# RMJ

# Rural Minnesota Journal

## The Agriculture and Forestry Issue: Looking to the Future

2009

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*Seeking solutions for Greater Minnesota's future*

# The Future of Forestry in Minnesota's Economy

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Predictions of the future often first require consideration of the past and an accounting of the present. What is the situation today, how did we get here, and what are the current and emerging trends that are likely to shape tomorrow? The future of Minnesota's forest sector will undoubtedly be informed by its turbulent past and the no-less tumultuous present.

## Minnesota's forests before forestry

About a half-century before professional forestry was introduced to North America, Minnesota's forests were heavily impacted by a combination of agricultural clearing and indiscriminate logging. Forest loss was substantial, with the heaviest losses in southern Minnesota, where hardwood forests gave way to homesteads, pastures, and tilled soil. In the northern part of the state, the greatest impact on forests was due to logging.

Minnesota's first sawmill opened in 1830 in Marine on St. Croix, followed by another in Stillwater in 1840. Then activity shifted to Minneapolis, where water power could be harnessed to run the mills. By 1880, and for three decades thereafter, the state was one of the nation's leading lumber producers. In 1900, the peak year for Minnesota lumber production, some 2.3 billion board feet of lumber (equivalent to about 4.6 million cords of wood) were sawn by an industry that employed over 15,000 people in the mills and another 23,000 felling and transporting timber. As a sign of the coming transition of Minnesota's forest industry, the Northwest Paper Company had been established two years earlier (1898) in Cloquet. By 1910, what had once been viewed as an inexhaustible supply of white, red, and jack pine was in noticeable decline, and over the next twenty years what had been a thriving lumber industry simply faded away as the supply of large trees ran out. It was a scenario that had played out in state after state.

The effect of unconstrained exploitation on the state's forests was breathtaking. Forests had covered an estimated 65% of the land area of Minnesota (or about 31.5 million acres) in the 1820s; by 1895 this had been reduced through logging, agricultural expansion, and growth of cities and towns to less than 25% of the land area (just over 12 million acres).

Not coincidentally, individual states began to act to protect forests within their borders, and in 1891 Congress gave the President, for the first time, authority to protect forest lands; establishment of federal forest reserves soon followed. Shortly thereafter, in 1898, the nation's first forestry school was established in North Carolina. Then came the turn of the century and with it the establishment of three more college-level forestry programs, at Cornell, Yale, and Minnesota (1903). Establishment of the Forest Service within the U.S. Department of Agriculture occurred two years later, and in 1911 the Minnesota Forestry Service was established.

As early actions to protect forests were reinforced by establishment of forest-oriented agencies and educational institutions, the area covered by eastern forests — Minnesota's among them — stabilized, and began to re-grow. Areas that had been heavily logged, and in some cases unsuccessfully homesteaded, slowly returned to forest cover as human activity shifted elsewhere. By 1935 the forest area in Minnesota had rebounded to just under 20 million acres, though trees were smaller and forests dominated by different species than previously.

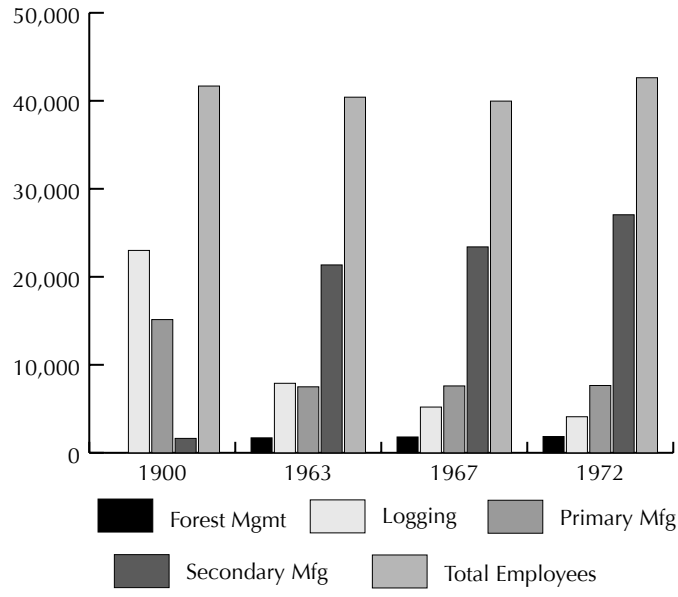
In 1950 what was left of the forest products industry was now focused on products that could be made from small trees and wood fiber, such as paper, fiberboard, and match sticks. The harvest from Minnesota's forests was less than 1 million cords in that year, and the forest sector employed fewer than 10,000; included among employees of the sector was a growing cadre of people involved in forest management, a job category that had been entirely absent a half-century earlier.

By the mid-1960s the state's paper industry began to expand, and timber harvests, though still only a fraction of peak levels, began to rise. The mid-'70s marked the beginning of a new period of forest industry investment; over the next two decades, both forest harvest levels and forest-based employment doubled. New industries and new technologies paved the way, bringing sophisticated and recycled paper products, oriented strandboard, and oriented strand lumber. This time around the sawmill industry was a minor player, with product lines reflecting the smaller average diameters of forest trees.

## A new forest industry, a new look

The revitalized Minnesota forest industry that emerged in the mid-twentieth century was different not only in the nature of the primary wood products manufacturers located in the northern part of the state, but also in that a sizeable secondary industry producing wood products of all kinds took up residence primarily in the southern part of the state, and in the Twin Cities metropolitan area in particular. The southern industry included manufacturers of cabinets, store fixtures, furniture, building components, and a number of specialty products; almost all of the wood used by this industry was (and is) imported from other states and regions. In addition, Minnesota became the home of the first and third largest window manufacturers in North America, both having been established based on the earlier availability of local pine. By mid-century this industry relied almost exclusively on wood raw materials obtained from outside Minnesota's borders, yet maintained Minnesota-based manufacturing facilities. Indications of the fundamental shift in industry structure can be seen in the changing make-up of the work force from 1900 to the early 1970s (Figure 1).

***Figure 1:*** *Makeup of Minnesota's forest sector workforce, 1900, 1963, 1967 & 1972.*

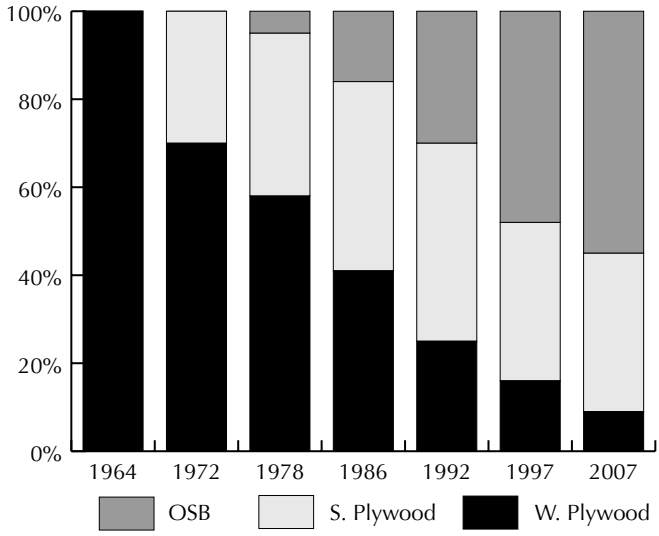



*Source: Hillman and Moore (2003); Phelps (1980).*

Whereas the forest industry of 1900 was comprised almost wholly of loggers and sawmill workers, and with very few working in secondary manufacturing (planing and milling), the industry of the early 1960s was heavily oriented toward secondary manufacturing. Moreover, logging employment was only about a sixth of what it had been six decades earlier. Total employment in the sector, however, was remarkably similar in 1900 and the period 1963-1972.

The early 1980s marked the beginning of what the Minnesota Forest History Center describes as the state's "Second Forest Revolution." In the decade that followed, based in part on forest survey data that showed timber removals well below annual growth, Minnesota's paper industry invested over $2 billion in expansion and modernization and increased output by almost 80%. The state's timber harvest volume increased accordingly, bringing wood removals to 4 million cords in 1993, the highest level since 1900; another 500,000 cords were imported to support production activity. Paper output increased in the form of de-inked and recycled paper products, the result of another half-billion in investment. In 1993, Minnesota was the nation's seventh leading producer of paper (McLaren 1994).

***Figure 2:*** *Production of OSB and softwood plywood in the United States, 1964–2007.*

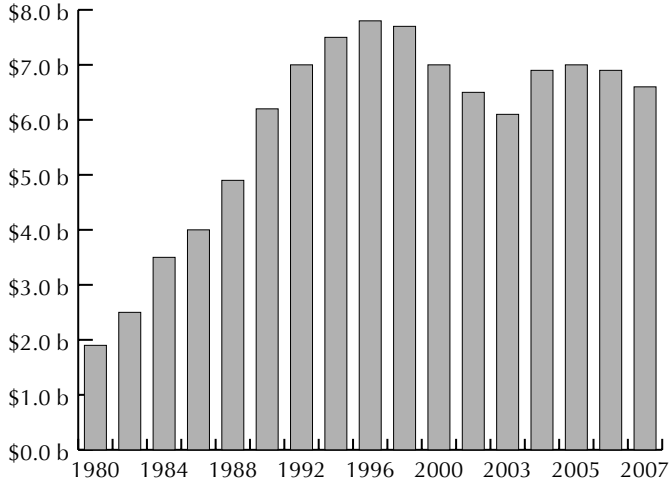


Forest industry growth in Minnesota was also fed by emergence and growth of the oriented strand board (OSB) industry. Commercial-scale production of waferboard began in Minnesota, and as that technology transitioned to OSB, Minnesota led the nation in production volume. As a lower cost substitute for softwood plywood, produced both in the western and southern United States, OSB popularity and production grew as softwood plywood production in Oregon and Washington (W. Plywood) declined (Figure 2). As with paper, the favored raw material for OSB production was small-diameter aspen. Minnesota's abundant, low-cost wood made the state a prime location for OSB industry development.

By 1995, harvest levels reached 4.1 million cords, forest sector employment reached 57,000, and the forest industry overall was the state's third largest manufacturing industry, with direct contributions of the forest sector to the state's economy approaching $8 billion (Figure 3).

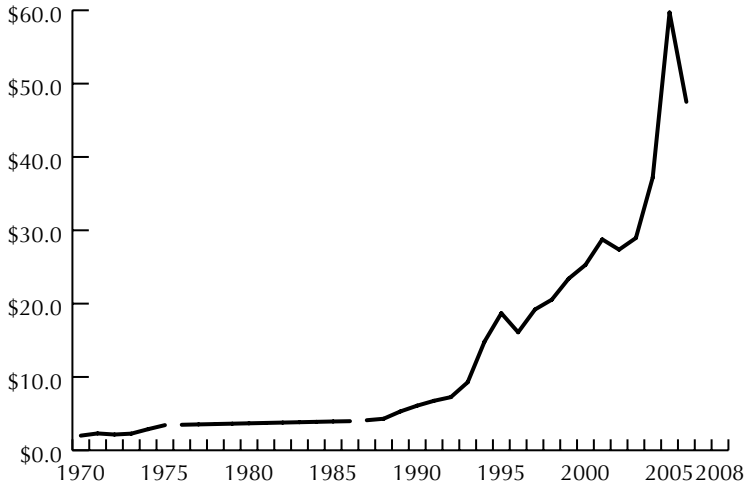
As harvest levels rose, some Minnesotans reacted with alarm, recalling over-harvesting of the state's forests 100 years earlier. In response to a citizen petition, the Minnesota Environmental Quality Board, commissioned what became known as the Generic

***Figure 3:*** *Value of forest products manufactured in Minnesota (in billions of dollars).*




*Source: Minnesota Department of Natural Resources,* Minnesota Forest Resources Annual Report *(2007).*

***Figure 4:*** *Average stumpage price received by public agencies for Minnesota aspen, 1970–2008.*




*Source: Minnesota Department of Natural Resources (2009).*

Environmental Impact Statement (GEIS) on Timber Harvesting. The GEIS effort involved an extensive examination of the environmental effects of timber harvesting on Minnesota's forests, aesthetics, water bodies, fish, wildlife, outdoor recreation, and historical/cultural values at different harvest levels — 4.0 million, 4.9 million, and 7.0 million cords annually. The final report, completed in 1994, led to passage of the 1995 Sustainable Forest Resources Act and to creation of the Minnesota Forest Resources Council, a 17-member board representing a wide range of public and private organizations with an interest in forest resources issues. One finding of the GEIS was that harvests of about 4 million cords could be sustained indefinitely with minimal environmental impact. The study also suggested that expansion of harvests to 5.5 million cords annually was sustainable over the long term, but that additional mitigation efforts would be necessary to protect non-timber forest values at that harvest level.

A fresh environmental assessment that largely endorsed forest practices, combined with record levels of economic activity and employment, appeared to place Minnesota's forest industry of the mid-1990s in a very strong position. But there was a price to pay for success, in this case in the form of rising raw material costs. As harvest levels grew, wood costs did as well (Figure 4), and within a 30-year period, from the early 1970s to the end of the century,

stumpage prices within the state increased 10 to 12 fold for the primary pulpwood species, aspen, from an average of about $2 to over $25 a cord (Lothner et al. 1979; Minnesota DNR 2007). Similar trends were seen for the vast majority of other pulpwood and sawtimber species.

While heralded as great news for forest landowners and land management agencies, reports began to surface that Minnesota's wood costs were among the highest in the world, a reality confirmed by a 2003 study of the competitiveness of the state's wood products industry (Minnesota Governor's Advisory Task Force 2003). At that point, prices were under $30 a cord. The high prices were not a good omen in a world of rising global competition and increasing Asia-directed foreign investment. And then, within three years, stumpage prices doubled. It was increasingly obvious to most observers that a shakeout was in the offing.

## Changing global realities

*Changing industrial wood production*

At precisely the time that Minnesota was entering its second forest revolution, events far outside the state's borders presaged what could be called a global forest revolution. After decades of research and field trials, significant plantations of fast-growing tree species began to appear in tropical and subtropical regions. Such

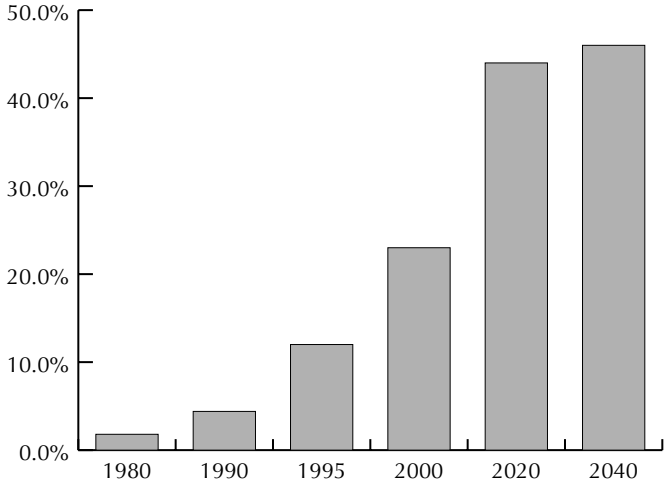
***Figure 5:*** *A 3-year-old eucalyptus plantation in Vittoria, Brazil (Aracruz, S.A.) illustrates the rapid growth potential of wood fiber plantations.*

plantations were being systematically located on highly productive sites, translating to rapid, and sometimes spectacularly fast, growth (Figure 5). Harvest cycles were often six to seven years and shorter, meaning that plantation-grown wood began to appear in world markets very soon following plantation establishment (Figure 6).

By 1995, almost one eighth of the world's fiber supply was coming from fast-growing plantations, even though such plantations covered an area equivalent to less than 2% of the area of forests globally. Just five years later the fiber percentage was 27% and the area 3.5% of total forest area worldwide. Over 40% of these plantations were located in Asia, with an increasing forest plantation estate in South America.

As the importance of plantations in global fiber supply grew, so, too, did growth rates. Reported yields from plantations of the sub-tropics were sobering: Reports of wood yields of 20–25 cubic meters per hectare per year (4-5 cords per acre per year) were not uncommon. In addition, by 2000, annual yields as high as 45-70 $m^3$ with some hardwood species (9-14 cords/ac/yr) were reported. In contrast, the statewide average growth of aspen in Minnesota in natural forests was (and is) approximately 0.3 cords/ac/yr, with the best sites producing about 0.75 cords/ac/yr. Hybrid poplar in plantation settings in Minnesota have achieved yields as high as 4 cords/ac/yr in trial plantings.

***Figure 6:*** *Contribution of plantations to world timber harvest.*




*Source: Brooks, USDA Forest Service (2001).*

Given that production rates were high and plantations were located in low-wage regions, plantation fiber costs tended to be very competitive globally. Early on, plantation managers were content to ship fiber in the form of market pulp to mill locations around the world. Eucalyptus pulp, for instance, was routinely shipped from the east coast of Brazil to paper mills in northern Wisconsin as long ago as the 1980s. But just as local and regional governments in the United States are passionate about finding ways to add value to raw materials locally, the same is true in the world's developing regions. Thus, in the '90s what were originally plantation-fed pulp mills began to be converted to paper mills.

*Shifts in global paper consumption*

In 1982 global consumption of paper and paperboard was 170 million tons, and North America accounted for 40% of that. Just 23 years later (2005), paper and paperboard consumption globally was 370 million tons, with the North American share of that consumption 27%. The rate of consumption growth in various regions during the decade of the 1990s provides an explanation of the rapid shift. During a period in which North American paper consumption grew at a 0.7% annual rate, consumption in the world's developing regions grew at 3% plus year-on-year; paper consumption in China grew at 4.6% annually (Table 1).

It is worth noting that regions experiencing the most rapid growth in paper consumption were the same regions in which rapid expansion of fast-growth plantations was occurring. It is not surprising, then, that paper production capacity began to shift to these regions. In 1980, for instance, 2% of global pulp and paper

***Table 1:*** *Rate of increasing demand for paper and paperboard, 1990s.*

| **Region/Country** | **Annual rate of increase in paper consumption** |
|---|---|
| China | 4.60% |
| Asia (except Japan, China) | 3.95% |
| Latin America | 3.50% |
| Africa | 2.95% |
| Western Europe | 1.60% |
| North America | 0.70% |

*Source: Kuusisto, I. 2004.*

production capacity investment occurred within China; by 2000 this percentage was *38%*. Thus, what was not long ago viewed as fertile ground for market growth of North American (and Minnesota) paper became instead a major global competitor in pulp and paper manufacturing.

*An evolving structural panels industry*

As oriented strand board (OSB) grew in popularity in the 1990s, production capacity grew as well. Manufacturing plants of increasing size appeared across southern Canada and the eastern and southeastern United States, all supplied by low-density, low-cost hardwood and softwood raw materials. Overcapacity was a chronic problem as rising demand stimulated investment that often did not anticipate fluctuations in the domestic housing market. Significant downturns occurred in 1991-92 and again in 2001, stressing an already highly competitive OSB industry. Minnesota's OSB mills were particularly impacted by rising raw material costs regionally, and by increasing economies of scale in new plants being established elsewhere. The most recent housing downturn (and subsequent collapse) led first to temporary curtailment of production and then to what is described as "permanent" closure of Minnesota mills. Over a period of just 2½ decades the new industry had come and gone. There is little likelihood of a resurgence of this industry in Minnesota.

## Changing Minnesota forests

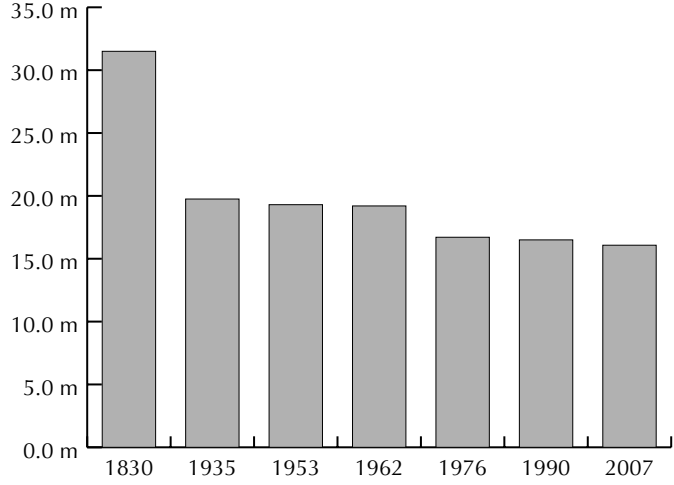
*More or less stabilized forested land base*

As explained by the Minnesota Historical Society:

> *When Euro-Americans began to settle in Minnesota in the early 1820s, they found about 19.5 million acres in natural prairie systems and about 31.5 million in forests. Fewer than 200 years later, only about 0.3% of the natural prairie remains. And forests have shrunk to fewer than 18 million acres.*

As noted previously, actions to protect Minnesota's forests that began early in the 20th century succeeded in halting forest loss by the 1930s (Figure 7). In addition, some of the lands that had been cleared early in the logging boom returned to forest cover during the period 1895-1935. For the next three decades following the 1930s the forest land base in Minnesota remained stable. Then, largely due to completion of the interstate highway system north of the Twin Cities, and urban expansion, forest cover declined by another 2.8 million

***Figure 7:*** *Area of forest land in Minnesota, 1820–2007 (millions of acres).*




*Source: Minnesota Historical Society (2002); Minnesota Department of Natural Resources, Division of Forestry (2008).*

acres between 1962 and 1976. Since the mid '70s, there has been slow but steady loss of forests within the state (from 16.7 million to 16.1 million acres) due to urban encroachment.

*Declining forest land per capita*

Despite relative stabilization of forest land in recent years, the inescapable effect of ongoing population growth is gradually reducing the area of forest on a per-capita basis (Table 2). For instance in the period 1950 to 2000, while the total area of forest in

***Table 2:*** *Forests then, now, and future — Minnesota.*

| Year | Population (in millions) | Total forest area (millions of acres) | Commercial forest area (millions of acres) | Forest area per capita (acres) |
|---|---|---|---|---|
| 1950 | 2.99 | 19.3 | 17.4 | 6.5 |
| 2000 | 4.92 | 16.4 | 14.8 | 3.3 |
| 2050 | 6.79 | 16.4 | 14.8 | 2.4 |

*Source: Forest data from Minnesota Department of Natural Resources, Division of Forestry. Population data and projection from Minnesota State Demographic Center.*

Minnesota declined by 15%, forest area per capita declined by 49%; the difference is explained by a 65% increase in population. There were similar declines in the area of forest available for periodic harvest (commercial forest). In the future, even should there be no further forest loss in Minnesota, the area of forest on a per-capita basis will continue to decline due to population growth. What this likely means is increasing conflict over forest land use, including periodic harvesting, regardless of how well lands are managed.

*Forest fragmentation and intergenerational shifts*

Forest fragmentation is defined as the breakup of a continuously forested landscape into various forest and non-forest uses. One form of this phenomenon is segmentation of a forest block into a number of separately owned parcels (also known as parcelization), something that tends to occur as land is passed on from one generation to the next. Ever smaller ownerships, involving an increasing number of land owners, can make management difficult. When some of those parcels are occupied by primary residences or second homes, not only does active management become extraordinarily difficult, but a number of forest values become compromised as well.

In Minnesota's north woods there is great demand for vacation homes, a situation that is stimulating second home development in previously remote areas. As an indication of the magnitude of change taking place, in a single decade — from 1990 to 2000 — the number of new recreational properties in northern counties jumped 25%. The current economic situation notwithstanding, recent divestiture of land holdings on the part of Minnesota's forest industries raises the possibility of an acceleration of this trend. Consequently, forest fragmentation has become a major issue in Minnesota.

In the words of John Myers (2006), a Minnesota environmental journalist:

> *The north woods is being sold off, divided up, and developed into weekend cabins and retirement homes like never before. Conservation leaders say the state needs to act now or lose a big part of its forest heritage forever. The rapid breakup of large tracts of forest is being called a threat to ecological diversity as forest plots get smaller and more fragmented, eating away key habitat for birds and wildlife and making it harder to manage for threatened species. Development is endangering water quality because of erosion and runoff. And development means less land open for*

*logging to supply the forest products industry. No Trespassing signs are closing off land to public recreation such as hunting, birding, and hiking.*

In some ways Minnesota is better protected against forest fragmentation than other states, because of its pattern of forest ownership. Here, over one half of forests are publicly owned (27% state, 13% country and municipal, 13% federal). Nonetheless, half of the wood that feeds the state's forest products mills comes from privately owned forest land, with 11%-12% flowing from forest industry-owned forest land. This latter category of forest land is at greatest risk for changes in ownership that could result in fragmentation.

Among the many implications of increasing forest fragmentation, the difficulty of periodic timber harvesting in a landscape characterized by multiple ownerships and checkerboard home site development looms large as a challenge for the state's forest-based industries.

*Forest industry sell-off*

Rising land values and federal tax law that effectively subjects forest industry-owned land to double taxation has led to a massive sell-off of forest land on the part of the forest industry nationally. Vast acreages of forest have been sold in Minnesota over the past five years as part of the national trend.

For the most part, lands owned by the forest industry in Minnesota have been in large contiguous blocks, have been well managed, and have been open to the public for hunting, fishing access, and other forest recreation. The sale of these lands to real estate trusts, timber management organizations, and others increases the risk of fragmented development.

**A perfect storm**

Entering the 21st century, all of the factors considered thus far — intensifying globalization, changing industrial wood production, shifts in global paper consumption, evolution of the wood panels industry, forest fragmentation, declining forest area per capita, sharply rising stumpage costs — were squeezing Minnesota's forest sector. Then came the economic repercussions of 9/11 and, a few years later, the mortgage bubble and housing collapse.

During the period July 2000 to July 2005, the United States lost more than 3 million jobs in manufacturing (Wial and Friedhoff 2006). As noted by the American Forest and Paper Association (2006), the nation's forest products industry was part of this trend, losing over

150,000 manufacturing jobs and some 350 paper and forest products manufacturing facilities in less than a decade (from early 1997 to mid-2005). In the four-year span of 2001-2005, job losses in two of the hardest hit sectors — pulp and paper and wooden furniture — totaled 32,700 and 56,500, respectively. Approximately 17,000 logging jobs were lost during this period as well (U.S. Department of Commerce 2006). In addition, most other sectors of the domestic forest products industry have lost market share to imports. In a period of just six years (1999-2005), overall U.S. imports of wood products (measured in dollars) increased 49%, while exports remained flat (U.S. Department of Agriculture, Foreign Agricultural Service 2006).

In Minnesota, where forest products manufacturing has been dominated in recent years by pulp and paper, oriented strandboard, and wooden windows, a downward trend in the wood products industry is evident. Whether viewed in current or constant dollars it appears that the industry peaked in the mid-1990s (Figure 3). As measured in constant dollars, the value of forest products manufactured in Minnesota in 2007 was only 63% that of fifteen years earlier. Figures from the Department of Natural Resources in a 2003 report (containing 2001 employment data) indicated statewide employment in forest products industries at 55,200, with 25,200 employed in primary processing and 30,000 in secondary; in the December 2008 edition of the same report (containing 2008 employment data), total employment statewide was estimated at 31,850, with 17,440 jobs in primary processing and 20,410 in secondary processing. Thus, in a span of only seven years forest products employment within Minnesota is estimated to have dropped by 42%, and secondary industry employment by 32%.

Thus, despite careful planning and myriad changes in how industry operates, Minnesota finds its primary forest sector in decline once again. The national and global economic cycles, housing industry woes, foreign competition, emerging economies, world fiber costs, aging manufacturing facilities and more have combined to negatively impact the local industry, resulting in recent years in rising layoffs, production curtailments, and even permanent plant closures across the northern counties. The secondary industry is also impacted by a number of these factors, most notably by the current deep recession in both housing and the general economy and by intensifying foreign competition. All of this raises questions about what the state's forest sector will look like in the decades ahead, and what role the forest sector is likely to play in Minnesota's economy going forward.

## The pathway to a third forest industry renewal: Trends that could help define a better future

*Conservation easements*

In 1999 a Minnesota State Forest Legacy Program was inaugurated with the goal of protecting large, mostly intact blocks of privately owned forest land from development. Designed to involve partners from across society, the legacy concept involves establishment of conservation easements in negotiations with key forest land owners. A conservation easement involves a commitment of a landowner to forego future development for a specified period of time, or in perpetuity, in return for a payment based on a calculation of the present value of future development potential (although payments are often less than this value). Easement agreements often allow ongoing management of land, including timber harvesting, but prohibit forest conversion, subdivision, or a change in land use such as residential development.

Since the beginning of the State Forest Legacy initiative, several environmental organizations, the Minnesota Department of Natural Resources, the state legislature, and several Minnesota foundations — most notably the Blandin Foundation — have taken significant steps to bring contiguous blocks of forest land under conservation easements. To date, almost 250,000 acres of forests have been protected using this mechanism.

*The emergence of forest certification*

In the early 1990s, certification of forest practices and of wood products was introduced as a way of encouraging responsible forestry in the world's tropical regions where most of the environmental and social problems were viewed to exist. The certification concept was soon refined to include all forests, and now at least 80% of the world's certified forests are located in the northern hemisphere.

About 8% of the total forest area worldwide is now certified by one or more certification programs, including more than 13% of the managed forest area, and now nearly 13,000 companies are chain-of-custody-certified to produce products that can be traced back to certified lands. The certified forest area continues to grow; the area of certified forest globally grew by nearly 9% from 2007 to 2008, and the number of certified forest product manufacturers (chain-of-custody certificates) increased by 50% during the same time period.

Demand from green building programs (see next section) and responsible paper procurement policies are helping drive the market for certified wood and paper products. Through the participation

of state land management agencies, county land departments and private landowners, Minnesota has more than ten years of experience with forest certification and has a higher percentage of certified forestland (just over 50%) than any other state. There are more than 100 Minnesota companies with chain-of-custody certificates for producing certified forest products, including the oldest continuously active certificate held by St. Cloud-based Colonial Craft.

*The green building movement gains momentum*

Inspired by events that began with the oil embargos of the 1970s, efforts to encourage the construction of energy efficient, durable, healthy buildings were initiated in the late 1970s and early 1980s. Such efforts were later expanded to include water efficiency, the use of environmentally responsible materials, and minimization of impacts on the building site. Dubbed "green building standards" by those involved in development, lists of requirements and recommendations and programs to support their implementation, appeared first in the United Kingdom and Canada, and then in the United States. The Leadership in Energy and Environmental Design (LEED) program of the U.S. Green Buildings Council, today the most popular green building program, was introduced in 2000.

Currently over 80 green building programs, three of them national in scope, operate in the United States. By every measure, participation in such programs is increasing rapidly.

There are a number of implications of the green building movement for the forest sector, the most obvious being that virtually all green building programs award or require the use of certified wood. All signs point to substantial growth of the certified wood products market as homebuilding and the commercial/industrial construction sectors emerge from recession.

Another common element in virtually all green building programs is local sourcing of materials, which is generally defined as raw material sourcing and product manufacture within 500 miles of product use (or within 1,500 miles if shipping is via rail or ship). As with certified wood, markets for local products can be expected to expand in the future.

*Growing carbon concerns*

All over the world there are growing concerns about the accumulation of carbon dioxide and other greenhouse gases in the upper atmosphere. The United States, which has long opposed efforts to reduce carbon emissions, now appears poised to take steps

to participate. A carbon cap and trade program, or some form of carbon tax, are distinct possibilities.

Attention to carbon inevitably leads to consideration of how emissions of carbon-containing compounds can be reduced or how such compounds might be captured and stored. Forests, and the wood they produce, play a major role in the carbon cycle. Thus, management of forests so as to maximize carbon storage, use of long-lived wood products that are one half carbon by weight, and use of wood for carbon-neutral energy production are emerging as important strategies in managing carbon and addressing the climate change issue.

*Rising concerns about energy security*

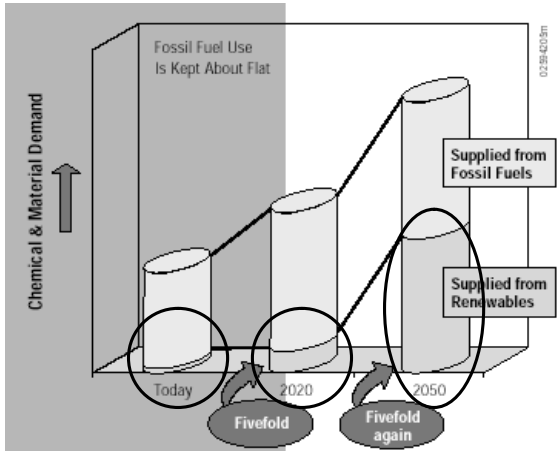
Concerns about carbon are directly linked to fossil fuel use. But fossil fuel consumption has also become an issue due to worries regarding long-term supply. Both of these factors are behind current government efforts to stimulate development and use of renewable energy including bioenergy. The goal of shifting a greater portion of energy production to renewables represents a major opportunity for both the agricultural and forest sectors. Rising use of biomass for production of heat, steam, electricity, and liquid fuels using a number of current and developing technologies is clearly part of the future — a future that appears even brighter when the potential for joint agricultural sector/forest sector bioenergy development is considered.

*Increasing interest in bioenergy and biochemicals*

The possibility that petroleum could become scarce and/or inordinately expensive raises issues not only with respect to availability of transportation fuels, but with availability of a wide range of industrial chemicals, lubricants, plastics, and synthetic fibers as well. Thus, concerns about energy security are stimulating interest in development of both energy from biomass and new types of biomass-derived products.

A 1999 industrial chemicals and materials future scenario developed by the U.S. Department of Energy provided an example of the magnitude of potential. The authors envisioned that 10% of industrial chemicals and materials would come from renewable resources by 2020 (~$400 billion/year in products, or two times the value of forest products produced in that year), with as much as 45%-50% from renewable sources by 2050 (Figure 8). More recently, the U.S. Departments of Energy and Agriculture have announced a goal of producing a sustainable supply of biomass

***Figure 8:*** *Projected biochemical production in the U.S., 1999-2050: Chemical and material demand 10% from renewable resources by 2020. About $400 billion per year in products (two times current forest products).*




*Source: U.S. Department of Energy, 1999.*

sufficient to displace 30% or more or the country's present petroleum consumption (Perlack et al. 2005).

## Implications for forestry in Minnesota: Many questions

The future of forestry in Minnesota is an open question dependent, in part, on how the citizens of the state, the forest-based industries and decision makers respond to the new realities and the lessons of history. The way in which several recent trends unfold is also likely to have a significant impact on forestry's future in the state.

Whatever strategy is pursued, there are a number of factors favorable to Minnesota's forest sector that can serve as a foundation for renewal. Strengths of this sector are that it:

- is reasonably well diversified between primary and secondary manufacturing;
- includes significant manufacturers of non-commodity products that may be difficult for foreign manufacturers to successfully target;
- is supplied (for those industries that use Minnesota wood) by forests that, to a greater extent than any other state, are environmentally certified as well managed;

- has well-established large players that add value to wood that originates in other regions (i.e. the local industry is not wholly dependent upon locally grown wood);
- enjoys strong political support within local and state units of government;
- benefits from innovative tax policy such as the Sustainable Forestry Incentive Act (SFIA) and 2c Managed Forest Land Tax Classification that help support management and reduce landowner costs;
- is supported by a vibrant research and development enterprise that is focused on wood and biomaterials development;
- has strong baseline data and modeling capacities to support evaluation of forestry potentials and alternative courses of action, including those related to carbon credit markets;
- has a track record of successful alternative energy development, including examples in the agricultural sector with ethanol production and with locally owned wind production;
- has established models of how bioenergy could be further developed, including the Laurentian project on the Iron Range and the district energy facilities in the Twin Cities; and
- is supported by well designed public interest institutions, including the Minnesota Forest Resource Council which aids in evaluating and addressing the needs of the sector and making policy recommendations.

On the other hand, Minnesota's forest industry also faces a number of challenges in addition to those discussed earlier. These include:

- relatively high costs of environmental compliance, including a lengthy time period for completing reviews;
- long distances to developing and foreign (and especially Asian) markets;
- relatively high raw materials costs;
- an aging infrastructure and workforce;
- declining budgets and reduced staffing for key land management agencies and research institutions;
- reduced funding and staffing for private landowner assistance programs that can facilitate more active forest management;
- increased parcelization, fragmentation and housing

development that takes forest land out of production;
- apparent warming of the climate and the potential increase in insect, disease and general forest health problems; and
- invasive exotic pests, including the Emerald Ash Borer (EAB), which may negatively impact forest productivity and which is already impacting the state's nurseries.

How all of these factors will impact the future of the forest sector going forward is unclear at this point, with what is likely to happen dependent, in part, upon the answers to the following questions:

1) To what extent will regional and national consumers embrace green building practices, environmentally certified wood products, and local purchasing?

2) Will Minnesota's forest sector act to take maximum advantage of the opportunities related to the high percentage of certified forest land in the state?

3) Will efforts to retain areas of privately owned contiguous forests and to minimize forest fragmentation succeed in keeping significant lands in active management status, or will large areas of what are now intact forests be parcelized and subject to residential and other development?

4) In what form will wood-based bioenergy development occur? Will development be characterized by community-dominated district heating, commercial production of wood fuel pellets, or by production of liquid transportation fuels in large-scale biorefineries? The pattern of development is likely significant since only the biorefinery route offers potential for large-scale biochemicals production.

5) As wood-derived energy grows in importance, will consumers embrace environmentally certified energy products?

6) To what extent will efforts to reduce carbon emissions formally recognize and create incentives for use of biomass fuels and products? Should the United States develop a cap and trade system that recognizes both avoided emissions and carbon storage in long-lived products, then wood-based industries will likely experience significant growth.

Similarly, science-based incentives for carbon sequestration within forests that recognize positive impacts of forest management on carbon stores would also have the effect of stimulating forest retention and active management.

7) Can Minnesota's forest sector adapt to a new model that focuses less on commodity products and to a greater extent on high value-added niche products?

## Crystal ball gazing

Nobel laureate in Physics, Dr. Nils Bohr once observed that: "Prediction is very difficult, especially if it's about the future." With this in mind, and fully recognizing the difficulty and inherent hazards of forecasting, a few things regarding the near- to mid-term future of forestry in Minnesota appear evident:

- The economy and housing market will eventually rebound, and demand for construction, communication, and other products will rebound as well, pumping new life into local, regional, and national forest sector enterprises.

- Minnesota, and the rest of the world, will continue to use significant volumes of forest products, ensuring demand for such products into the foreseeable future.

- The forest products industry of the future will be structurally different from the recent past.

- OSB production is unlikely to return to Minnesota in the foreseeable future.

- Energy products will play an increasingly important role in Minnesota's forest sector.

- There is a low likelihood of future industry growth oriented toward high-volume commodity products (other than energy products) that require large volumes of wood. More likely is development of niche oriented, higher-value added products.

- Markets for certified wood products (perhaps including bioenergy products) will grow in the region and nationally, creating significant opportunities for Minnesota's forest sector.

- Societal attention to carbon management will create new and expanded markets for wood products and new opportunities for forest owners and managers.

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