamp in der Praxis Erfolgreich. MDF-Supplement von Holz-Zentralblatt. DRW-Verlag Weinbrenner, Leinfelden-Echterdingen, Germany.

Spelter, Henry; McKeever, David B.; Durbak, Irene. 1997. Review of wood-based panel sector in United States and Canada. Gen. Tech. Rep. FPL–GTR–99. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 45 p.

Wood Products Promotion Council. 1996. Wood used in new residential construction 1995. Tacoma, WA: APA – The Engineered Wood Association. 95 p.

Wood Products Council. 1999a. Wood used in new residential construction—1998 and 1995. Tacoma, WA: APA – The Engineered Wood Association. 154 p.

Wood Products Council. 1999b. Wood products used in residential repair and remodeling—1997. Tacoma, WA: APA – The Engineered Wood Association. 146 p.

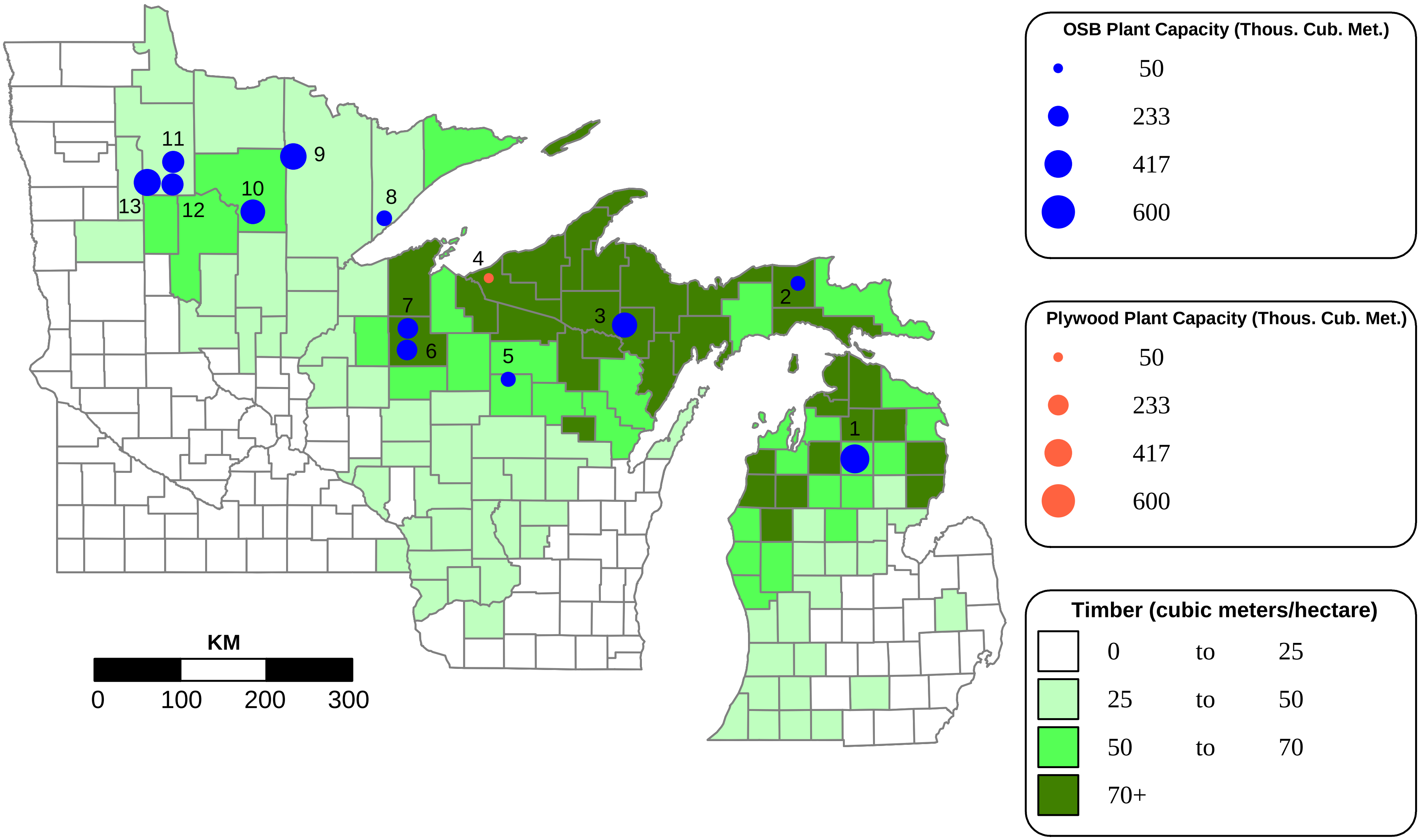
Wood Products Council. 2005a. Wood products used in new residential construction in the U.S. and Canada—2003. Tacoma, WA: APA – The Engineered Wood Association. 102 p.

Wood Products Council. 2005b. Wood products used in residential repair and remodeling in the U.S. and Canada—2003. Tacoma, WA: APA – The Engineered Wood Association. 76 p.

# Appendix—U.S. and Canadian Structural Panel Plants by Region

The following tables and maps show North American (United States and Canada only) structural panel plant locations by capacity (in 1,000 m$^3$) and ownership from 1990 to the present.

# U.S. Midwest
## Timber Inventory and Plywood & OSB Capacity
### (Michigan, Minnesota, Wisconsin)



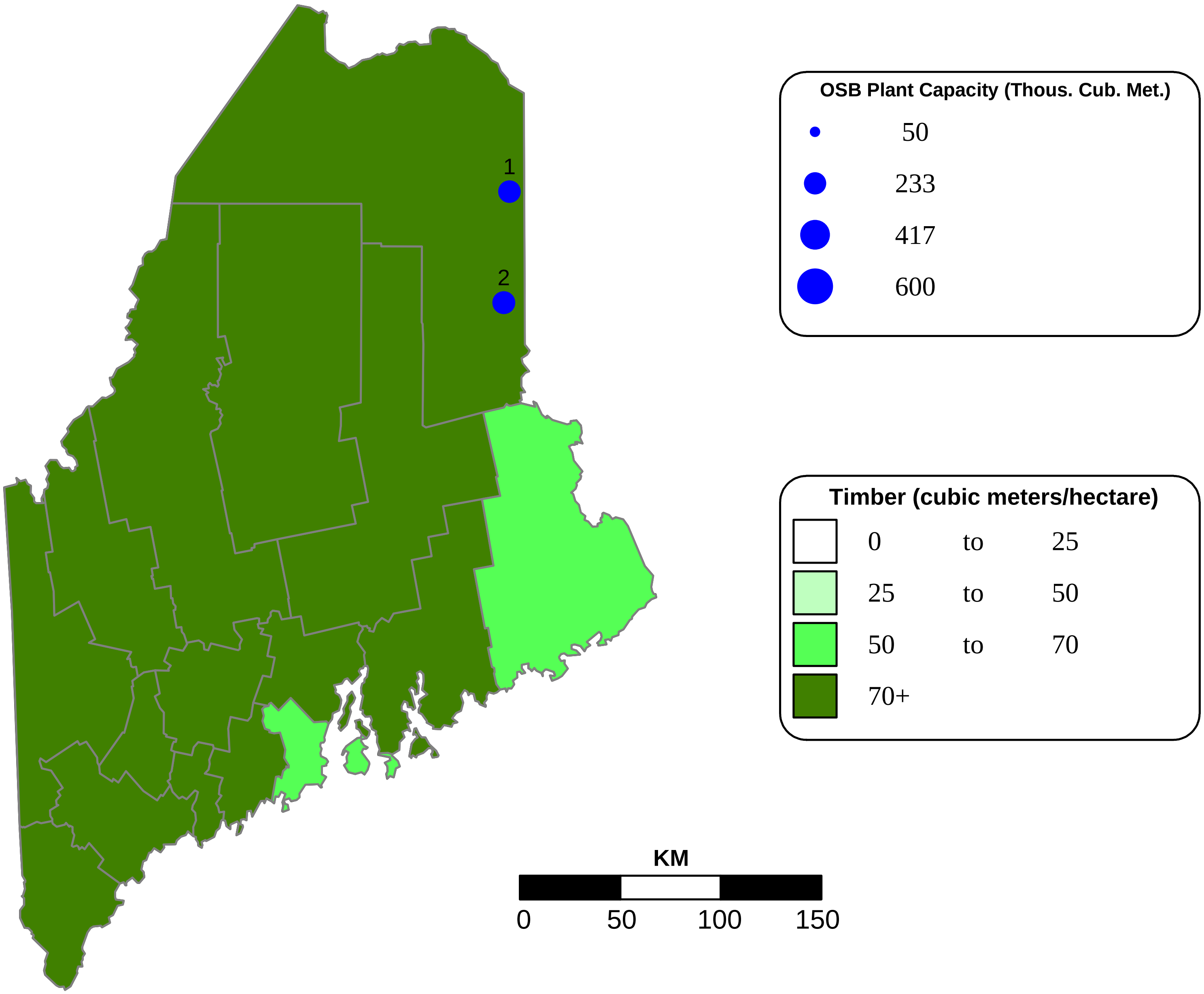
## U.S. Midwest (Michigan, Minnesota, Wisconsin)

| Mill I.D. | Company Name | Former Name or DBA | State | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |  |  |  | **Capacity (1,000 m³)** |  |  |  |  |  |  |  |  |  |  |
| **Plywood** |  |  |  |  |  |  |  |  |  |  | Operating Mills |  |  |  |  |  |  |  |  |  |  |
| 4 | Bessemer Plywd |  | Mi | Bessemer | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
|  | **TOTAL** |  |  |  | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| **OSB** |  |  |  |  |  |  |  |  |  |  | Operating Mills |  |  |  |  |  |  |  |  |  |  |
| 1 | Weyerhaeuser |  | Mi | Grayling | 266 | 266 | 266 | 319 | 327 | 336 | 345 | 363 | 389 | 398 | 398 | 407 | 425 | 443 | 451 | 456 | 456 |
| 2 | L-P |  | Mi | Newberry | 71 | 106 | 106 | 106 | 106 | 106 | 111 | 115 | 115 | 115 | 115 | 111 | 115 | 115 | 119 | 119 | 119 |
| 3 | L-P |  | Mi | Sagola | 319 | 319 | 319 | 319 | 319 | 310 | 310 | 332 | 332 | 332 | 332 | 332 | 332 | 336 | 341 | 345 | 345 |
| 11 | Ainsworth | Potlatch | Mn | Bemidji I | 195 | 195 | 199 | 204 | 208 | 212 | 212 | 212 | 220 | 220 | 226 | 226 | 230 | 230 | 235 | 248 | 266 |
| 12 | Ainsworth | Potlatch | Mn | Bemidji II | 106 | 195 | 199 | 204 | 208 | 220 | 220 | 220 | 220 | 220 | 226 | 226 | 230 | 230 | 235 | 248 | 266 |
| 9 | Ainsworth | Potlatch | Mn | Cook | 168 | 168 | 186 | 212 | 212 | 215 | 215 | 215 | 215 | 221 | 221 | 310 | 372 | 381 | 381 | 381 | 381 |
| 10 | Ainsworth | Potlatch | Mn | Gr Rapids | 301 | 301 | 301 | 301 | 301 | 310 | 310 | 310 | 310 | 310 | 314 | 314 | 327 | 332 | 332 | 332 | 332 |
| 13 | Norbord | Nexfor | Mn | Solway | 230 | 230 | 230 | 239 | 239 | 266 | 294 | 310 | 327 | 327 | 327 | 336 | 345 | 385 | 389 | 389 | 398 |
| 8 | L-P |  | Mn | Two-Harbors | 115 | 115 | 115 | 115 | 115 | 119 | 119 | 119 | 119 | 119 | 119 | 119 | 124 | 124 | 128 | 133 | 133 |
| 7 | L-P |  | Wi | Hayward I | 204 | 204 | 204 | 204 | 204 | 212 | 221 | 221 | 221 | 221 | 221 | 221 | 221 | 221 | 230 | 230 | 230 |
| 6 | L-P |  | Wi | Hayward II | 204 | 204 | 204 | 204 | 204 | 212 | 221 | 221 | 221 | 221 | 221 | 221 | 221 | 221 | 230 | 230 | 230 |
| 5 | L-P |  | Wi | Tomahawk |  |  |  | 106 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 |
|  | **TOTAL** |  |  |  | 2177 | 2301 | 2328 | 2531 | 2567 | 2643 | 2703 | 2763 | 2814 | 2830 | 2845 | 2947 | 3067 | 3142 | 3195 | 3235 | 3279 |
| TOTAL PLYWOOD AND OSB |  |  |  |  | 2230 | 2354 | 2381 | 2584 | 2620 | 2697 | 2756 | 2816 | 2867 | 2883 | 2898 | 3000 | 3120 | 3195 | 3248 | 3288 | 3332 |
|  |  |  |  |  |  |  |  |  |  |  | **Employment** |  |  |  |  |  |  |  |  |  |  |
| Plywood |  |  |  |  | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| OSB |  |  |  |  | 1250 | 1250 | 1250 | 1380 | 1380 | 1390 | 1330 | 1350 | 1320 | 1320 | 1320 | 1320 | 1330 | 1510 | 1510 | 1560 | 1560 |
| Total employment |  |  |  |  | 1350 | 1350 | 1350 | 1480 | 1480 | 1490 | 1430 | 1450 | 1470 | 1470 | 1470 | 1470 | 1480 | 1660 | 1660 | 1710 | 1710 |

# U.S. Northeast

## Timber Inventory and Plywood & OSB Capacity

## (Maine)



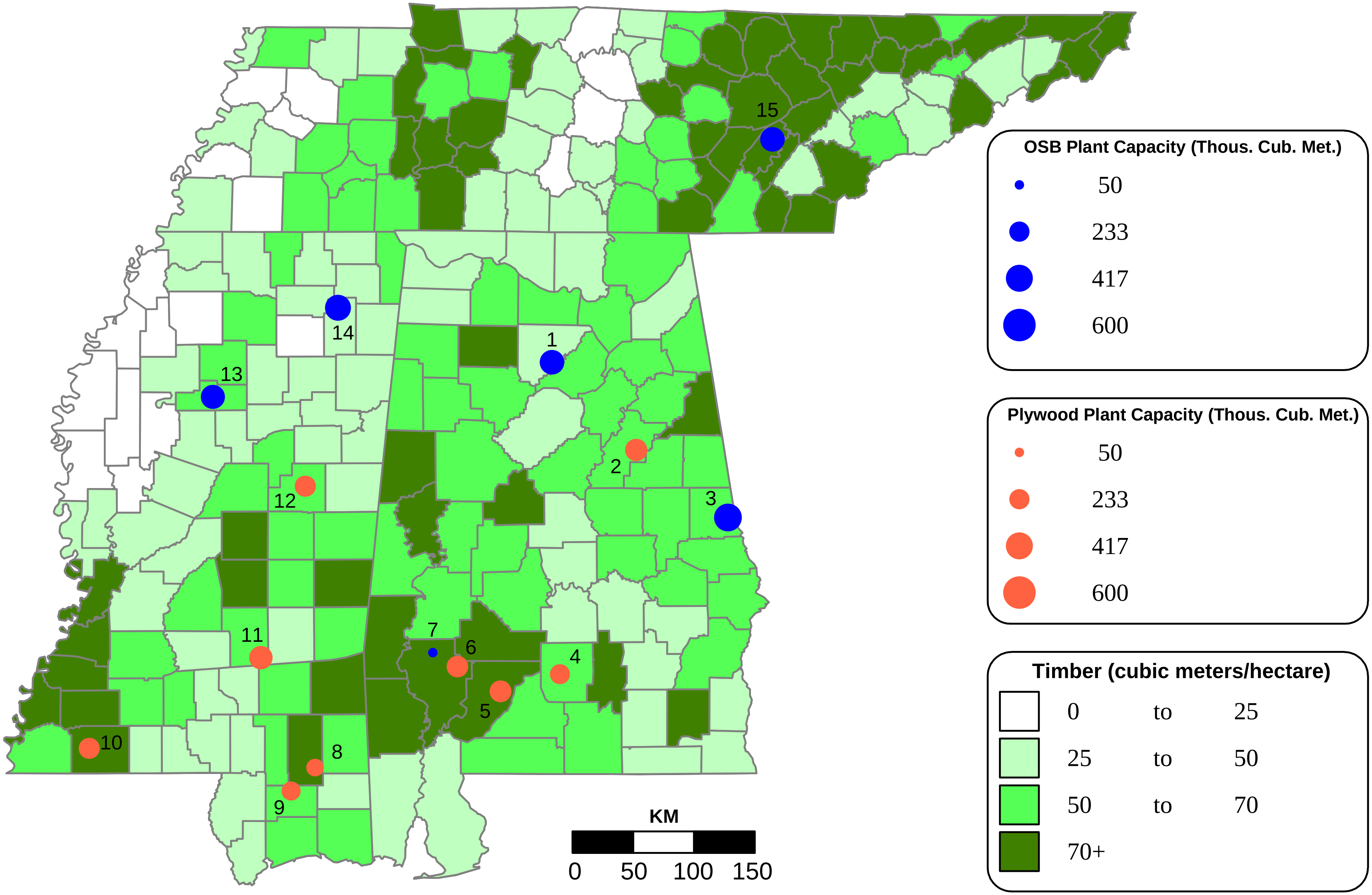
## U.S. Northeast (Maine)

| Mill I.D. | Company Name | Former Name or DBA | State | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | **Capacity (1,000 $m^3$)** | | | | | | | | | | |
| **OSB** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | L-P | G-P | Me | Woodland | 137 | 137 | 137 | 137 | 177 | 177 | 190 | 190 | 142 | 243 | 243 | 243 | 243 | 239 | 239 | 89 | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 1 | Huber | | Me | Easton | 164 | 164 | 164 | 164 | 164 | 164 | 164 | 164 | 177 | 177 | 177 | 177 | 221 | 239 | 239 | 239 | 239 |
| 2 | L-P | | Me | Houlton | 164 | 164 | 177 | 177 | 217 | 230 | 230 | 230 | 230 | 230 | 239 | 239 | 239 | 243 | 248 | 248 | 248 |
| | **TOTAL** | | | | 465 | 465 | 478 | 478 | 558 | 571 | 584 | 584 | 549 | 650 | 659 | 659 | 704 | 721 | 726 | 575 | 487 |
| TOTAL PLYWOOD AND OSB | | | | | 465 | 465 | 478 | 478 | 558 | 571 | 584 | 584 | 549 | 650 | 659 | 659 | 704 | 721 | 726 | 575 | 487 |
| | | | | | | | | | | | **Employment** | | | | | | | | | | |
| OSB | | | | | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 260 | 260 |
| Total employment | | | | | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 380 | 260 | 260 |

# U.S. South Central

## Timber Inventory and Plywood & OSB Capacity

### (Alabama, Mississippi, Tennessee)



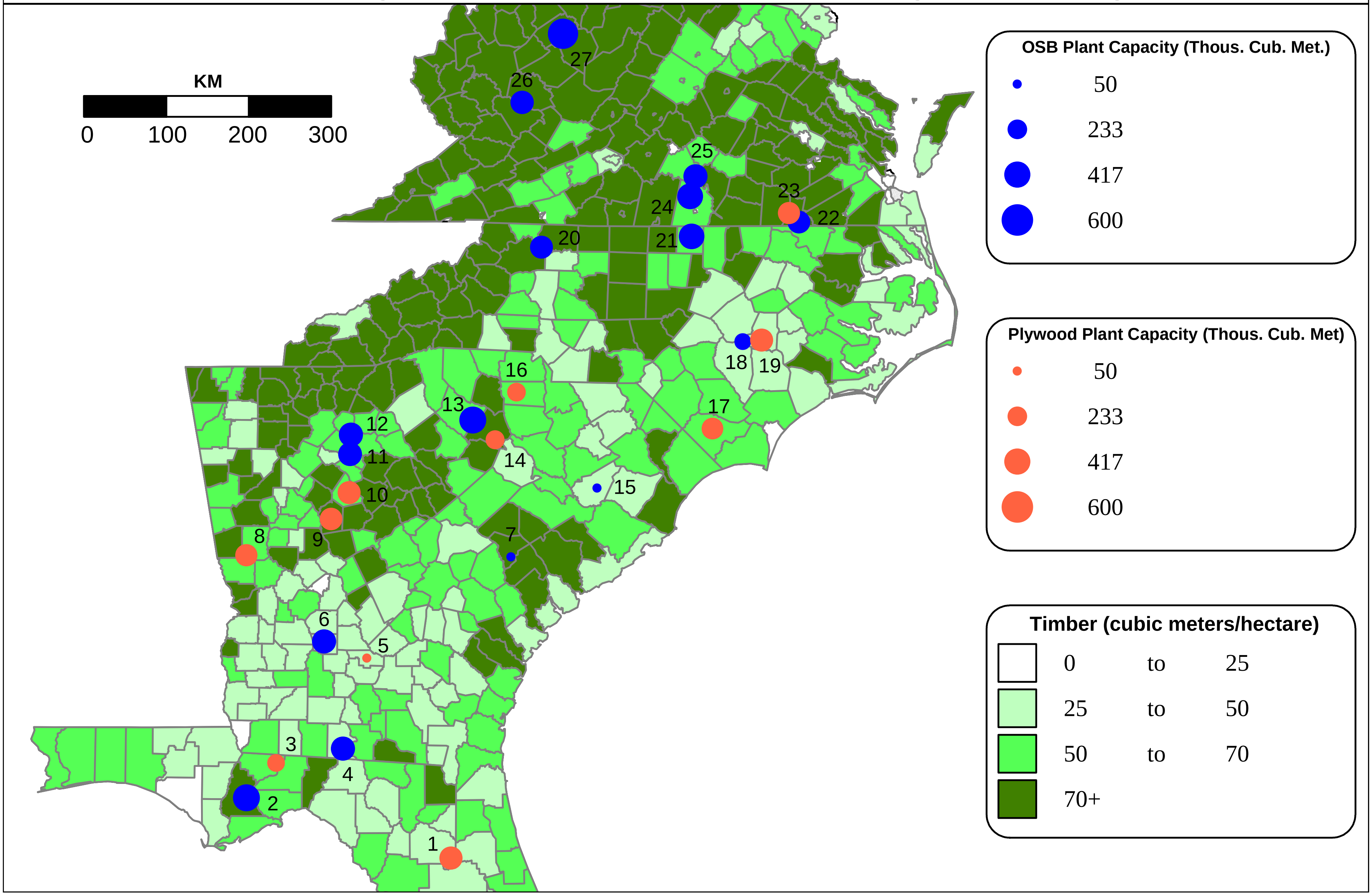
## U.S. Southcentral (Alabama, Mississippi, Tennessee)

| Mill I.D. | Company Name | Former Name or DBA | State | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | **Capacity (1,000 m³)** | | | | | | | | | | |
| **Plywood** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | Weyerhaeuser | | Ms | Philadelphia | 75 | 75 | 75 | 75 | | 115 | 115 | 89 | | | | | | | | | |
| | Weyerhaeuser | | Al | Millport | 111 | 115 | 115 | 115 | 115 | 128 | 140 | 140 | 140 | 140 | 140 | 142 | 147 | 37 | | | |
| | Weyerhaeuser | McM-Bloedel | Al | Pine Hill | 119 | 122 | 124 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | | | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 6 | Scotch | | Al | Fulton | 235 | 235 | 235 | 235 | 251 | 257 | 257 | 257 | 257 | 257 | 257 | 266 | 266 | 266 | 266 | 266 | 266 |
| 5 | G-P | | Al | Peterman/Monroe | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 |
| 4 | I-P | Union-Camp | Al | Chapman | 186 | 186 | 186 | 186 | 212 | 221 | 221 | 221 | 221 | 221 | 221 | 226 | 226 | 226 | 226 | 226 | 226 |
| 2 | G-P | | Al | Talladega | 274 | 283 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 289 | 285 | 285 | 285 | 285 | 285 |
| 11 | G-P | | Ms | Taylorsville | 305 | 305 | 305 | 305 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 323 | 314 | 314 | 314 | 314 | 314 |
| 8 | Hood Indust | Delta Pine | Ms | Beaumont | 124 | 124 | 124 | 155 | 161 | 178 | 178 | 150 | 178 | 178 | 177 | 177 | 177 | 177 | 177 | 177 | 177 |
| 12 | G-P | | Ms | Louisville | 258 | 258 | 258 | 258 | 258 | 258 | 258 | 258 | 258 | 258 | 258 | | 133 | 257 | 257 | 257 | 257 |
| 10 | G-P | | Ms | Gloster | 248 | 248 | 248 | 248 | 248 | 257 | 261 | 261 | 261 | 261 | 261 | 266 | 252 | 252 | 252 | 26 | 252 |
| 9 | Hood Indust | I-P | Ms | Wiggins | 195 | 195 | 181 | 181 | 181 | 187 | 187 | 199 | 199 | 199 | 199 | 208 | 208 | 208 | 208 | 208 | 208 |
| | **TOTAL** | | | | 2405 | 2420 | 2415 | 2464 | 2456 | 2629 | 2645 | 2604 | 2543 | 2543 | 2542 | 2312 | 2423 | 2437 | 2259 | 2032 | 2259 |
| **OSB** | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 1 | L-P | | Al | Hanceville | | | | | 236 | 310 | 310 | 310 | 310 | 310 | 319 | 319 | 319 | 323 | 323 | 345 | 345 |
| 7 | L-P | | Al | Thomasville | | | | | | | | | | | | | | | | | |
| 3 | Norbord | | Al | Huguley | | | | | | | | | | | | 221 | 420 | 425 | 443 | 443 | 443 |
| 14 | Norbord | | Ms | Guntown | | | | | | 89 | 310 | 363 | 363 | 363 | 363 | 363 | 363 | 363 | 381 | 385 | 385 |
| 13 | G-P | | Ms | Grenada | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 274 | 274 | 274 | 274 | 310 | 332 | 332 | 332 | 332 |
| 15 | Huber | | Tn | Spring City | | | | | | | | 195 | 319 | 319 | 319 | 319 | 327 | 327 | 345 | 345 | 345 |
| | **TOTAL** | | | | 266 | 266 | 266 | 266 | 502 | 664 | 885 | 1133 | 1266 | 1266 | 1274 | 1496 | 1739 | 1770 | 1823 | 1850 | 1850 |
| TOTAL PLYWOOD AND OSB | | | | | 2670 | 2686 | 2681 | 2729 | 2958 | 3293 | 3530 | 3736 | 3808 | 3808 | 3816 | 3807 | 4162 | 4207 | 4082 | 3882 | 4108 |
| | | | | | | | | | | | **Employment** | | | | | | | | | | |
| Plywood | | | | | 3500 | 3500 | 3500 | 3500 | 3300 | 3600 | 3600 | 3600 | 3400 | 3400 | 3400 | 3100 | 3400 | 3100 | 2900 | 2600 | 2900 |
| OSB | | | | | 120 | 120 | 120 | 120 | 250 | 370 | 370 | 500 | 500 | 500 | 500 | 630 | 630 | 630 | 630 | 630 | 630 |
| Total employment | | | | | 3620 | 3620 | 3620 | 3620 | 3550 | 3970 | 3970 | 4100 | 3900 | 3900 | 3900 | 3730 | 4030 | 3730 | 3530 | 3230 | 3530 |

# U.S. Southeast

## Timber Inventory and Plywood & OSB Capacity

## (Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia)



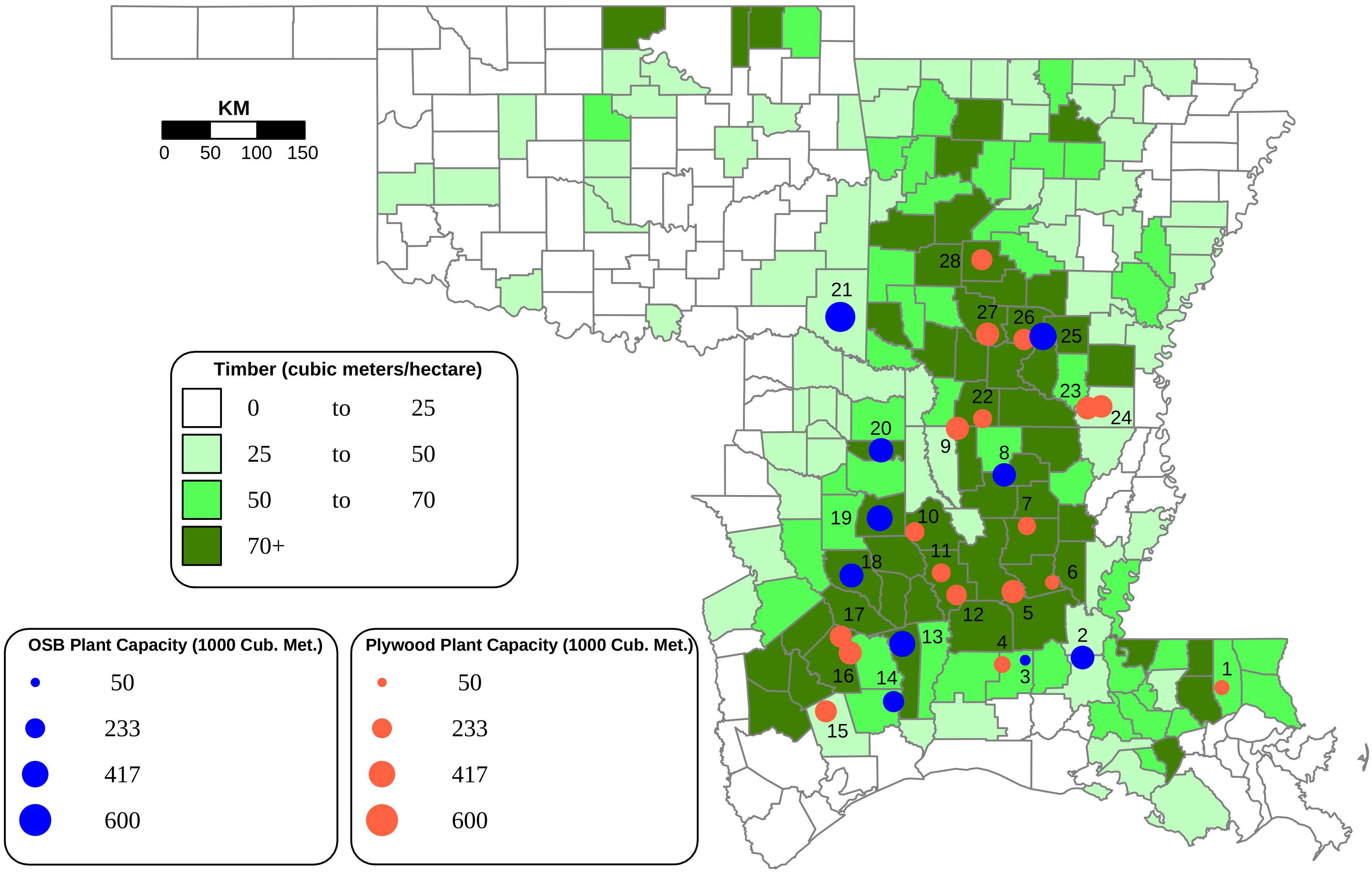
## U.S. Southeast (Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia)

| Mill I.D. | Company Name | Former Name or DBA | State | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |  |  |  | **Capacity (1,000 m³)** |  |  |  |  |  |  |  |  |  |  |
| **Plywood** |  |  |  |  |  |  |  |  |  |  | Closed Mills |  |  |  |  |  |  |  |  |  |  |
|  | Weyerhaeuser |  | Nc | Jacksonville | 137 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | G-P | Gt Northern | Ga | Cedar Springs | 142 | 142 | 142 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Weyerhaeuser |  | Nc | Plymouth | 97 | 97 | 97 | 97 | 97 | 111 | 124 | 80 |  |  |  |  |  |  |  |  |  |
|  | Willamette | B-C | Nc | Moncure | 97 | 97 | 97 | 97 | 119 | 119 | 119 | 119 | 119 | 44 |  |  |  |  |  |  |  |
|  | I-P | Champion Int | Ga | Waycross | 89 | 89 | 87 | 133 | 137 | 133 | 133 | 133 | 133 | 142 | 128 |  |  |  |  |  |  |
|  | G-P |  | Sc | Russelville | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  | Operating Mills |  |  |  |  |  |  |  |  |  |  |
| 3 | Coastal |  | Fl | Havana | 127 | 126 | 135 | 144 | 142 | 168 | 177 | 177 | 186 | 186 | 186 | 186 | 186 | 190 | 190 | 190 | 190 |
| 1 | G-P |  | Fl | Hawthorne | 243 | 243 | 243 | 243 | 257 | 288 | 326 | 334 | 332 | 332 | 332 | 332 | 327 | 327 | 327 | 327 | 327 |
| 5 | S Veneer Prod | Springfield | Ga | Fitzgerald |  |  |  |  |  | 40 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| 10 | G-P | GA Kraft | Ga | Madison | 274 | 274 | 310 | 319 | 319 | 319 | 319 | 324 | 324 | 324 | 324 | 324 | 325 | 325 | 325 | 325 | 325 |
| 9 | G-P |  | Ga | Monticello | 274 | 274 | 274 | 274 | 230 | 239 | 239 | 239 | 239 | 239 | 239 | 239 | 307 | 307 | 307 | 307 | 307 |
| 8 | G-P |  | Ga | Warm Springs | 261 | 261 | 261 | 261 | 261 | 301 | 301 | 301 | 301 | 301 | 301 | 301 | 301 | 301 | 301 | 301 | 301 |
| 19 | G-P |  | Nc | Dudley | 226 | 227 | 227 | 243 | 292 | 301 | 301 | 301 | 301 | 301 | 301 | 301 | 324 | 324 | 324 | 324 | 324 |
| 17 | G-P |  | Nc | Whiteville | 248 | 248 | 248 | 248 | 270 | 274 | 274 | 288 | 288 | 288 | 288 | 288 | 288 | 288 | 288 | 288 | 288 |
| 16 | Chester Wood | Weyerhaeuser | Sc | Chester | 208 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 |
| 14 | G-P |  | Sc | Prosperity | 199 | 218 | 218 | 218 | 218 | 218 | 218 | 218 | 218 | 218 | 218 | 218 | 221 | 221 | 221 | 221 | 218 |
| 23 | G-P |  | Va | Emporia | 261 | 266 | 281 | 281 | 281 | 281 | 281 | 281 | 281 | 281 | 281 | 283 | 297 | 297 | 297 | 297 | 297 |
|  | **TOTAL** |  |  |  | 3127 | 3018 | 3075 | 3014 | 3077 | 3245 | 3314 | 3297 | 3224 | 3159 | 3101 | 2732 | 2837 | 2842 | 2842 | 2842 | 2838 |
| **OSB** |  |  |  |  |  |  |  |  |  |  | Closed Mills |  |  |  |  |  |  |  |  |  |  |
|  | L-P |  | Va | Dungannon | 106 | 106 | 106 | 106 | 106 | 111 | 111 |  |  |  |  |  |  |  |  |  |  |
|  | Langboard |  | Ga | Quitman | 150 | 159 | 164 | 164 | 190 | 190 | 168 | 186 | 187 | 187 | 187 | 187 | 199 | 199 | 204 | 204 |  |
|  |  |  |  |  |  |  | Operating Mills |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | G-P |  | Fl | Hosford |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 199 | 443 |
| 11 | L-P |  | Ga | Athens | 283 | 283 | 283 | 283 | 283 | 288 | 288 | 288 | 288 | 310 | 319 | 323 | 323 | 323 | 341 | 345 | 345 |
| 12 | Huber |  | Ga | Commerce | 253 | 253 | 253 | 253 | 253 | 253 | 253 | 266 | 266 | 266 | 292 | 301 | 301 | 301 | 301 | 354 | 354 |
| 6 | Norbord | I-P | Ga | Cordele | 243 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 270 | 288 | 323 | 354 | 354 | 354 |
| 4 | Langboard |  | Ga | Quitman |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 354 |
| 18 | G-P |  | Nc | Dudley | 111 | 111 | 111 | 124 | 124 | 124 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 |
| 20 | Weyerhaeuser |  | Nc | Elkin | 199 | 199 | 204 | 221 | 230 | 230 | 257 | 291 | 291 | 291 | 291 | 291 | 296 | 310 | 310 | 319 | 319 |
| 21 | L-P |  | Nc | Roxboro |  |  |  |  |  |  | 292 | 332 | 336 | 336 | 354 | 376 | 398 | 398 | 398 | 398 | 398 |
| 7 | Grant |  | Sc | Fairfax/Allendale |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 22 |
| 13 | Norbord |  | Sc | Joanna/Kinards |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 | Grant |  | Sc | Manning/Clarendon |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | G-P |  | Va | Brookneal |  |  |  |  |  |  | 239 | 288 | 305 | 319 | 319 | 319 | 336 | 345 | 354 | 354 | 354 |
| 24 | Huber |  | Va | Crystal Hill |  |  |  |  |  | 221 | 301 | 301 | 310 | 319 | 319 | 319 | 336 | 336 | 389 | 407 | 407 |
| 22 | G-P |  | Va | Skippers | 266 | 266 | 292 | 292 | 292 | 309 | 309 | 309 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 314 |
| 26 | G-P |  | Wv | Mt Hope |  |  |  |  |  | 183 | 314 | 314 | 314 | 314 | 314 | 314 | 314 | 332 | 332 | 332 | 332 |
| 27 | Weyerhaeuser |  | Wv | Sutton/Heaters |  |  |  |  |  |  | 168 | 420 | 434 | 443 | 496 | 513 | 513 | 531 | 540 | 558 | 558 |
|  | **TOTAL** |  |  |  | 1612 | 3002 | 3064 | 3126 | 3192 | 3631 | 5015 | 6291 | 6729 | 6831 | 6991 | 7150 | 7296 | 7469 | 7686 | 8107 | 8823 |
| TOTAL PLYWOOD AND OSB |  |  |  |  | 4738 | 6020 | 6139 | 6140 | 6269 | 6876 | 8330 | 9587 | 9953 | 9990 | 10092 | 9882 | 10133 | 10311 | 10528 | 10948 | 11662 |
|  |  |  |  |  |  |  | **Employment** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Plywood |  |  |  |  | 4300 | 4100 | 4100 | 3900 | 4000 | 4000 | 4000 | 3900 | 3700 | 3500 | 3500 | 3300 | 3300 | 3400 | 3400 | 3400 | 3400 |
| OSB |  |  |  |  | 1060 | 1060 | 1060 | 1060 | 1070 | 1320 | 1740 | 1610 | 1590 | 1590 | 1720 | 1720 | 1720 | 1720 | 1720 | 1840 | 1860 |
| Total employment |  |  |  |  | 5360 | 5160 | 5160 | 4960 | 5070 | 5320 | 5740 | 5510 | 5290 | 5090 | 5220 | 5020 | 5020 | 5120 | 5120 | 5240 | 5260 |

# U.S. Southwest

## Timber Inventory and Plywood & OSB Capacity

(Oklahoma, Arkansas, Eastern Texas, Louisiana)



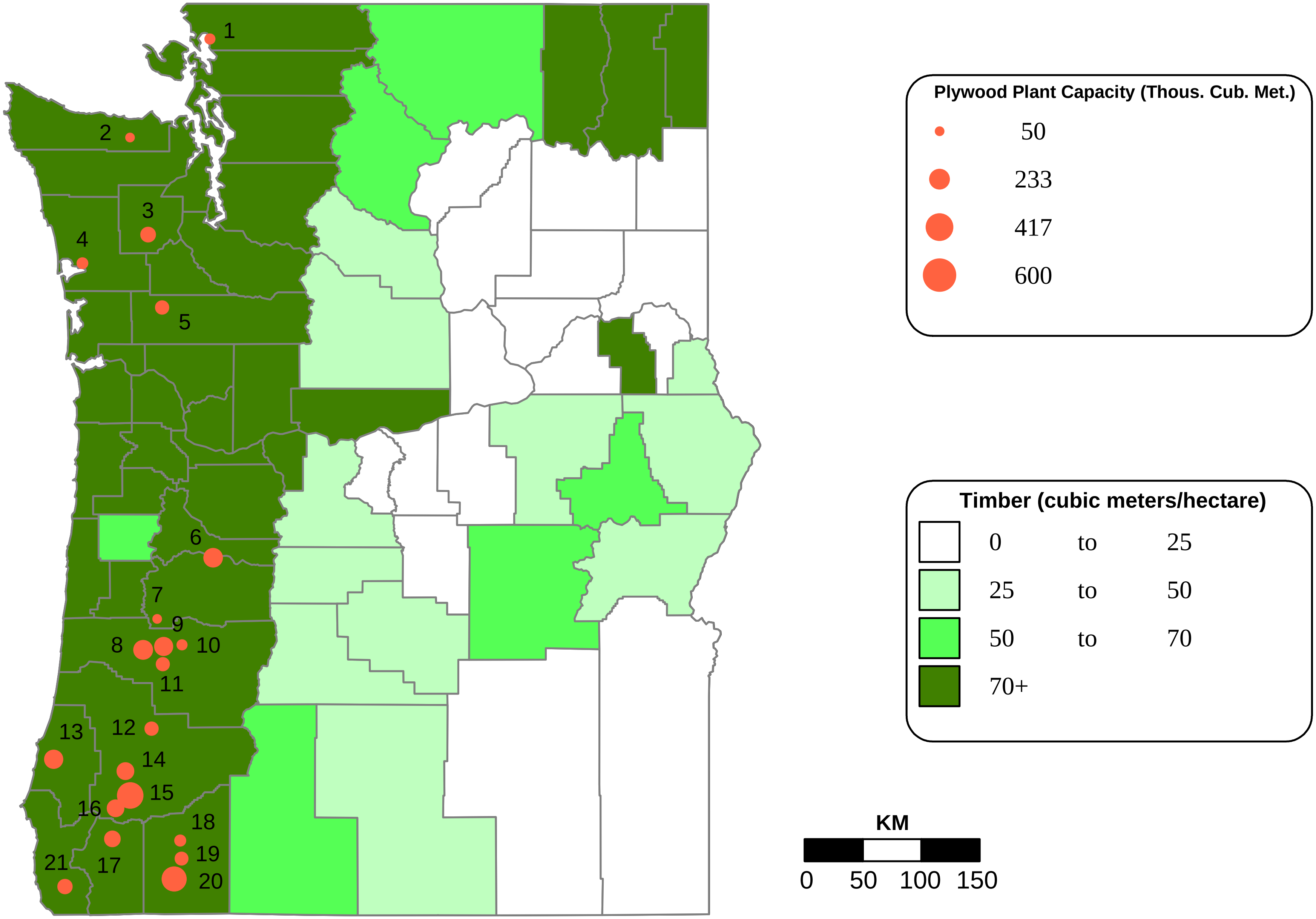
## U.S. Southwest (Texas, Oklahoma, Arkansas, Louisiana)

| Mill I.D. | Company Name | Former Name or DBA | State | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Capacity (1,000 m³) | | | | | | | | | | |
| **Plywood** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | L-P | Angelina | Tx | Lufkin, Keltys | 168 | 168 | 142 | 142 | 150 | 155 | 155 | 111 | | | | | | | | | |
| | Willamette | | La | Taylor | 177 | 186 | 186 | 186 | 186 | 186 | 186 | 124 | | | | | | | | | |
| | L-P | Owens Illinois | Tx | Jasper | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 31 | | | | | | | | | |
| | Plum Creek | Riverwood | La | Joyce | 173 | 173 | 175 | 175 | 175 | 186 | 186 | 186 | 124 | | | | | | | | |
| | Temple | | Tx | Pineland | 177 | 221 | 221 | 221 | 221 | 221 | 235 | 235 | 235 | 235 | 235 | | | | | | |
| | LP | G-P | Tx | New Waverly | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 243 | 243 | 243 | | | | | | |
| | Willamette | Santiam | La | Ruston | 133 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 20 | | | | | |
| | Weyerhaeuser | | Ar | Dierks | 106 | 111 | 111 | 111 | 158 | 158 | 158 | 164 | 164 | 164 | 164 | 89 | | | | | |
| | G-P | L-P | Tx | Bon Wier | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 243 | 142 | | | | |
| | G-P | L-P (form G-P) | La | Urania | 239 | 239 | 239 | 239 | 239 | 212 | 212 | 212 | 177 | 177 | 177 | 177 | 177 | | | | |
| | Weyerhaeuser | | Ok | Wright Cty | 106 | 106 | 142 | 142 | 142 | 146 | 146 | 173 | 173 | 173 | 173 | 173 | 146 | 146 | 146 | 110 | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 1 | Hunt Plywd | | La | Natalbany | 133 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 | 137 |
| 4 | BC | VanPly | La | Oakdale | 230 | 230 | 252 | 252 | 264 | 266 | 266 | 266 | 266 | 266 | 221 | 221 | 221 | 177 | 177 | 168 | 168 |
| 5 | Martco | | La | Chopin | | | | | | 1 | 133 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 319 |
| 6 | Hunt Plywd | | La | Pollock | 102 | 97 | 97 | 97 | 119 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 | 124 |
| 7 | Weyerhaeuser | Willamette | La | Dodson | 173 | 173 | 173 | 173 | 173 | 197 | 197 | 197 | 197 | 197 | 197 | 197 | 197 | 197 | 197 | 197 | 197 |
| 9 | I-P | | La | Springhill | 239 | 239 | 243 | 243 | 266 | 283 | 283 | 283 | 283 | 283 | 283 | 283 | 283 | 283 | 310 | 332 | 332 |
| 10 | G-P | L-P (form G-P) | La | Logansport | 212 | 221 | 221 | 221 | 221 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 221 | 221 | 221 | 221 | 221 |
| 11 | Weyerhaeuser | Willamette | La | Zwolle | 164 | 164 | 169 | 169 | 199 | 200 | 200 | 200 | 133 | 212 | 212 | 212 | 212 | 212 | 212 | 212 | 212 |
| 12 | BC | VanPly | La | Florien | 261 | 263 | 263 | 263 | 270 | 274 | 266 | 266 | 266 | 266 | 274 | 274 | 274 | 252 | 252 | 252 | 252 |
| 15 | G-P | L-P | Tx | Cleveland | 266 | 266 | 266 | 266 | 266 | 230 | 199 | 266 | 266 | 266 | 266 | 266 | 288 | 288 | 288 | 288 | 288 |
| 16 | I-P | Champion Int | Tx | Camden | 279 | 279 | 279 | 279 | 279 | 310 | 310 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 |
| 17 | I-P | Champion Int | Tx | Corrigan | 264 | 266 | 266 | 266 | 266 | 292 | 292 | 301 | 301 | 301 | 301 | 301 | 292 | 292 | 292 | 292 | 292 |
| 22 | Weyerhaeuser | Willamette | Ar | Emerson | 164 | 168 | 170 | 170 | 177 | 208 | 208 | 208 | 217 | 217 | 217 | 217 | 217 | 217 | 217 | 217 | 217 |
| 23 | G-P | | Ar | Crossett #1 | 279 | 279 | 279 | 279 | 292 | 292 | 292 | 292 | 292 | 292 | 292 | 301 | 301 | 301 | 301 | 310 | 310 |
| 24 | G-P | | Ar | Crossett #2 | 283 | 283 | 283 | 283 | 301 | 305 | 305 | 283 | 288 | 288 | 288 | 288 | 288 | 292 | 292 | 301 | 301 |
| 26 | G-P | | Ar | Fordyce | 252 | 252 | 252 | 252 | 252 | 270 | 270 | 270 | 279 | 279 | 279 | 279 | 274 | 274 | 274 | 274 | 274 |
| 27 | I-P | | Ar | Gurdon | 230 | 230 | 243 | 243 | 252 | 252 | 252 | 252 | 252 | 252 | 252 | 252 | 252 | 266 | 310 | 325 | 325 |
| 28 | Weyerhaeuser | | Ar | Mt Pine | 106 | 106 | 106 | 106 | 142 | 159 | 159 | 159 | 164 | 168 | 177 | 243 | 248 | 248 | 248 | 248 | 248 |
| | **TOTAL** | | | | 5557 | 5653 | 5712 | 5712 | 5944 | 6075 | 6180 | 6225 | 5799 | 5760 | 5733 | 5120 | 4906 | 4538 | 4609 | 4619 | 4536 |
| **O S B** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | L-P | | Tx | New Waverly | 80 | 80 | 80 | 80 | 80 | 44 | 44 | | | | | | | | | | |
| | L-P | | Tx | Urania | 97 | 89 | 89 | 89 | 102 | 119 | 119 | 44 | | | | | | | | | |
| | L-P | | Tx | Corrigan | 124 | 119 | 119 | 119 | 119 | 133 | 133 | 124 | | | | | | | | | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 2 | Martco | | La | LeMoyen | 168 | 195 | 212 | 230 | 230 | 230 | 230 | 257 | 257 | 257 | 266 | 310 | 310 | 310 | 310 | 332 | 332 |
| 3 | Martco | | La | Oakdale | | | | | | | | | | | | | | | | | 69 |
| 8 | Weyerhaeuser | Willamette | La | Arcadia | | | | | | | 177 | 283 | 288 | 310 | 310 | 310 | 310 | 310 | 327 | 327 | 327 |
| 13 | L-P | | Tx | Jasper | | | | | | | 18 | 310 | 372 | 385 | 398 | 398 | 398 | 398 | 398 | 398 | 398 |
| 14 | L-P | | Tx | Silsbee | | 71 | 283 | 283 | 283 | 301 | 301 | 301 | 301 | 301 | 301 | 301 | 305 | 305 | 266 | 266 | 266 |
| 18 | Norbord | I-P | Tx | Nacogdoches | 168 | 168 | 168 | 177 | 212 | 212 | 212 | 212 | 248 | 266 | 266 | 283 | 283 | 283 | 292 | 336 | 343 |
| 19 | L-P | | Tx | Carthage | | | | | | | | | 221 | 354 | 376 | 385 | 398 | 398 | 398 | 398 | 398 |
| 20 | Norbord | I-P | Tx | Jefferson | | | | | | | 266 | 296 | 310 | 310 | 310 | 327 | 327 | 327 | 354 | 354 | 354 |
| 21 | Huber | | Ok | Broken Bow | | | | | | | | | | | | | | | 133 | 487 | 531 |
| 25 | G-P | | Ar | Fordyce | | | | | | | | | | | | 363 | 389 | 407 | 443 | 443 | 443 |
| | **TOTAL** | | | | 637 | 721 | 951 | 978 | 1027 | 1040 | 1500 | 1828 | 1996 | 2182 | 2226 | 2677 | 2721 | 2739 | 2921 | 3340 | 3461 |
| TOTAL PLYWOOD AND OSB | | | | | 6194 | 6375 | 6663 | 6690 | 6970 | 7115 | 7680 | 8053 | 7795 | 7941 | 7959 | 7797 | 7627 | 7277 | 7530 | 7959 | 7997 |
| | | | | | | | | | | | **Employment** | | | | | | | | | | |
| Plywood | | | | | 8400 | 8400 | 8400 | 8400 | 8400 | 8400 | 8800 | 8600 | 7900 | 7700 | 7700 | 7100 | 6700 | 6300 | 6200 | 6200 | 5900 |
| OSB | | | | | 660 | 790 | 790 | 790 | 790 | 790 | 1170 | 930 | 950 | 950 | 950 | 1090 | 1090 | 1070 | 1230 | 1230 | 1390 |
| Total employment | | | | | 9060 | 9190 | 9190 | 9190 | 9190 | 9190 | 9970 | 9530 | 8850 | 8650 | 8650 | 8190 | 7790 | 7370 | 7430 | 7430 | 7290 |

# U.S. West (Coast)

## Timber Inventory and Plywood & OSB Capacity

### (Washington, Oregon)



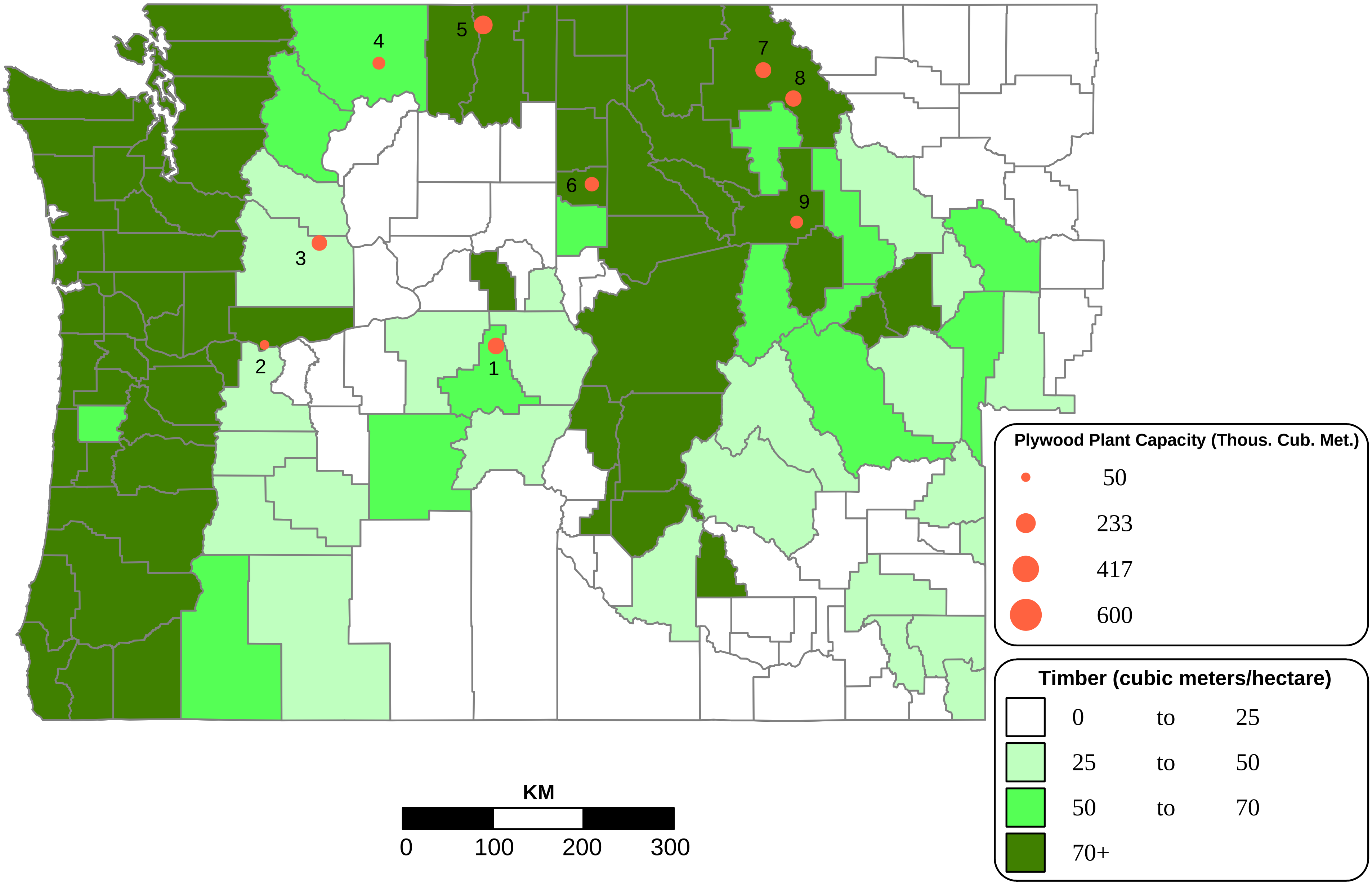
## U.S. West (California, Oregon, Washington)

| Mill I.D. | Company Name | Former Name or DBA | State | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Capacity (1,000 m³) | | | | | | | | | | |
| **Plywood** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | G-P | Smith Wood Prod | Or | Coquille | 89 | | | | | | | | | | | | | | | | |
| | White Plywd | Cascade Plywd | Or | Lebanon | 221 | | | | | | | | | | | | | | | | |
| | Murphy Plywd | West Door & Plywd | Or | Milwaukie | 27 | | | | | | | | | | | | | | | | |
| | Bohemia | | Or | Culp Creek | 44 | | | | | | | | | | | | | | | | |
| | Sun Plywd | Weyerhauser | Or | North Bend | 66 | | | | | | | | | | | | | | | | |
| | Astoria Plywd | | Or | Astoria | 115 | 115 | | | | | | | | | | | | | | | |
| | Bohemia | Drain Plywd | Or | Drain | 119 | 119 | | | | | | | | | | | | | | | |
| | Willamette Indust | Santiam Lumber | Or | Lebanon | 142 | 71 | | | | | | | | | | | | | | | |
| | Kogap Mfg | | Or | Medford | 310 | 310 | | | | | | | | | | | | | | | |
| | Stevenson Co-Ply | Stevenson Plywd | Wa | Stevenson | 111 | 111 | 111 | | | | | | | | | | | | | | |
| | Pugent Sound Plywd | | Wa | Tacoma | 124 | 124 | 80 | | | | | | | | | | | | | | |
| | Custom Plywood Corp | Anacortes Veneer | Wa | Anacortes | 127 | 127 | 124 | | | | | | | | | | | | | | |
| | Seneca Sawmill | US Plywd | Or | Roseburg | 181 | 177 | 177 | | | | | | | | | | | | | | |
| | Roseburg | Interstate Container | Ca | Red Bluff | 102 | 102 | 102 | | | | | | | | | | | | | | |
| | Miller Redwood | Bate Lumber | Or | Merlin | 80 | 80 | 85 | 85 | | | | | | | | | | | | | |
| | Willamette Indust | I-P | Or | Vaughn | 115 | 115 | 124 | 133 | | | | | | | | | | | | | |
| | Medford Corp | | Or | Medford | 204 | 204 | 124 | 124 | | | | | | | | | | | | | |
| | Pac Western Forest Ind | Crown Zellerbach | Or | St. Helens | 195 | 195 | 195 | 195 | | | | | | | | | | | | | |
| | RHD Elma | Elma Plywd | Wa | Elma | 71 | 81 | 81 | 81 | 81 | | | | | | | | | | | | |
| | Stone Forest Indust | Hub City Plywd | Or | Albany | 177 | 177 | 177 | 177 | 177 | | | | | | | | | | | | |
| | Linn Forest Products | Mid-Plywd | Or | Sweet Home | 66 | 66 | 66 | 66 | 66 | | | | | | | | | | | | |
| | Willamette Indust | Santiam Lumber | Or | Sweet Home | 155 | 155 | 155 | 155 | 155 | | | | | | | | | | | | |
| | Brand-S | Leading Plywd | Or | Philomath | 124 | 124 | 124 | 124 | 124 | | | | | | | | | | | | |
| | Textured FP | Ellison's Indust | Wa | Washougal | 18 | 18 | 18 | 18 | 18 | 80 | 80 | | | | | | | | | | |
| | Hardel Mutual Plywd | | Wa | Olympia | 133 | 133 | 133 | 127 | 161 | 143 | 80 | | | | | | | | | | |
| | Fort Vancouver Plywd | Vancouver Plywd | Wa | Vancouver | 142 | 142 | 142 | 115 | 106 | 97 | 22 | | | | | | | | | | |
| | Timber Products | Grants Pass Plywd | Or | Grants Pass | 117 | 117 | 89 | 89 | 106 | 80 | 89 | | | | | | | | | | |
| | BC | | Or | White City | 142 | 142 | 142 | 142 | 142 | 173 | 180 | 180 | | | | | | | | | |
| | Lane Plywd | Willamette Plywd | Or | Eugene | 164 | 164 | 164 | 164 | 93 | 93 | 93 | 93 | | | | | | | | | |
| | Roseburg #1 | | Or | Dillard | 188 | 188 | 188 | 188 | 188 | 188 | 188 | 188 | 188 | 188 | | | | | | | |
| | Willamette Indust | Willamette Valley Lum | Or | Dallas | 168 | 168 | 168 | 168 | 133 | 133 | 134 | 134 | 134 | 134 | 106 | | | | | | |
| | Linnton Plywd Assn | | Or | Portland | 96 | 96 | 89 | 66 | 42 | 53 | 66 | 66 | 66 | 66 | 66 | 66 | | | | | |
| | Fourply | Veneer Prod | Or | Grants Pass | 133 | 133 | 106 | 106 | 106 | 106 | 106 | 71 | 71 | 71 | 71 | 71 | 27 | | | | |
| | Roseburg #3 | Umpqua Plywd | Or | Green | 195 | 195 | 177 | 177 | 204 | 204 | 204 | 204 | 204 | 204 | 204 | 204 | 204 | 170 | | | |
| | Weyerhaeuser | Willamette Indust | Or | Foster | 124 | 124 | 124 | 124 | 127 | 124 | 86 | 86 | 86 | 86 | 89 | 89 | 89 | 89 | 89 | | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 14 | Roseburg #2 | | Or | Dillard | | 159 | 159 | 168 | 168 | 173 | 173 | 173 | 173 | 173 | 173 | 173 | 173 | 173 | 173 | 173 | 173 |
| 17 | Timber Products | US Forest Indust | Or | Grants Pass | 159 | 159 | 159 | 155 | 155 | 152 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 19 | 150 | 150 | 150 |
| 13 | Roseburg #6 | Coquille Plywd | Or | Coquille | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 | 199 |
| 21 | Pacific Wood Lam | South Coast Lum | Or | Brookings | 133 | 133 | 111 | 106 | 111 | 111 | 111 | 124 | 124 | 124 | 124 | 128 | 128 | 128 | 128 | 128 | 128 |
| 19 | Med-Ply | Medford Veneer & Plywd | Or | White City | 106 | 93 | 106 | 106 | 106 | 111 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 |
| 8 | Emerald FP | Snellstrom Lumber | Or | Eugene | 133 | 133 | 133 | 138 | 168 | 177 | 177 | 177 | 177 | 177 | 177 | 177 | 177 | 221 | 221 | 221 | 212 |
| 12 | Murphy | Sutherlin Plywd | Or | Sutherlin | 149 | 127 | 127 | 127 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 66 | 111 |
| 18 | TImber Products | White City Plywd #1 | Or | White City | 53 | 53 | 58 | 69 | 66 | 72 | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 78 | 78 |
| 9 | McKenzie For Prod | Springfield For Prod | Or | Springfield | 168 | 177 | 195 | 212 | 230 | 221 | 196 | 196 | 196 | 196 | 196 | 196 | 196 | 196 | 196 | 196 | 196 |
| 10 | Rosboro Lumber | | Or | Springfield | 89 | 89 | 89 | 89 | | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| 16 | Superior Plywd | Glendale Plywd | Or | Glendale | 186 | 186 | 186 | 186 | 195 | 195 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 | 168 |
| 6 | Freres Lumber | North Santiam Plywd | Or | Mill City | 159 | 150 | 150 | 159 | 159 | 159 | 159 | 143 | 119 | 142 | 159 | 168 | 177 | 186 | 199 | 208 | 208 |
| 20 | BC | Elk Lumber | Or | Medford | 288 | 288 | 288 | 286 | 310 | 319 | 338 | 341 | 177 | 341 | 341 | 341 | 341 | 341 | 341 | 341 | 341 |
| 11 | Weyerhaeuser | Willamette Indust | Or | Springfield | 111 | 111 | 111 | 111 | 112 | 111 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 | 108 |
| 15 | Roseburg #4 | | Or | Riddle | 416 | 416 | 363 | 381 | 381 | 381 | 381 | 381 | 381 | 381 | 381 | 381 | 381 | 381 | 381 | 381 | 381 |
| 7 | Eagle Veneer | | Or | Harrisburg | | 31 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 49 | 49 | 49 | 49 |
| 5 | Hardel Mutual Plywd | | Wa | Chehalis | | | | | | | | 53 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 | 111 |
| 1 | Mt Baker Plywd | | Wa | Bellingham | 31 | 62 | 62 | 62 | 62 | 62 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| 4 | Hoquiam Plywd | Woodlawn Plywd | Wa | Hoquiam | 93 | 93 | 89 | 80 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| 2 | K-Ply | Peninsula Plywd | Wa | Pt Angeles | 71 | 71 | 53 | 53 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 |
| 3 | Olympic Panel Prod | Simpson Timber | Wa | Shelton | 111 | 111 | 124 | 148 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 143 | 134 |
| | **TOTAL** | | | | 7234 | 6909 | 6064 | 5500 | 4891 | 4421 | 4246 | 3994 | 3591 | 3777 | 3582 | 3489 | 3387 | 3251 | 3226 | 3079 | 3105 |
| TOTAL PLYWOOD AND OSB | | | | | 7234 | 6909 | 6064 | 5500 | 4891 | 4421 | 4246 | 3994 | 3591 | 3777 | 3582 | 3489 | 3387 | 3251 | 3226 | 3079 | 3105 |
| | | | | | | | | | | | **Employment** | | | | | | | | | | |
| Total employment | | | | | 13200 | 12100 | 11200 | 9900 | 8600 | 7800 | 7700 | 7200 | 6500 | 6300 | 6100 | 5900 | 5600 | 5300 | 5300 | 5300 | 5300 |

# U.S. West (Interior)

## Timber Inventory and Plywood & OSB Capacity

### (Washington, Oregon, Idaho, Montana)



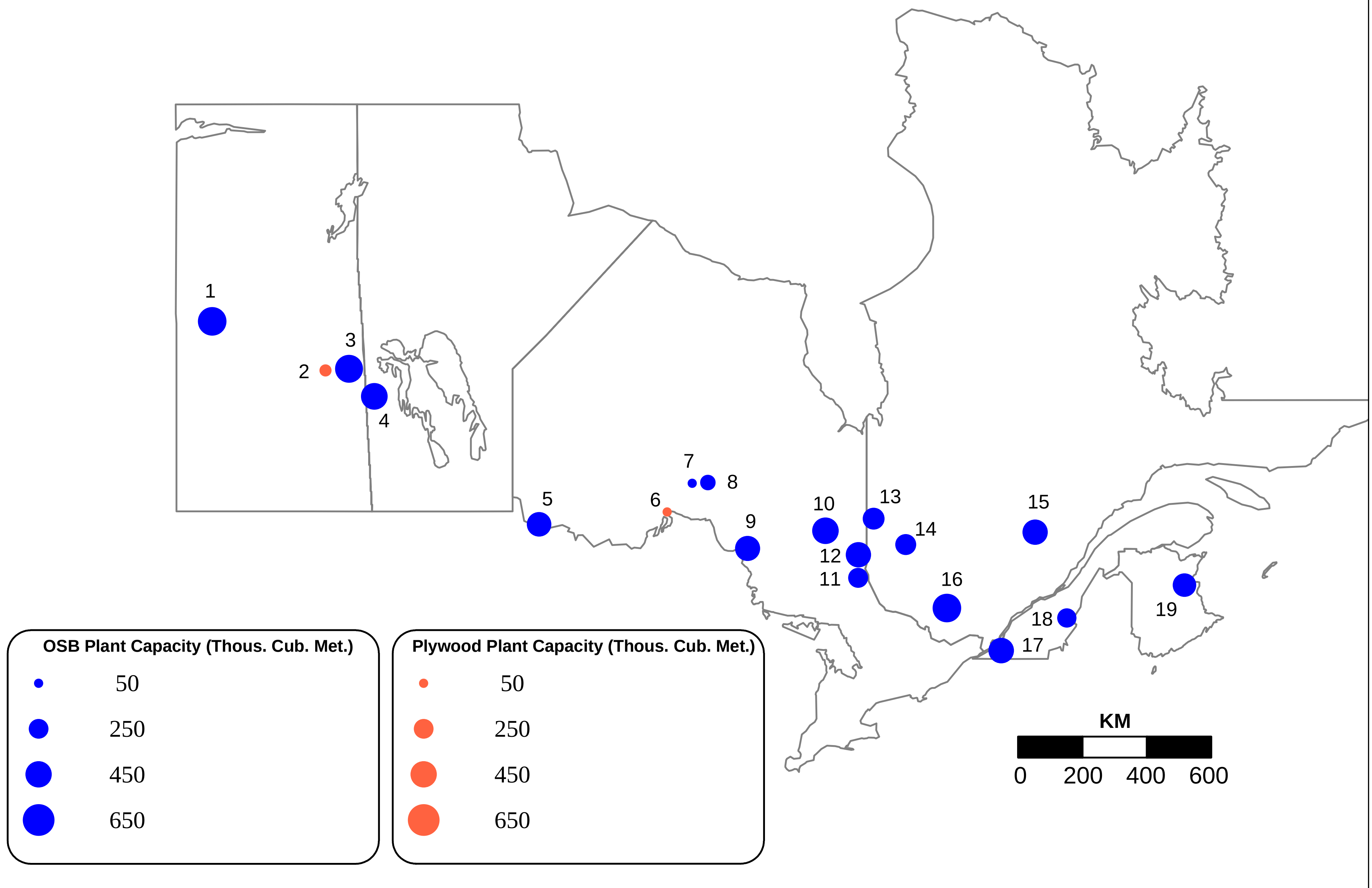
## U.S. West - Inland (California, Colorado, Oregon, Idaho, Montana, Washington)

| Mill I.D. | Company Name | Former Name or DBA | State | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | **Capacity (1,000 m³)** | | | | | | | | | | |
| **Plywood** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | Roseburg | Interstate Contain | Ca | Red Bluff | 102 | 102 | 102 | | | | | | | | | | | | | | |
| | Warm Spr FP | Jefferson Plywd | Or | Warm Springs | 75 | 75 | 75 | | | | | | | | | | | | | | |
| | Crown Pacific | Brooks-Willamette | Or | Redmond | 159 | 159 | 159 | 155 | 133 | 133 | 115 | | | | | | | | | | |
| | Potlach Corp | | Id | Pierce/Jaype | 133 | 133 | 133 | 133 | 133 | 133 | 137 | 137 | 137 | 137 | 75 | | | | | | |
| | Collins Pine | Weyerhaeuser | Or | Klamath Falls | 111 | 111 | 142 | 142 | 146 | 150 | 150 | 150 | 150 | 150 | 150 | 13 | | | | | |
| | BC | | Id | Emmett | 150 | 150 | 159 | 159 | 164 | 177 | 159 | 159 | 159 | 159 | 159 | 97 | | | | | |
| | Stimson Lum | J Neils Lumber | Mt | Libby | 133 | 133 | 133 | 133 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | | | | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 6 | Potlach Corp | St Maries Plywd | Id | St. Maries | 127 | 127 | 133 | 133 | 133 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 128 | 124 | 124 |
| 8 | Plum Creek | C & C Plywd Corp | Mt | Kalispell | 106 | 106 | 115 | 117 | 133 | 131 | 131 | 131 | 131 | 131 | 131 | 142 | 146 | 159 | 159 | 159 | 159 |
| 7 | Plum Creek | Plum Creek Lum | Mt | Columbia Falls | 133 | 133 | 133 | 143 | 135 | 151 | 151 | 151 | 151 | 151 | 151 | 151 | 151 | 151 | 151 | 151 | 151 |
| 9 | Stimson Lum | Champ Int Corp | Mt | Bonner | 310 | 310 | 310 | 310 | 310 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 97 | 97 |
| 1 | BC | | Or | Elgin | 140 | 140 | 140 | 140 | 150 | 156 | 161 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 | 165 |
| 5 | BC | | Wa | Kettle Falls | 168 | 177 | 186 | 190 | 204 | 204 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 | 208 |
| 2 | SDS Lum Co | Bingen Plywd | Wa | Bingen | 71 | 71 | 71 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 53 | 53 | 53 | 53 | 53 |
| 4 | Omak Wood Prod | Bico-Kinzua | Wa | Omak | 159 | 159 | 133 | 133 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | | | 97 | 97 | 97 | 97 |
| 3 | Yakima Res | BC | Wa | Yakima | 142 | 142 | 142 | 142 | 142 | 142 | 122 | 173 | 84 | 84 | | | 44 | 142 | 142 | 142 | 142 |
| | **TOTAL** | | | | 2218 | 2227 | 2264 | 2095 | 2189 | 2065 | 2024 | 1963 | 1874 | 1874 | 1728 | 1270 | 1195 | 1257 | 1245 | 1197 | 1197 |
| **OSB** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | L-P | | Co | Kremmling | 111 | 106 | | | | | | | | | | | | | | | |
| | L-P | | Id | Chilco | 119 | 111 | 111 | 111 | 111 | 133 | 133 | | | | | | | | | | |
| | L-P | | Co | Montrose | 106 | 106 | 106 | 106 | 128 | 128 | 128 | 128 | 128 | 128 | 128 | 128 | 53 | | | | |
| | **TOTAL** | | | | 336 | 323 | 217 | 217 | 239 | 261 | 261 | 128 | 128 | 128 | 128 | 128 | 53 | | | | |
| TOTAL PLYWOOD AND OSB | | | | | 2554 | 2550 | 2481 | 2312 | 2428 | 2326 | 2285 | 2091 | 2003 | 2003 | 1857 | 1398 | 1248 | 1257 | 1245 | 1197 | 1197 |
| | | | | | | | | | | | **Employment** | | | | | | | | | | |
| Plywood | | | | | 3800 | 3800 | 3800 | 3400 | 3400 | 3200 | 3000 | 2900 | 2900 | 2900 | 2400 | 1900 | 2100 | 1700 | 1700 | 1700 | 1700 |
| OSB | | | | | 330 | 330 | 220 | 220 | 220 | 220 | 220 | 100 | 100 | 100 | 100 | 100 | 70 | | | | |
| Total employment | | | | | 4130 | 4130 | 4020 | 3620 | 3620 | 3420 | 3220 | 3000 | 3000 | 3000 | 2500 | 2000 | 2170 | 1700 | 1700 | 1700 | 1700 |

# Eastern Canada

## Plywood & OSB Capacity

## (Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick)



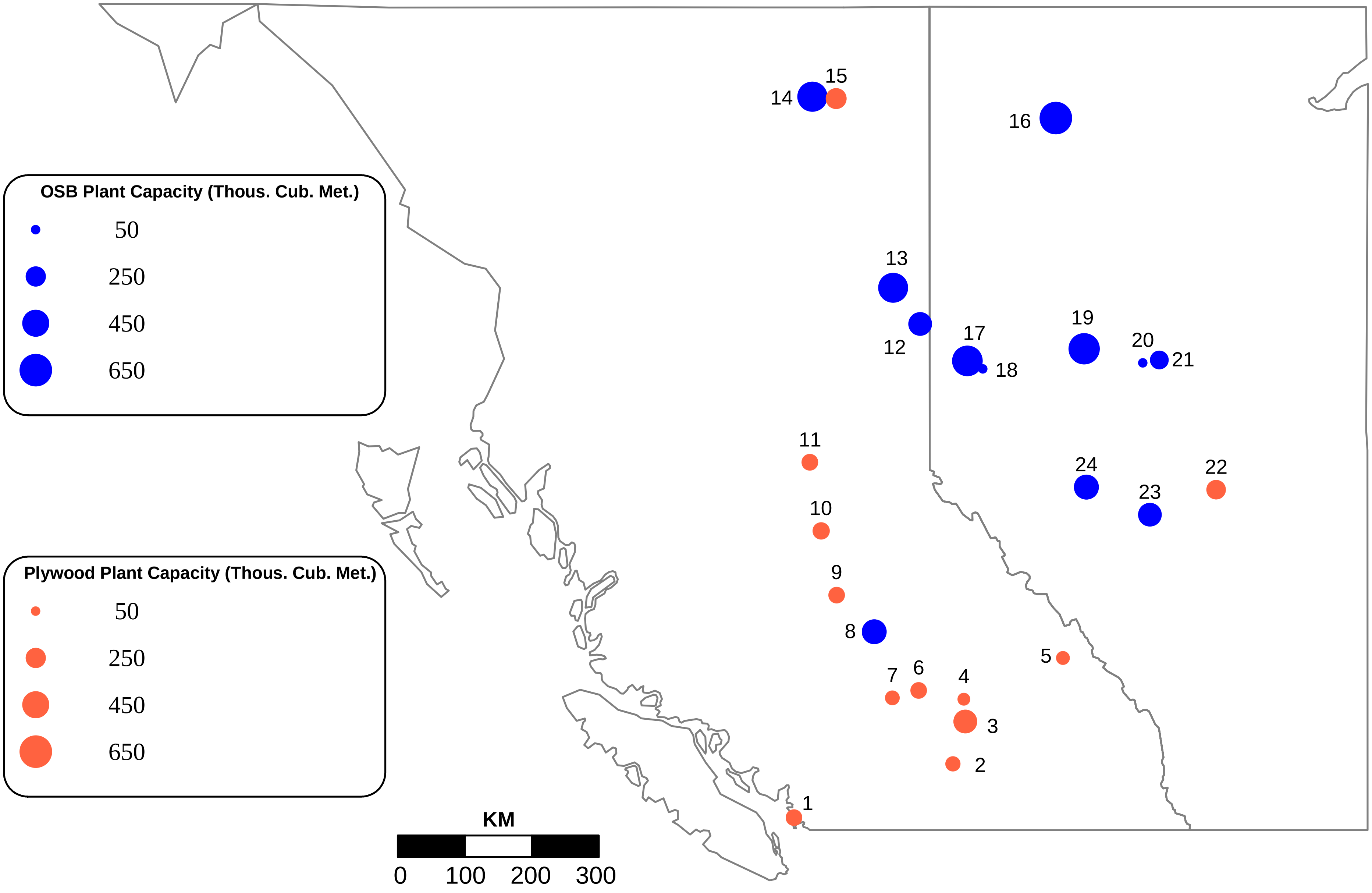
## Canada East (Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick)

| Mill I.D. | Company Name | Former Name or DBA | Prov | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | **Capacity (1,000 m³)** | | | | | | | | | | |
| **Plywood** | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 6 | Weyerhaeuser | MacMillan Bloed | Ont | Nipigon | 23 | 23 | 23 | 34 | 34 | 34 | 34 | 34 | 34 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| 2 | Weyerhaeuser | Saskfor McMillan | Sas | Hudson Bay | 71 | 71 | 71 | 75 | 73 | 75 | 75 | 75 | 75 | 75 | 75 | 91 | 91 | 91 | 91 | 91 | 91 |
| | **TOTAL** | | | | 94 | 94 | 94 | 109 | 107 | 109 | 109 | 109 | 109 | 111 | 111 | 127 | 127 | 127 | 127 | 127 | 127 |
| **OSB** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | Norbord | | Que | LaSarre I | 89 | 89 | 89 | 89 | 89 | 89 | 27 | | | | | | | | | | |
| | Weyerhaeuser | | Sas | Huds Bay I | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | | | | | |
| | Weyerhaeuser | | Sas | Huds Bay II | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 53 | | | | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 19 | Weyerhaeuser | | Nbr | Miramichi | 195 | 119 | | | | | 48 | 250 | 305 | 336 | 336 | 336 | 336 | 336 | 358 | 358 | 358 |
| 15 | L-P | | Que | Chambord | 230 | 195 | | 93 | 243 | 266 | 327 | 330 | 443 | 443 | 443 | 443 | 443 | 443 | 443 | 416 | 416 |
| 14 | Norbord | | Que | Val d'or | 159 | 159 | 159 | 177 | 177 | 212 | 212 | 237 | 237 | 239 | 239 | 239 | 266 | 283 | 283 | 283 | 283 |
| 17 | L-P | | Que | St Michel | 252 | 252 | 257 | 270 | 270 | 270 | 336 | 451 | 451 | 434 | 443 | 443 | 443 | 443 | 443 | 443 | 421 |
| 13 | Norbord | | Que | LaSarre II | | | | | | 66 | 177 | 239 | 248 | 248 | 248 | 248 | 266 | 310 | 310 | 310 | 310 |
| 16 | L-P | | Que | Maniwaki | | | | | | | | 310 | 487 | 531 | 531 | 531 | 531 | 531 | 531 | 531 | 531 |
| 18 | Jolina Capital | | Que | St Georges | 142 | 142 | 142 | 142 | 142 | 142 | 177 | 177 | 177 | 177 | 177 | 177 | 195 | 221 | 239 | 239 | 239 |
| 11 | Grant FP | | Ont | Englehart I | 177 | 177 | 177 | 177 | 195 | 195 | 239 | 239 | 239 | 239 | 239 | 239 | 243 | 248 | 257 | 257 | 257 |
| 10 | Grant FP | | Ont | Timmins | 80 | 80 | 80 | 177 | 177 | 177 | 400 | 196 | 233 | 460 | 460 | 460 | 460 | 460 | 460 | 460 | 460 |
| 5 | Ainsworth | | Ont | Barwick | | | | | | | | 221 | 354 | 354 | 354 | 354 | 354 | 381 | 389 | 389 | 389 |
| 9 | Weyerhaeuser | | Ont | Wawa | | | | | | 142 | 341 | 341 | 354 | 363 | 372 | 381 | 389 | 398 | 407 | 407 | 407 |
| 12 | Grant FP | | Ont | Englehart II | 279 | 279 | 279 | 283 | 310 | 310 | 381 | 381 | 381 | 381 | 381 | 381 | 389 | 398 | 416 | 416 | 416 |
| 8 | Kruger | | Ont | Longlac I | 120 | 120 | 120 | 120 | 124 | 142 | 142 | 142 | 142 | 142 | 142 | 150 | 150 | 150 | 150 | 150 | 150 |
| 7 | Kruger | | Ont | Longlac II | | | | | | | | | | | | | | | | | 0 |
| 4 | L-P | | Man | Swan River | | | | | | | 292 | 352 | 352 | 376 | 398 | 398 | 416 | 434 | 460 | 465 | 465 |
| 3 | Weyerhaeuser | | Sas | Hudson Bay | | | | | | | | | | | 221 | 487 | 504 | 504 | 504 | 504 | 504 |
| 1 | Tolko Indust | | Sas | Meadow lake | | | | | | | | | | | | | | 177 | 531 | 531 | 531 |
| | **TOTAL** | | | | 1908 | 1797 | 1488 | 1713 | 1912 | 2195 | 3284 | 4052 | 4588 | 4907 | 5168 | 5452 | 5438 | 5717 | 6182 | 6160 | 6138 |
| TOTAL PLYWOOD AND OSB | | | | | 2002 | 1891 | 1581 | 1822 | 2019 | 2304 | 3393 | 4160 | 4697 | 5018 | 5279 | 5578 | 5565 | 5844 | 6308 | 6286 | 6264 |
| | | | | | | | | | | | **Employment** | | | | | | | | | | |
| Plywood | | | | | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| OSB | | | | | 1440 | 1340 | 1300 | 1330 | 1330 | 1520 | 1920 | 2230 | 2250 | 2250 | 2410 | 2420 | 2360 | 2270 | 2270 | 2280 | 2280 |
| Total employment | | | | | 1740 | 1640 | 1600 | 1630 | 1630 | 1820 | 2220 | 2530 | 2650 | 2650 | 2810 | 2820 | 2760 | 2670 | 2670 | 2680 | 2680 |

# Western Canada

## Plywood & OSB Capacity

### (British Columbia, Alberta)



## Canada West (British Columbia, Alberta)

| Mill I.D. | Company Name | Former Name or DBA | Prov | Town | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | **Capacity (1,000 m³)** | | | | | | | | | | |
| **Plywood** | | | | | | | | | | | Closed Mills | | | | | | | | | | |
| | Crestbrook | | Alb | Fort MacLeod | 26 | | | | | | | | | | | | | | | | |
| | Weyerhaeuser | MacMillan Bloedel | BC | Vancouver | 106 | | | | | | | | | | | | | | | | |
| | Weyerhaeuser | MacMillan Bloedel | BC | Port Alberni | 159 | | | | | | | | | | | | | | | | |
| | Victoria Plywd | | BC | Victoria | 62 | 62 | | | | | | | | | | | | | | | |
| | Fletcher Challenge | | BC | New Westminster | 106 | 106 | | | | | | | | | | | | | | | |
| | Evans FP | | BC | Vancouver | 137 | 137 | | | | | | | | | | | | | | | |
| | West Coast Plywd | | BC | Vancouver | 168 | 168 | 133 | | | | | | | | | | | | | | |
| | Slocan | Cantree | BC | New Westminster | 133 | 133 | 115 | 97 | 97 | 97 | 97 | 97 | 97 | | | | | | | | |
| | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 22 | West Fraser | Zeidler | Alb | Edmonton | 106 | 106 | 124 | 150 | 155 | 155 | 177 | 177 | 177 | 204 | 212 | 221 | 235 | 235 | 235 | 235 | 235 |
| 3 | Tolko Indust | Riverside FP | BC | Armstrong | 159 | 159 | 177 | 195 | 195 | 195 | 199 | 199 | 199 | 210 | 207 | 208 | 257 | 266 | 350 | 350 | 350 |
| 11 | Canfor | N Central Plywds | BC | Prince George | 150 | 150 | 150 | 155 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 159 | 168 | 168 | 168 | 168 |
| 7 | Ainsworth | | BC | Savona | 49 | 49 | 58 | 71 | 71 | 66 | 66 | 112 | 115 | 127 | 127 | 127 | 127 | 127 | 131 | 131 | 131 |
| 1 | Richmond Plywd | | BC | Richmond | 177 | 177 | 171 | 177 | 209 | 209 | 209 | 209 | 209 | 209 | 133 | 209 | 168 | 168 | 165 | 165 | 165 |
| 10 | West Fraser | Weldwood | BC | Quesnel | 146 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 168 | 178 | 178 | 178 | 178 | 178 | 178 | 178 |
| 9 | West Fraser | Weldwood | BC | Williams Lake | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 159 | 159 | 159 | 159 | 166 | 166 | 166 |
| 2 | Tolko Indust | Riverside FP | BC | Kelowna | 124 | 111 | 111 | 111 | 111 | 111 | 124 | 128 | 128 | 127 | 133 | 133 | 133 | 133 | 138 | 138 | 138 |
| 4 | Federated Co-op | | BC | Canoe | 84 | 84 | 89 | 89 | 96 | 96 | 96 | 96 | 96 | 96 | 64 | 66 | 97 | 97 | 97 | 97 | 97 |
| 6 | Tolko | | BC | Heffley Cr/Kamloo | 133 | 133 | 133 | 106 | 106 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 146 | 165 | 165 | 165 |
| 5 | L-P | Evans FP | BC | Golden | 142 | 142 | 135 | 135 | 135 | 135 | 135 | 66 | 66 | 80 | 85 | 89 | 106 | 106 | 112 | 112 | 112 |
| 15 | Canfor | Slocan | BC | Fort Nelson | 106 | 133 | 159 | 159 | 165 | 165 | 165 | 172 | 175 | 235 | 246 | 246 | 267 | 267 | 267 | 267 | 267 |
| | **TOTAL** | | | | 2428 | 2155 | 1859 | 1749 | 1794 | 1829 | 1869 | 1858 | 1865 | 1906 | 1841 | 1933 | 2033 | 2051 | 2174 | 2174 | 2174 |
| **OSB** | | | | | | | | | | | Operating Mills | | | | | | | | | | |
| 12 | L-P | | BC | Dawson Creek | 305 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 327 | 327 | 345 | 345 | 345 |
| 24 | Weyerhaeuser | | Alb | Edson | 266 | 266 | 266 | 266 | 292 | 288 | 288 | 288 | 327 | 327 | 336 | 341 | 345 | 354 | 381 | 381 | 381 |
| 23 | Weyerhaeuser | | Alb | Drayton | 230 | 235 | 310 | 310 | 310 | 310 | 310 | 310 | 313 | 313 | 313 | 313 | 319 | 327 | 345 | 345 | 345 |
| 21 | Tolko Indust | Weyerhaeuser | Alb | Slave Lake | 97 | | | 124 | 177 | 166 | 186 | 186 | 186 | 195 | 195 | 195 | 204 | 204 | 212 | 212 | 212 |
| 8 | Ainsworth | | BC | 100 Mile House | | | | | 89 | 310 | 310 | 323 | 323 | 323 | 332 | 336 | 363 | 376 | 376 | 376 | 376 |
| 17 | Ainsworth | | Alb | Gr Prairie I | | | | | | | 398 | 478 | 482 | 484 | 496 | 513 | 566 | 566 | 580 | 580 | 580 |
| 19 | Tolko Indust | | Alb | High Prairie | | | | | | | 354 | 420 | 420 | 434 | 482 | 496 | 496 | 504 | 602 | 602 | 602 |
| 14 | Canfor | Slocan | BC | Ft Nelson | | | | | | | 221 | 376 | 381 | 381 | 416 | 460 | 469 | 500 | 500 | 504 | 562 |
| 16 | Footner FP | | Alb | High Level | | | | | | | | | | | 27 | 266 | 531 | 708 | 708 | 708 | 717 |
| 13 | Peace Valley OSB | Canfor L-P | BC | Ft St John | | | | | | | | | | | | | | | | 60 | 549 |
| 20 | Tolko Indust | | Alb | Slave Lake | | | | | | | | | | | | | | | | | 0 |
| 18 | Ainsworth | | Alb | Gr Prairie II | | | | | | | | | | | | | | | | | 0 |
| | **TOTAL** | | | | 898 | 819 | 894 | 1018 | 1186 | 1392 | 2385 | 2699 | 2751 | 2775 | 2915 | 3238 | 3620 | 3867 | 4049 | 4114 | 4668 |
| TOTAL PLYWOOD AND OSB | | | | | 3327 | 2974 | 2752 | 2767 | 2980 | 3221 | 4254 | 4557 | 4616 | 4682 | 4757 | 5172 | 5653 | 5919 | 6223 | 6288 | 6842 |
| | | | | | | | | | | | **Employment** | | | | | | | | | | |
| Plywood | | | | | 4800 | 4200 | 3200 | 3200 | 3200 | 3200 | 3300 | 3300 | 3400 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 | 3300 |
| OSB | | | | | 610 | 470 | 470 | 610 | 740 | 740 | 1130 | 1130 | 1150 | 1150 | 1300 | 1300 | 1300 | 1290 | 1330 | 1450 | 1450 |
| Total employment | | | | | 5410 | 4670 | 3670 | 3810 | 3940 | 3940 | 4430 | 4430 | 4550 | 4450 | 4600 | 4600 | 4600 | 4590 | 4630 | 4750 | 4750 |