

EVERGREEN

A Publication of the Evergreen Foundation • Spring 2000



**Minnesota White Pine:
Window on the Past—Bridge to the Future
Facts about Minnesota's Timber Industry
State Forester Jerry Rose**

"The days are ended when the forest may be viewed only as trees and trees viewed only as timber. The soil and water, the grasses and the

shrubs, the fish and the wildlife, and the beauty that is the forest must become integral parts of resource managers' thinking and actions."

- Minnesota Senator Hubert Humphrey

In this issue of *Evergreen* Magazine we write about forests and forestry in Minnesota — and especially about the state's fabled white pine.

No tree has played a more significant or lasting role in American history than the eastern white pine. Just as surely as gold would later lure the nation west, white pine fueled development of the Northeast and the Midwest. Crudely sawn white pine framed the earliest buildings in five of America's greatest cities—Boston, New York, Chicago, Minneapolis/St. Paul and St. Louis—and it subsequently sheltered millions, fired blast furnaces and powered the locomotives and steamships that mobilized the Industrial Revolution. Directly or indirectly, all of the great nineteenth century timber, steel and railroad fortunes rested on its abundance.

Long known as the monarch of eastern forests, its unmistakable silhouette was sewn into the fabric of the first Revolutionary War battle flag—a symbol of the new nation's defiance of English rule, in particular British Royal Navy appropriation of all white pine two or more feet in diameter. The

towering giants made ideal ship's masts at a time when Baltic unrest threatened England's control of the high seas. Crown axmen marked reserved trees with a "broad arrow" and colonists who cut them down risked hanging. The so-called Broad Arrow Acts pushed freedom-hungry colonists ever closer to war with England.

But the English were not the first Europeans to see eastern white pine. That distinction probably belongs to the Vikings, though some historians credit French explorer Jean Nicolet with its subsequent exploitation in the Great Lakes Region. Cathay-bound Nicolet stepped ashore near Green Bay, Wisconsin in the summer of 1634. Though he never reached China, or found the gold and silk he sought, he did find fur, and it was fur, and the great wealth it created, that first drove explorers and trappers deep into the region's vast white pine forests.

Of course, long before Europeans reached American shores, eastern white pine held a special place in Indian ritual.

To the warring Iroquois nations—the Mohawk, Onondaga, Cayuga, Oneida, Seneca and Tuscarora—it became a symbol of the Great Peace that united them some 500 years ago. The founding of the Iroquois League, symbolized in legend by the planting of a single white pine, is still celebrated today.

Fossil-pollen records indicate eastern white pine forests first appeared in

On the cover

Little Wolf Lake, north of Deer River in the "Land of 10,000 Lakes." Jim Petersen

The unmistakable canopy of a towering eastern white pine, monarch of eastern forests, photographed northeast of Grand Rapids. Jim Petersen

Minnesota about 7,000 years ago. The species has been in slow decline in the eastern Great Lakes and Northeastern regions for about 4,000 years. Although the decline has been less evident in Minnesota, its east-west range has varied as much as 60 miles as a function of warming and cooling trends that occurred between 3,500 and 2,500 years ago. These trends are thought to have resulted from changes in the earth's orbit.

Over the last century and a half, human events have changed Minnesota forests in four ways. First, the total area occupied by forests has been reduced. Clearings for agriculture and urban-related expansion are the primary reasons. Second, there is less old forest and more young and mature forest, a direct result of the cumulative impact of human events. Third, species composition is changing, in large measure because wildfires are no longer allowed to burn unchecked. There is, for example, more aspen and less white pine. And fourth, Minnesota's pre-settlement landscape, once broken only by wildfires, violent winds and geography, is now divided into millions of small pieces, most of them privately owned. Farming, urban sprawl, road and highway construction, railroad and utility corridors and (more recently) vacation home developments are the chief causes of continuing forest fragmentation.

In the 14 years we've been publishing *Evergreen* Magazine, we've never seen so much public interest focused on a single tree species. Across the state, especially



(Top) No one in Minnesota has devoted more time or invested more money in white pine restoration than Jack Rajala. Here, he stands between two giants on one of his tree farms. (Bottom) Some 25 million trees are planted annually in Minnesota forests. Most are grown from seeds in nurseries for 1–2 years before replanting. These seeds—red cedar, black and white spruce and red, white and jack pine—photographed at Potlatch Corporation's Cloquet nursery attest to the diversity of the replanting effort. Not all species require replanting after harvest. Many including aspen, birch, balsam, and balsam of gilead regenerate naturally in full sunlight.

in urban environs, there is great interest in restoring white pine. Just how much of this interest is real and how much is a proxy for those who dislike the way Minnesota's forests are being managed is virtually impossible to discern. No matter the reason, there is a good deal of public misunderstanding surrounding both the history and ecology of white pine. Many believe vast white pine forests blanketed the state before white settlement began, but this was never the case. In fact, white pine was—and still is—rarely found in pure stands.

In the course of our investigation, we made four trips to Minnesota: first to confer with State Division of Forestry staff members and University of Minnesota scientists, and thereafter to explore the

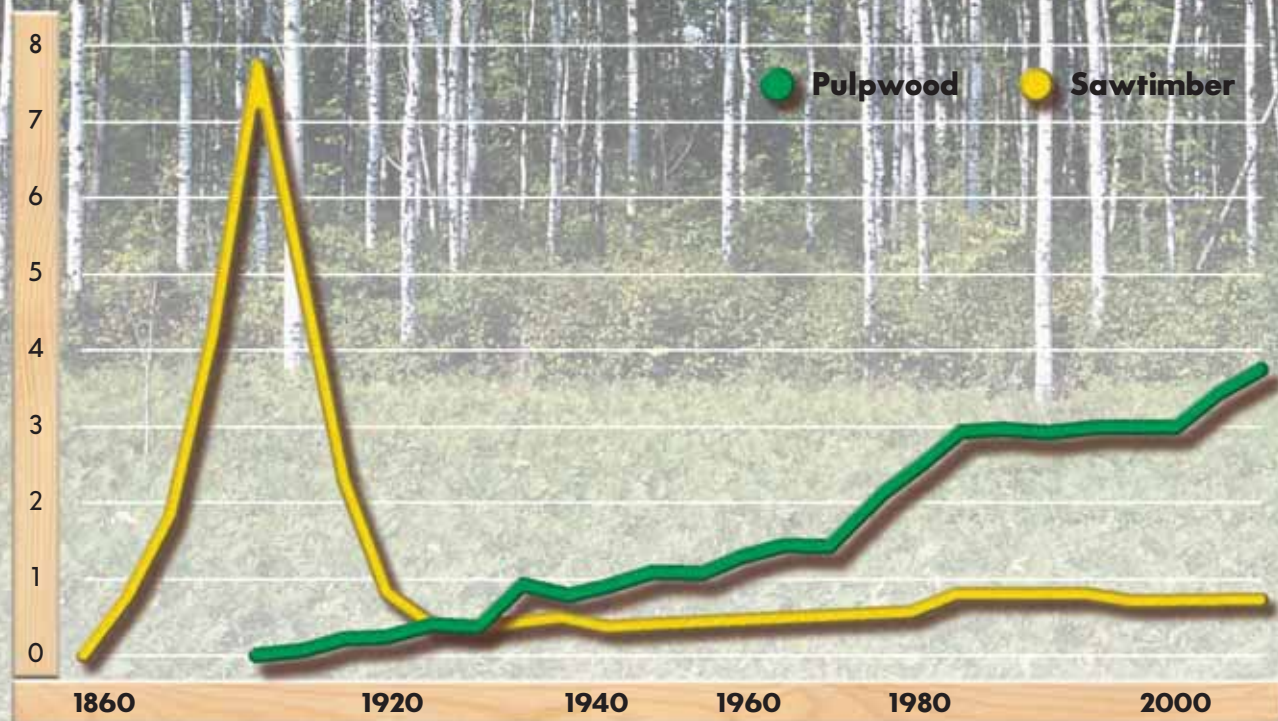
likely potential for restoring white pine. Along the way, we discovered a robust, technologically advanced forest products industry profoundly different from the industry that prospered here a century ago. Pulpwood has replaced lumber as the primary product and aspen has replaced white pine as the tree of choice. White pine now accounts for less than one half of one percent of Minnesota's annual harvest. This fact ought to reassure those who favor a ban on white pine harvesting; though as we discovered, its future is paradoxically far more dependent on active management than outright preservation. There are now significant private and public investments in white pine reforestation, but whether Minnesota taxpayers will be willing to underwrite their portion of the cost of the

tree's long-term care is an open question.

Minnesota's fascination with white pine has caused many to overlook an event of equal or greater significance: the emergence of hybrid poplar. Borrowing from the results of biomass research conducted by the federal Department of Energy during and after the Arab oil embargo, four companies—Potlatch, Boise Cascade, Blandin and Champion International—are growing poplar experimentally on idle farmland across the state. Apart from stunning growth rates (12-year-old trees 60 feet tall, with trunks eight inches in diameter), hybrid poplar holds a unique advantage over aspen: it can be grown from cuttings—meaning that precise genetic traits favoring growth, resistance to diseases

Wood Harvest - 1860 to 2005

In Millions of Cords - Excludes Fuelwood



An aspen stand west of International Falls, Minnesota. It is about 35 years old and belongs to Boise Cascade Corporation. Aspen is a mainstay at the company's International Falls paper mill. In Minnesota, aspen is the mainstay of both the pulp and paper industries and the oriented strandboard (OSB) industry. . Despite the fact that harvesting is increasing in Minnesota, the superimposed graph shows it is still miniscule compared with the harvest that occurred in the early 1900s. Source: Dana, et al., and USFS.

Jim Petersen

and tree form can be emphasized. If these experimental plantations prove themselves, which seems likely, fast growing poplar would allow paper-makers and OSB manufacturers to remain competitive globally at a time when land and fiber costs are increasing. And because it is most efficiently grown and harvested in an agricultural rather than a forest setting, it might well become an important cash crop for economically hard-pressed Minnesota farmers.

In preparing this report, we referenced several valuable sources. For anyone wanting to learn more about Minnesota's forest past we highly recommend Agnes Larson's fine 1949 work, *History of the White Pine Industry in Minnesota*. For a more current view, we recommend the proceedings of the 1992 White Pine Symposium, published by the University of Minnesota College of Natural Resources and "Minnesota's White Pine, Now and for the Future," a 1996 report by the White Pine Regeneration Strategies Work Group. Also of great value, DNR's web site, <http://www.dnr.state.mn.us>, and two reports: "Minnesota's Forest Resources," 1999 and "Minnesota's Forest Resources at a Crossroads," 1993. The Minnesota Forest Resources Council's 1999 "Biennial Report on Sustainable Forest Resources Act Implementation" also proved valuable as did the 1994 "Final Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota," by Jaakko Poyry, a global forest consulting group hired by the Minnesota

Minnesota DNR



John Krantz



(Top) The future of forestry in Minnesota looks bright, but balancing the timber industry's raw material needs with the aesthetic interests of outdoor enthusiasts will require patience and mutual respect. (Bottom) Logging is mainly a winter business in Minnesota. When the ground is frozen soil erosion is rare.

Environmental Quality Board. Equally valuable were several research papers given to us by Lee Frelich and Klaus Puettmann, two fine University of Minnesota forest scientists.

We have many to thank for their assistance and support in developing this special issue. Minnesota State Forester Jerry Rose first approached us about this project more than two years ago. Meg Hanisch, Public Affairs Specialist, Minnesota Department of Natural Resources, shepherded us through the state's grant approval process. Our old friend, Dr. Jim Bowyer, Director of the Forest Products Management Development Institute at the University of Minnesota, arranged a series of on-campus interviews with forest scientists, then developed the "Minnesota Forestry Quiz" that appears on **Page 27**. The Forest History Center at Grand Rapids also proved to be a gracious

host. What a fine museum it is. If you haven't visited, you've missed a most entertaining educational experience. Boise Cascade Corporation, Potlatch Corporation and Blandin Paper graciously toured us through their manufacturing and forestry operations—and picked up the tab for costs that exceeded our state grant. Last, but certainly not least, Jack Rajala shared his time and his passion for white pine. Over the last 17 years, Mr. Rajala has planted more than 2.5 million white pine seedlings on his family's land. He even wrote and published a book about his experiences. *Bringing Back the White Pine* is both a forester's manifesto and a how-to guide for would-be planters. We doubt that anyone anywhere can match

his extraordinarily personal contribution to white pine restoration.

One might legitimately ask why the Minnesota Department of Natural Resources would ask a Montanan with roots in Idaho and an office in Oregon to evaluate its state's forests and forestry. Fresh perspective is the best answer I can offer. Although Minnesotans pride themselves on being able to settle their differences amicably, there lingers a fear that the political disembowelment that has gutted the West's rural timber communities might occur here. But with so little federal forestland in Minnesota it seems unlikely, at least so long as Minnesota remains a populist state held together by strong rural-urban voting blocks.

Onward we go,
Jim Petersen, Editor
Evergreen Magazine

“One thought emerges above all others.”

“The lesson this situation should bring home to us is the need of restoring the forest industry. Our forests should be nurtured so as to serve the generations to come as they did the generations that are past. To this end, the people of Minnesota must shape their plans. Only thoughtful planning and

careful management over a long period of time can again make productive the forest lands of the white pine region.”

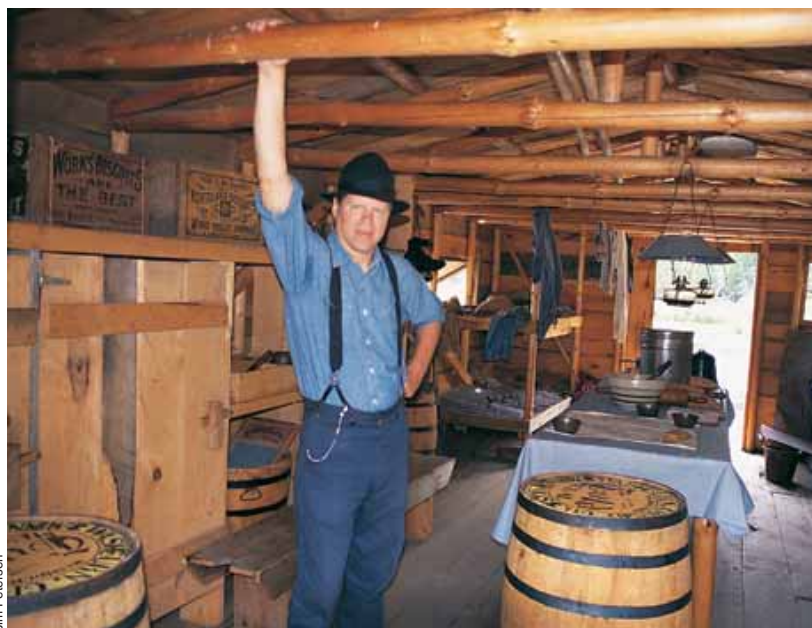
History of the White Pine Industry in Minnesota, Agnes Larson, Professor of History and Chairman of the Department of History, St. Olaf College, University of Minnesota Press, 1949

Fifteen miles northeast of St. Paul, at Marine on the St. Croix—the first white settlement in Minnesota—the Marine Lumber Company made history on August 24, 1839. Using waterpower diverted from the fast moving St. Croix River, it cut the first commercial saw log ever milled in Minnesota. History does not record the species, but it is assumed that it was a white pine cut from river's edge.

Sixty-seven billion board feet later, on October 9, 1929, history was made a second time. The giant Virginia and Rainy Lumber Company—the largest white pine sawmill ever built in Minnesota—cut its last log. One long blast from the mill's steam whistle and it was over—or so it seemed.

In a very real sense, the tiny Marine Lumber Company and the mighty Virginia and Rainy Lumber Company form the bookends for most of Minnesota's history. Their years span not only the history of the state's legendary timber industry, but also the histories of four more great industries, each built from white pine: flour milling, machinery, railroading and banking.

It is all exquisitely documented in the late Agnes Larson's seminal 1949 doctoral thesis: *History of the White Pine Industry in Minnesota*. Decade by decade, she brings to



Actor Kent Johnson aboard his replica wanigan at the Forest History Center in Grand Rapids. Floating wanigans doubled as cook and supply shacks during log drives. Before roads replaced rivers, water was the primary means for moving logs from remote logging camps to mills. During the tourist season, actors like Mr. Johnson provide visitors with a rare and historic look at the dangers 19th century loggers faced daily. For anyone wanting to learn more about the early days of Minnesota's logging and milling industries, the Center is an outstanding public resource.

life the people and events that shaped early Minnesota in an image remaining remarkably unchanged 161 years after the telling begins. Then as now, technology and capital were the real driving forces—forces in whose absence white pine could never have been exploited. Circular saws replaced primitive water-powered saws, increasing daily production from 5,000 board feet to 4,000 feet *per hour*. Powerful steam-driven carriages flipped logs from one flat-sawn side to the next replacing men who did the turning by hand. Edging machines transformed crudely sawn boards into concisely measured lumber. Kiln dryers condensed the time it took to move lumber from mill to market, reducing the cost of capital, and hot ponds kept logs from freezing in winter,

allowing the cutting to go on year-round.

But technology exacted a steep price. Between 1870 and 1890, the cost of building a sawmill increased five-fold. The Virginia and Rainy mill, completed in 1908, cost its principal owners—Frederick Weyerhaeuser and Edward Hines—\$10 million. In 1949, historian Larson would write that she was not sure which came first—increased competition or increased milling efficiency. Either

way, the outcome was the same: mills got bigger and there were more of them.

By 1870, there were 207 sawmills in Minnesota, including 13 at Minneapolis, all driven by the Mississippi power of St. Anthony Falls. And by 1876 rough cut lumber was being “dressed” at 17 Minneapolis factories—made into doors, blinds, flour and pork barrels, boats, furniture and planking for sidewalks. Adding to demand, in 1887 the City of Minneapolis bought 6 million board feet of sidewalk planks, which it then used to extend the city's boardwalk—by 67 miles.

Throughout the 1880s, *annual* consumption in the Twin Cities hovered near 300 million board feet—only slightly less than mills in the area were producing. And in 1899, Minneapolis became the leading

lumber market in the world. Its mills cut 594.3 million board feet of timber, astonishing for the time. That same year the statewide harvest topped 2.3 billion board feet—2.14 billion of it white pine, more than 200 times the 1997 harvest. The following year, three of the four largest sawmills in the U.S. were reported to be operating in Minnesota, and two of them were in Minneapolis, by then the largest sawmill town on Earth. Its mills alone were worth \$52 million.

Until 1848, timber companies owned no private land in Minnesota. Early lumbermen, including those who built the first sawmill at Marine on the St. Croix, simply took what they needed from nearby public domain

lands. That year, they bought their first tract—108 acres of pineland—from the federal government for the standard asking price of \$1.25 per acre. As the industry fanned out across Minnesota's white pine forests, it bought more land from the government—sometimes legally and sometimes by questionable means.

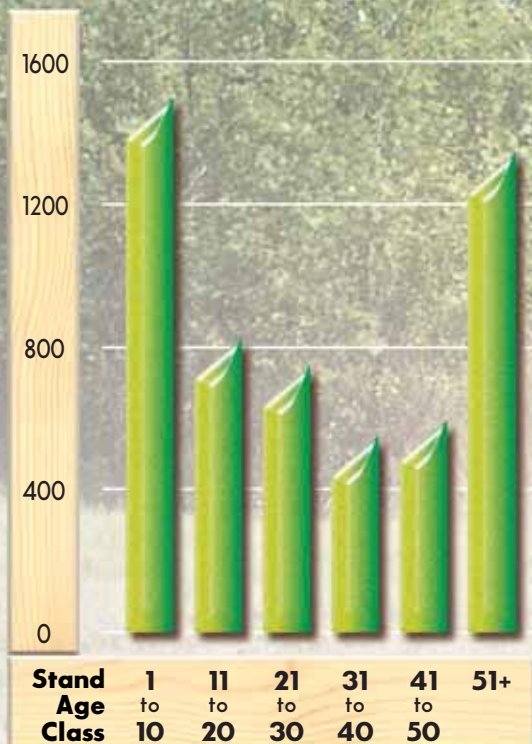
As loggers cut their way north, the railroads followed and shantytowns sprang up beside the tracks: Winona, St. Cloud, Little Falls, Brainerd, Stillwater, Cloquet and Virginia. Logging camps first, they became big mill towns. Minnesota was on a roll. Minneapolis sash, door and blind makers did almost \$4 million in sales in 1892, factories that built and repaired railroad cars did another \$4.2 million and furniture makers did \$2.8 million. Lumber paced a wave of economic diversification that pushed Minneapolis ahead of Detroit, Cleveland or New Orleans.

For all of its glory, the Minneapolis sawmill industry was short-lived. By 1907, the biggest mills had lost their competitive advantage to Duluth. One by one, they fell silent. But where Minneapolis lumber had gone south down the Mississippi by barge or west by rail, Duluth lumber moved across Lake Superior, down Lake Michigan to Chicago. But of even greater significance, it moved across Lake Erie to Tonawanda, New York, which then advertised itself as "the greatest white pine assembling and distributing market on the continent." Perhaps it was, for once Minnesota white pine reached Tonawanda by water it was railed to New York, Philadelphia, Boston, Cleveland, Pittsburgh and Toledo. And from port cities, it reached England, the West Indies and South America.

But the same magnificent rail and barging systems that delivered Minnesota lumber to far-flung destinations also

Aspen & Balm Type Age Distribution - 2000 In Thousands of Acres

Statewide



Boise Cascade procurement forester Craig Halla (right) and Jim Hebner, Minnesota land and timber manager, amid a 20-foot-tall stand of 4-year-old hybrid poplar. These trees will be 60 feet tall when they are harvested in 2008. Minnesota's pulp and paper manufacturers are experimenting with hybrid poplar as a fiber source to fill a predicted shortfall in the amount of harvestable aspen. The superimposed graph illustrates the gap in the supply of aspen between 21 and 40 years old, and the abundance in ages 1–10 and 51–plus years old. Source: Minnesota DNR

delivered less expensive lumber to Minnesota. In 1888, Northern Pacific Railway tracks reached Tacoma, Washington, the epicenter of a timber treasure many times the size of Minnesota. Five years later, Jim Hill's Great Northern Railroad also reached the coast. Before the last Minneapolis mill was shut down, coast Douglas fir and western pine constituted 52% of the sales from Minnesota lumberyards.

Many of Minnesota's timber barons placed big bets in the West—and won again. Chief among them: the reclusive Frederick Weyerhaeuser, whose already vast fortune grew considerably after he bought 900,000 acres of coast Douglas fir timberland from Northern Pacific in 1900—for six cents per thousand board feet.

To her credit, Agnes Larson saw Minnesota's early timber industry for what it really was—an exploiter, yes, but also the primary turn-of-the-century investor in the state's future. True, once the pine gave out the industry headed west. But much of the great wealth pine generated stayed in Minnesota where it was invested in a wide variety of enterprises essential to the state's growth: flour milling, banking, manufacturing, retailing—and philanthropy, including universities, museums and art galleries.

"One thought emerges above all others



Jim Petersen

Boise Cascade's International Falls paper mill stands beside the Rainy River, a prized sturgeon fishery. Over the last decade the company has invested more than \$500 million in the Minnesota facility, improving air and water pollution control and increasing manufacturing capacity. More than 1,100 men and women work here, many of them the grandsons and granddaughters of the EW Backus workforce that started here in 1905.

as this book draws to a close," she wrote in 1949. "We have seen that the pine forests played a major role in the development of the Upper Mississippi Valley; the lumber industry they supported provided materials, men, capital and institutions which contributed richly to the growth of the nation and particularly the region where the industry flourished. That industry is gone because the pine forests are gone, and Minnesota and the region are poorer as a result. To be sure, we still have much of the material and human wealth that were stored up in the decades of activity in forest and lumber mill."

With extraordinary vision, she saw the need for Minnesotans to unite around a single theme: *restoring the forest industry*.

"Our forests should be nurtured so as to serve the generations to come as they did the generations that are past," she concluded. "To this end the people of Minnesota

must shape their plans. Only thoughtful planning and careful management over a long period of time can again make productive the forest lands of the white pine region."

Ms Larson was right about the need for Minnesotans to get behind a publicly inspired conservation ethic. But what she did not know was that thanks mainly to the

unappreciated resiliency of nature, Minnesota's next forest was already in the ground and growing when C.H. Rogers, superintendent of the Virginia and Rainy Lumber Company, sent the last white pine log down the carriage October 9, 1929. And it is this *next* forest—the one too young and too scrawny to be regarded as much of a forest in 1949—that is a half-century later poised to power Minnesota's forest products industry into the new millennium.

And as we enter the new millennium one new thought emerges "above all others" to be added to Ms Larson's 1949 vision. These new forests do not hold vast reserves of white pine. They are composed mainly of faster growing more easily managed aspen, red pine, jack pine and spruce—species of considerable value to their current owners, whose mills are no longer dependent on white pine. All this should make white pine restoration—however feasible—a little bit easier.



An Interview with Minnesota State Forester Jerry Rose

“The system is working just as we intended.”

Editor's Note: Gerald A. Rose has been Minnesota State Forester since 1987. He is a 1963 graduate of Michigan State University, and holds a Bachelor of Science degree in Forestry. Before his appointment as state forester he held several positions within the Michigan Department of Natural Resources: manager of the Michigan State Forest, Forest Resource Planning Section Leader and Assistant State Forester. In 1986, he was elected a Fellow of the Society of American Foresters.

Would you agree that the public has within its power the ability to confer on an industry an intangible “license” to do business?

I don't know that I would call it a 'license', but

Mr. Rose, as state forester, what are your responsibilities?

Minnesota's State Forestry Agency is responsible for the management of 4.3 million acres of forestland, and we monitor forest health and provide wildland fire protection on non-federal lands. We also provide technical assistance to private landowners and communities, and we work cooperatively with other public and private agencies that are similarly engaged.

When you put your finger on the public pulse what do you learn about Minnesota attitudes toward forests and forestry?

Minnesotans care very much about forests in their state and generally speaking they are well informed where forestry issues are concerned. I attribute this to the fact that many in our state rely on forests for recreation and employment.

public social concerns can and do play a significant role in how forestlands are managed. The environmentalist-sponsored drive toward third-party certification of the sustainability of forest management is an example.

A red pine seedling at Potlatch Corporation's Cloquet nursery. Potlatch grows about 2.5 million seedlings a year here including red, white and jack pine, white spruce, white cedar, blue spruce, European larch and hybrid poplar. The company plants about half of what it grows and sells the rest to other Minnesota landowners. Red pine is a favorite with many commercial tree growers because it grows uniformly and quickly on a variety of sites, suffers few diseases, and is suitable for use as lumber or pulp.

Jim Petersen

Increasingly, Minnesota timberland owners, including counties, are embracing certification, most notably the American Forest and Paper Association's Sustainable Forestry Initiative, but also the certification program offered by the Forest Stewardship Council

How has the industry responded to public pressure, and are its actions sufficient to merit public trust?

I've been quite pleased by the industry's proactive response, but public trust seems to be fleeting. Some trust the industry and some don't. They've earned my trust.

Since 1980, Minnesota's forest product manufacturers have invested more than \$3 billion in new plants and environmental technology. In your view, have these investments been positive in terms of the way Minnesotans perceive the industry?

Yes, I think so. But beyond the public's positive perception of the industry, modernization has driven up the price of wood, which has, in turn, stimulated landowner interest in doing what is necessary to increase forest productivity. So apart from increasing demand for wood fiber—an economic benefit—modernization has also stimulated interest in better forest management practices—an environmental benefit. Increased fiber demand has also forced us to address biological diversity in managed forests, also a plus.

How is the state addressing increased public interest in forestry and forest regulation?

The 1995 Minnesota Sustainable Forest Resources Act has been the

credit for doing good work. Of course the key to our program is monitoring, and compliance is quite high, especially among industrial landowners.

What are you monitoring for?

The after harvest quality of water, wetlands, riparian areas, wildlife habitat, cultural and historic resources and visual conditions. Our comprehensive forest management guidelines set the standard. We monitor for compliance with guidelines and the effectiveness of the guidelines.

Harvest levels on public lands in Minnesota—including state lands—are declining. Is this in response to public concern for over-harvesting?

To some degree it is, but mainly it is part of the state's planned response to a one-age forest. We have lots of old aspen in Minnesota. To capture as much value as we could before it died, we increased the aspen harvest in the 1970s knowing we would later have to reduce it. Our long-term objective is to balance our age classes—meaning that we will have good representation in all age classes: young, middle age and old. Timber production will be emphasized in some areas, but in others we will let forests age to provide habitat for plant and animal species that occupy niches in older forests.

How much of Minnesota's total harvest comes from state lands, and is the state harvest still significant in economic terms?



Jim Petersen

According to State Forester Jerry Rose, the Minnesota Logger Education Program has done much to improve the quality of loggers as well as the quality of their work. Thousands of loggers have completed the program, which is designed to help assure compliance with federal environmental regulations and state harvest guidelines.

centerpiece of our response to increased public interest in forest regulation. However, we chose to make the Act's guidelines voluntary, rather than write them into law, because we felt a collaborative approach would help us make further progress in our quest for quality management of all forest resources.

Has the voluntary approach worked to your satisfaction?

It certainly has. The level of cooperation between landowners and our department is far higher than it is in states that observe a strict regulatory approach. Most of our landowners have adopted a real 'can-do' attitude. It is human nature to want to get public

State timberlands account for about 16% of the total harvest and generate about \$15 million in annual stumpage revenue, so I would say the state harvest is very significant.

How would you characterize the state of forests in Minnesota? For example, is reforestation adequate and are landowners in the aggregate providing a full range of wildlife habitat?

Minnesota forests are in pretty good shape, and landowner interest in improving stewardship is quite high. Reforestation is more than adequate among planted tree species, such as red pine, and natural regeneration in aspen is prolific. Most if not all of our timberland owners choose to harvest periodically to recover their investments in the land and to finance projects and products of their interests. Still, most landowners are clearly very interested in improving habitat quality. Private timberland owners are the major providers of early succession plant and animal habitat, while federal lands provide most of our late succession habitat. Between our various state and private ownerships we are providing a full range of habitat.

Minnesota's forest inventory system is widely regarded. Can you describe it to us and tell us why it enjoys such positive notoriety.

Inventory systems are designed to account for growth, harvest and mortality in forests. Most report every ten years. Because we place such a high value on our

forests—and their owners—we developed an annually updated forest inventory system that is based on re-measuring all of our sample plots every four years.

In 1994, Minnesota completed its so-called "Generic Environmental

If the GEIS is a roadmap, then the Act is the compass. It provides a framework for going forward.

Who is regulated under the Act and for what purpose?

All forest landowners are involved, though I want to say again that no one is regulated. The Act stresses voluntary compliance. We would only adopt a regulatory approach if it became necessary, and it has not. We're making good progress through voluntary compliance and monitoring at the site level. Where we find problems we seek the most efficient and effective remedy. It may be education, technical assistance, a cost-sharing program or, as a last resort, a carefully developed and focused regulation. The system is working just as we intended.

In its approach, how does the Minnesota

Act differ from, say, the Oregon Forest Practices Act which places strict, legally enforceable restrictions on the activities of private timberland owners.

Our program is voluntary. Theirs is not. They have an army of regulators. We don't. Our program costs taxpayers a lot less than theirs and I believe we get the same or better result. On the other hand, they face some challenges we don't face in Minnesota. I cannot over-emphasize the fact that Minnesota timberland owners have given us far more in the way of cooperation and investment than we ever could have hoped to attain had we opted to write our voluntary guidelines into law.



Potlatch Corporation engineering and construction vice president Mike Mangan is dwarfed by the sheer size of this soon to be installed drum de-barker, part of the company's soon to be completed \$525 million Cloquet modernization. The tumbling action of the revolving drum can de-bark 100 cords of wood per hour.

Impact Statement." What was its impetus and would you characterize the document as your state's forest roadmap to the future?

The GEIS was done in response to public concern over increased harvesting brought on by the industry's billion-dollar investment in new manufacturing technologies. You could say it is a roadmap to the future, but like all roadmaps, it will need to be updated whenever significant new information is available.

A year later, in 1995, Minnesota enacted its Sustainable Forest Resources Act. If the GEIS is the roadmap to the future how would you characterize the Act?

The Minnesota Act gives the governor the authority to appoint a Forest Resources Council. How are council members selected and what is their role?

Council members represent industrial landowners, small timberland owners, environmental organizations, labor, tourism, local government and the academic community. Individuals who desire membership apply to the Secretary of State and are appointed by the Governor. As Council members, they advise on matters of policy. For example—the recently implemented site-level harvesting guidelines.

What has been the industry response to the Act, the Council and the GEIS?

The industry has been very responsive from the beginning.

And how have Minnesota's loggers responded?

Quite well, I think. The Minnesota Logger Education Program, which provides continuing education for loggers, has done much to improve logger quality as well as the quality of their work.

And how have environmental groups responded to the Act, formation of the Council and the GEIS?

It's hard to characterize environmental groups. Some have played a significant role and have been very supportive of

the Act, while others continue to believe we are moving too slow or in the wrong direction.

How have federal agencies responded to the Act?

dominant factor was statewide public interest in doing what could be done to increase its presence, bringing it closer to historic levels within our forests. The objective of the Initiative is to bring white pine back into prominence in our forests. Deer browsing, blister rust,

historic logging practices and a lack of natural regeneration have all contributed to the species' plight, but we're confident that planned public and private sector investments in reforestation, thinning, blister rust and deer browse control, and vegetation management will eventually pay off.

Forest scientists we interviewed say white pine cannot be restored by simply placing timber stands in reserves where no harvesting is permitted. Do you think Minnesotans understand that management, including periodic harvesting, is essential to white

pine restoration?

Many Minnesotans are not far removed from family heritages in farming and logging, so I suspect most of them realize that periodic timber harvesting is essential to white pine restoration. Of course urban Minnesotans will want some white pine to be managed for its old-growth characteristics. Our job will be to help them understand that thinning is an essential step in aging a forest.

State harvesting records indicate the white pine harvest is miniscule compared to aspen or red pine. In your view is there a future for



Jim Petersen

A red pine forest along the "Avenue of the Pines" in the Chippewa National Forest. Scientists believe such stands provide ideal growing conditions for white pine seedlings, which are capable of tolerating modest shade. But introducing white pine to red pine forests requires periodic harvesting. Brush must also be controlled to give seedlings the opportunity to grow. Minus active management white pine seedlings will not survive.

We've had marvelous support from the U.S. Forest Service. A good deal of the research underway in Minnesota forests would not be possible without their cooperation and financial support.

Your state legislature also enacted a White Pine Initiative in 1996. What is its objective and is there a connection between the Initiative and environmentalist-sponsored efforts to ban harvesting of white pine?

Yes, the attempt to ban white pine harvesting contributed to enactment of the White Pine Initiative, but the

Minnesota's once dominant white pine industry or will it eventually fade away?

There will be more white pine available for harvesting in the future as a result of the Initiative, but the industry that uses it will fill a small niche in a manufacturing complex dominated by paper, oriented strand board and composite materials producers. Aspen, red pine, balsam and spruce will play the dominant role that white pine played a century ago.

These events—the GEIS, the Act, formation of the Council, the White Pine Initiative and industry's responses to them— would seem to be bode well for your leadership as state forester. Would you rate one or perhaps all of these as your most significant accomplishment?

Oh my, I think it would be more appropriate for me to leave it to others to judge my accomplishments. But speaking personally, I've worked hard to engage people of varying points of view in the common cause of improving forests and forestry. Other state foresters around the country would probably say the same thing, though I do believe my job has been made easier by the fact that Minnesotans are very supportive of collaborative approaches to resolving conflict and developing consensus. We aren't perfect here, but because so many Minnesotans share similar goals where forests are concerned, we are on the cutting edge in dealing with many of forestry's most contentious problems.

What is the most significant task still facing your department and how are you approaching it?

We still need to get our landscape level guidelines up and running.



Potlatch forester Greg Bernu surrounded by 4-month-old aspen sprouts near Cloquet. Though these stands look pure, they often hold 14 or more species of hardwoods and softwoods. Scientists credit soil types, which can vary widely in no more than 40 acres. This helps explain why so many tree species returned to forests that were logged in the early 1900s. Regeneration surveys confirm that where multiple species are present they usually return after harvest.

Progress was slow initially because landscape level management requires a convergence of many, often competing, scientific disciplines. For example, silviculturists—those who manage timber stands—have not historically had a lot of interaction with wildlife biologists. The GEIS and the Act have forced them to sit at the same table and work toward common goals.

Do you believe Minnesota can avert the legal and political entanglements now so prevalent in other forested regions, particularly western states? If so, how?

I hope so. The credibility of our collaborative process rests on keeping all stakeholders, particularly local stakeholders, at the same table working together for the common good. I emphasize “local shareholders” to underscore my belief that government leaders, in both the executive and legislative branches, need to address the conflict industry's repeated attempts to disrupt the public will. Special interest groups working at the national level should not have undue power over decision making at the state or community level in Minnesota or any other state.

Draw us a picture of Minnesota forests and forestry in the year 2025?

We will see more natural forests protected and managed at low intensity. These forests will be allowed

to grow older to satisfy the public's desire for older forests. We will also see more Minnesota forests managed more intensively to meet the fiber needs of consumers who are served by our robust and growing forest industry. Hybrid poplar and cottonwoods will become an important new source of wood fiber. Plantations harvested every 10–12 years will occupy now idle farmlands, providing farmers with new economic opportunities. A bright future, I'd say.

White Pine in M

◆ White pine is one of 52 tree species considered native to Minnesota forests. ten species are softwoods, also called conifers or evergreens because they constantly replace their needles. 42 are hardwoods, also called deciduous trees because they shed their leaves in the fall.

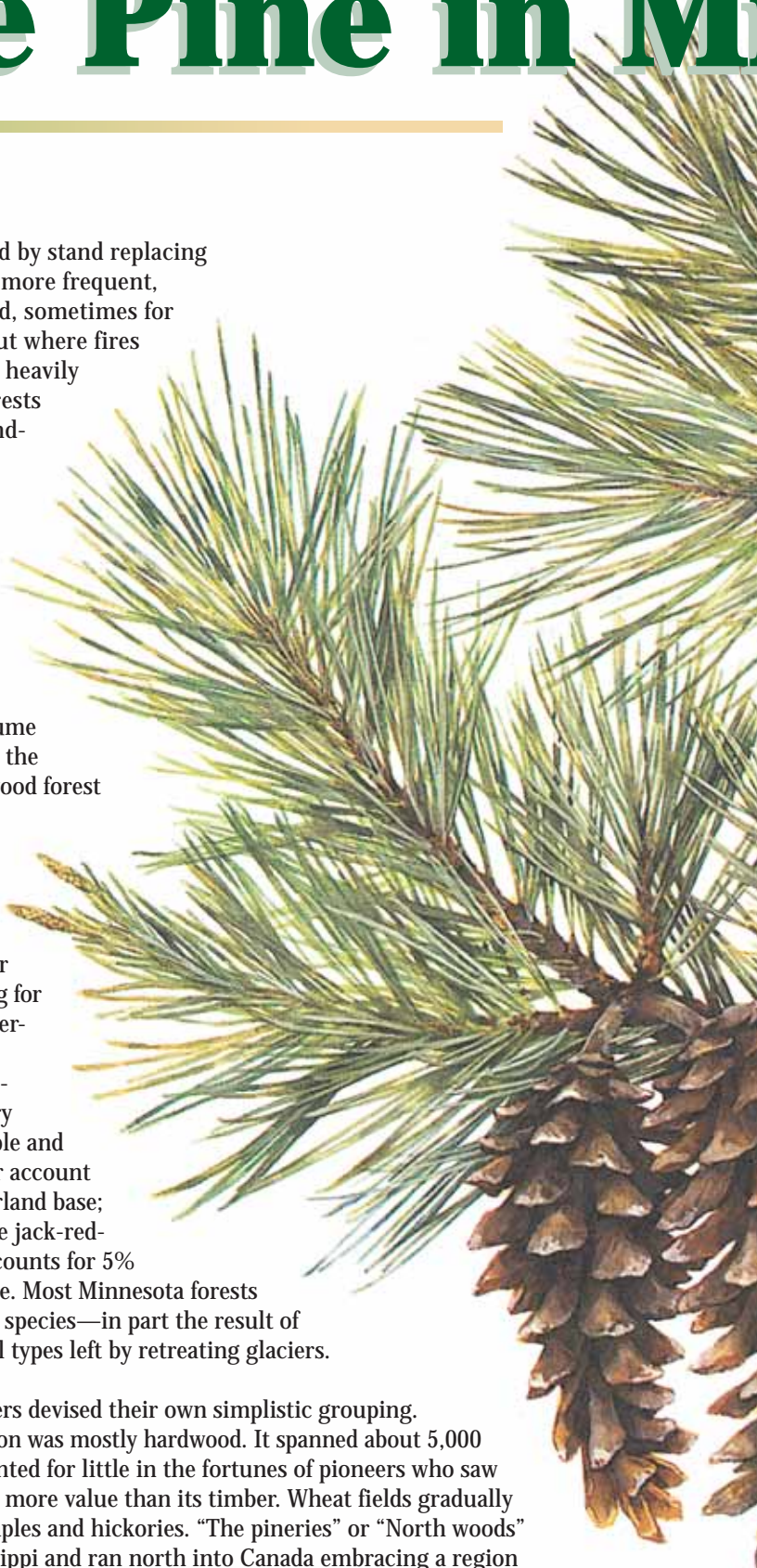
◆ When white settlers entered Minnesota (around 1830) forests covered about two-thirds of the state. East to west forests covered 300 of the state's 375-mile width and north to south they spanned 364 of its 400-mile depth. Clearings for agriculture and community development have reduced the state's forestland base by about 50% to about 16.7 million acres. Tree species composition has also changed noticeably. In the absence of wildfires, which have been suppressed for most of this century, thin-barked, fire-sensitive species—most notably aspen, which sprouts from its own roots—have greatly expanded their range.

◆ A century ago, three forest types dominated Great Lakes region forests. Nutrient-poor near-boreal forests held a mixture of jack pine, aspen, paper birch and black spruce covering some 11 million acres in northeast Minnesota. Fires were frequent. Nutrient-rich northern hardwood-hemlock forests covered almost 38 million acres in northern Michigan and Wisconsin and held a mix of three shade tolerant species: northern hemlock, sugar maple and yellow birch. Fires were infrequent. White-red pine forests were found in all three states in areas where catastrophic fires occurred at 150-300 year intervals. These mixed species forests, which covered about ten million acres, usually established themselves beneath the canopies of faster growing aspen, birch, red maple or oak, species that quickly

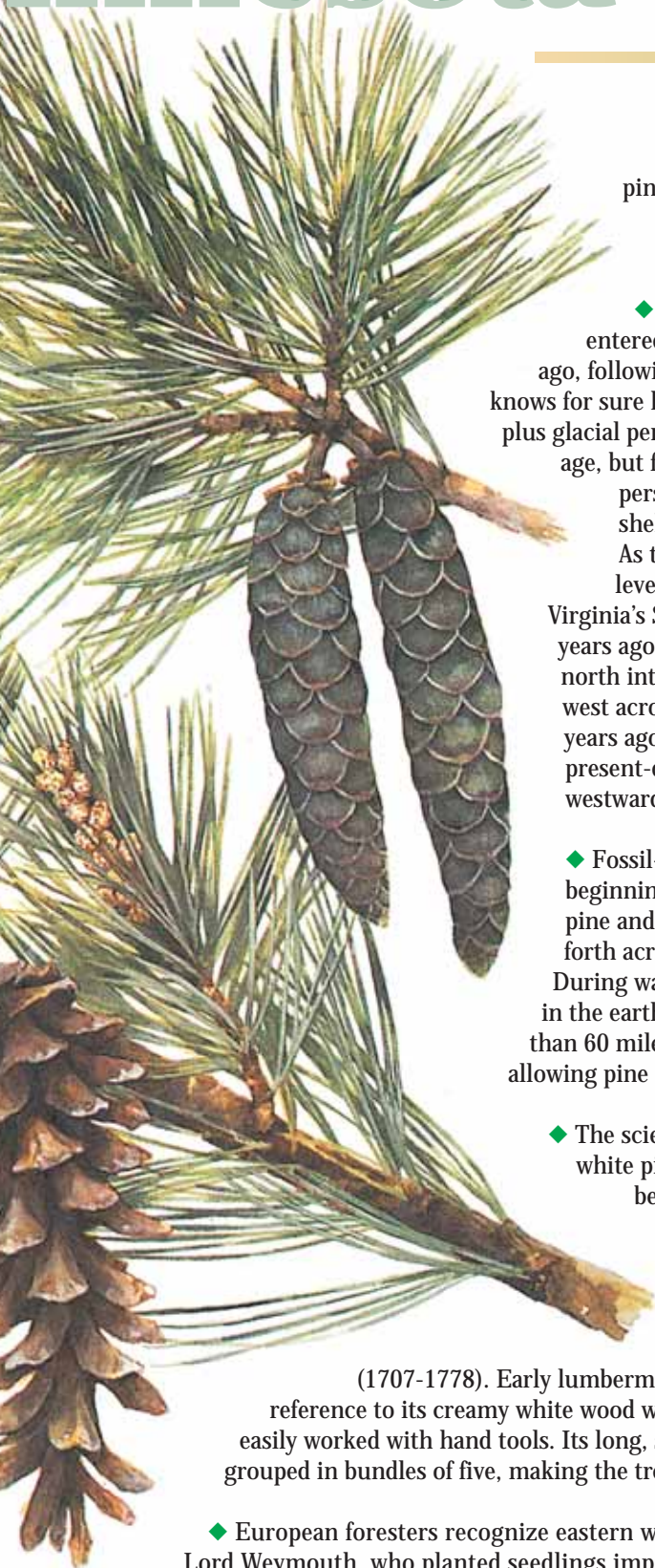
colonize areas cleared by stand replacing fires. Where fire was more frequent, white pine dominated, sometimes for hundreds of years; but where fires burned infrequently, heavily shaded hardwood forests kept pine from expanding its range.

◆ Today, there are 14 forest types, or cover types, in Minnesota, each bearing the name of one or more tree species that form a majority of wood volume in the stand. Aspen is the most common hardwood forest type, accounting for 35% of the state's 14.8 million-acre timberland base. Black spruce is the most common conifer cover type, accounting for about 9% of the timberland base. Hardwood forests include maple-basswood, oak-hickory and elm-ash-soft maple and birch, which together account for 36% of the timberland base; and softwoods include jack-red-white pine, which accounts for 5% of the timberland base. Most Minnesota forests contain multiple tree species—in part the result of wide variations in soil types left by retreating glaciers.

◆ Minnesota's pioneers devised their own simplistic grouping. "The Big Woods" region was mostly hardwood. It spanned about 5,000 square miles but counted for little in the fortunes of pioneers who saw its rich soil as having more value than its timber. Wheat fields gradually replaced big oaks, maples and hickories. "The pineries" or "North woods" lay east of the Mississippi and ran north into Canada embracing a region larger than the entire state of Maine. These were mixed conifer forests, but it was white pine that gave the region its singular character. No wonder: white



Minnesota Forests



pine could be found in every county east of the Mississippi from Minneapolis north to Canada.

◆ White pine is thought to have entered Minnesota about 7,000 years ago, following the last ice age. No one knows for sure how white pine survived the 40-plus glacial periods that preceded the last ice age, but fossil-pollen records suggest it persisted on exposed continental shelves off the mid-Atlantic coast. As the glaciers melted and the sea level rose again, it came ashore in Virginia's Shenandoah Valley about 12,000 years ago. From there it worked its way north into Maine 10,000 years ago, then west across the Great Lakes region 9,000 years ago. The prairies that lie west of present-day Itasca State Park halted its westward migration.

◆ Fossil-pollen records also indicate that beginning about 7,000 years ago, white pine and oak pushed each other back and forth across Minnesota for 3,000 years. During warm dry periods, caused by a shift in the earth's orbit, oak pushed east more than 60 miles. Thereafter, the climate cooled, allowing pine to push west again.

◆ The scientific name given to eastern white pine is *Pinus strobus*, which can be literally translated from Greek as "pine cone," a reference to its conspicuous long, narrow cone. The tree was first classified by Swedish botanist Carolus Linnaeus,

(1707-1778). Early lumbermen called it "white pine," a reference to its creamy white wood which, because of its softness, is easily worked with hand tools. Its long, slender blue-green needles are grouped in bundles of five, making the tree easy to identify.

◆ European foresters recognize eastern white pine as Weymouth Pine, for Lord Weymouth, who planted seedlings imported from the U.S. on his English estate more than 200 years ago.

◆ Next to the sugar pines that grow in southern Oregon and northern California, eastern white pine is the largest pine that grows in the U.S. Early Minnesota lumbermen described monarchs 250 feet tall with trunks six feet in diameter. Minnesota's largest white pine is located on state-owned land in Itasca County. It measures 131 feet tall, 180 inches in circumference and has a crown spread of 51 feet.

◆ Eastern white pine is a favorite with many wildlife species. Red squirrels, rabbits, black bears and birds eat its seeds. Beaver, snowshoe hares, rabbits, field mice and porcupines are fond of its bark, and eagles sometimes nest in its massive mast-like crown. Browsing deer enjoy its buds, a fact that poses huge problems for foresters and Tree Farmers interested in regenerating the species.

◆ White pine grows slowly at first—usually only about three feet in its first five years. Because it is easily overtaken by competing vegetation, controlling brush is especially important to its early survival and growth. Growth accelerates at about year five. 10 to 30 year-old trees often grow 20 inches a year.

◆ Unlike aspen or even red pine, white pine seed production is irregular and infrequent. If seed production does not coincide with seedbed preparation (meaning mineral soil is exposed by plowing or fire) successful regeneration is unlikely. White pines begin to produce seeds when they are 20-30 years old.

◆ White pine is fire-dependent, meaning it cannot regenerate itself in the absence of wildfire or some other kind of disturbance, like harvesting, that creates an opening in the forest canopy while also exposing mineral soil. Even then,

white pine lacks important regeneration attributes held by other fire-dependent species. It does not sprout vegetatively like aspen, and it does not possess serotinous cones that open under the heat of fire, like jack pine or black spruce. And unlike paper birch, it does not produce abundant seed crops year after year.

◆ No tree growing in America is more susceptible to insect and disease attack than eastern white pine. By one count, 277 different insects and 110 diseases have been known to attack it, though only 16 insects and seven diseases are considered fatal. Among the killers, white pine blister rust is the most prominent. Blister rust is a fungus that entered Minnesota around 1916 in nursery stock imported from England. After entering the needles (turning them a rust-brown color) it advances down the branch to the tree trunk, girdling the stem. Its ability to infect trees depends on the presence of a very narrow range of temperature, wind and moisture conditions. Ironically, these conditions are most often found in low moist sites where white pine thrives. Despite blister rust's devastating impact, many think pine weevils—which deform trees, causing their trunks to fork—are a greater impediment to commercial white pine management.

◆ Unlike red pine, young white pines will tolerate some shading from taller nearby trees. Thus, the species thrives in mixed stands, associating itself with red pine, white cedar, birch, aspen, tamarack, oak, jack pine, balsam fir, black spruce, and northern hardwoods including sugar maple. Foresters and tree farmers interested in adding species diversity to their forests often plant white pine in small sunlit openings in their forests. About 2.3 million white pine seedlings are planted annually in Minnesota, twice the amount that was planted before 1998 implementation of the White Pine Initiative.

◆ White pine's fire-dependence, its inability to successfully re-seed itself except in exposed mineral soil, its early intolerance for competing vegetation and its vulnerability to insects, diseases and deer, creates a multiple paradox for those who believe restoration is simply a matter of reserving remaining forests in no harvest reserves. Eastern white pine restoration rests on successful regeneration through (1) planting seedlings on



Jim Petersen

When Boise Cascade Corporation harvested a mixed aspen stand north of Grand Rapids it reserved about a dozen mature eastern white pine trees as part of its program to assist the state of Minnesota in its efforts to conserve older white pine. Using bright orange water-soluble paint, the company marked each tree with the word "save" to make certain loggers did not cut them by mistake.

the best-suited sites (2) under-planting in mixed species forests (3) selection harvesting to promote natural re-seeding during good seed years (4) controlling competing vegetation, blister rust, pine weevil and deer browsing. Prescribed fire can also be used to expose mineral soil seedbeds while reducing competition from hazel, though use of such fire may raise air

quality concerns. As an alternative, the soil around white pine seed trees can also be exposed using machines that scarify the ground.

◆ A 1996 survey by the Minnesota Forest Resources Partnership, a consortium of public and private timberland owners and managers, describes both the potential and the challenge facing those who support white pine restoration.

Respondents reported they manage 82,000 acres where white pine is the dominant cover type, but the species is "significantly present" on another 491,000 acres. Statewide, there are 1,008,900 acres of timberland with at least one white pine per acre.

◆ Before the 1880s, eastern white pine accounted for more than half of all softwood lumber consumed in the United States. Once Minnesota's mature stands were cut lumbermen turned to Douglas-fir which (because of its structural superiority) quickly replaced pine in many building applications. In 1997, white pine harvesting accounted for less than 5% of total jack-red-white pine harvest, about 2% of total softwood harvest and less than one-half of 1% of combined hardwood-softwood harvest. White pine harvesting is proportionately greater on private and county-owned forests than it is on state and federal ownerships. Between 1989 and 1995, the state lands harvest declined from 333,000 to 43,000 board feet. By comparison, in the 1920s, the Virginia and Rainy Lake Company mills at Virginia, Minnesota, were milling 875,000 board feet per day. About 70% of what was milled was white pine.

◆ White pine remains a favorite with woodworkers because it is soft and easily painted or stained. It is thus still widely used in window frames, door casings and moldings. And because it is free of objectionable odors and tastes, it is still widely used to make tongue depressors and ice cream sticks.

Minnesota White Pine:

Window on the Past—Bridge to the Future

“The point is this. Although certainly not as glorious as the past, there is a viable white pine industry yet today and there is a significant demand for this wonderful wood.”

Jack Rajala, White Pine Symposium,
Duluth, Minnesota, September, 1992

If Minnesota is successful in its quest to restore eastern white pine it will be because it followed Jack Rajala's lead. Since 1972, he has planted more than 2.5 million seedlings on forestland his family owns between Deer River and Big Fork. No one in the state has spent more time or money learning how to grow white pine. Its charisma has become his passion.

“I know of no other tree growing in Minnesota forests that can fulfill so many economic and environmental needs,” Mr. Rajala said in a recent interview. “It produces beautiful wood, provides a wide range of wildlife habitat, can be grown under a wide variety of conditions, doesn't need to be clearcut to insure adequate regeneration and is a sentimental favorite among Minnesotans who love forests.”

Mr. Rajala's ardor for white pine led him to write a book in 1998 about his years spent trying to figure out how to regenerate the tree. *Bringing Back the White Pine* is both a forester's manifesto and a how-to guide for anyone interested in growing white pine commercially.

“The future for white pine—of any abundance in Minnesota—has to do with methodically and religiously carrying out well-thought plans and rigorous silviculture,” he wrote. “It requires up-front commitment, disciplined execution and a willingness to stick with it.”

Indeed it does. Mr. Rajala—now 60—will not live long enough to see even the first of his planted pines harvested. But he is undaunted, this despite the fact that his



Jim Petersen

Jack Rajala prunes a white pine sapling on a company tree farm between Deer River and Big Fork. Mr. Rajala's passion for white pine led him to write a book about his years spent learning how to regenerate the tree. *Bringing Back the White Pine* is both a forester's manifesto and a how-to guide for anyone interested in growing white pine commercially. Re-planting in the right places is the key.

capital investment now exceeds one million dollars.

“What I am doing is an investment in the future of Minnesota's forests and its once grand white pine industry,” he says resolutely.

Although Mr. Rajala's passion for white pine is widely admired, it has placed him

at odds with environmentalists who see its sought after recovery as simply a matter of placing remnant stands in no management reserves where presumably they will regenerate themselves naturally.

“It is a romantic notion with no scientific basis,” Mr. Rajala says of the idea, which has twice led to efforts by environmentalists to force a moratorium on white pine harvesting in Minnesota forests. Both attempts failed.

“Self-regeneration hasn't worked in a hundred years and it won't work now,” Mr. Rajala declares. “The key to successful white pine restoration is regeneration, not preservation. The only remaining question among experts is whether regeneration can best be accomplished through natural seeding or planting. I don't personally care so long as we bring back pine, though I can tell you that planting yields far more predictable outcomes than does natural regeneration. The *only* places where white pine is reseeding itself is in areas that have been subjected to natural disturbance—say a wildfire—or areas where timber harvesting has exposed mineral soil and created openings where regeneration can occur. White pine is not reseeding itself in untended natural stands.”

Remarkably, Mr. Rajala is not a forester, though he is certainly a keen observer of nature and of white pine in particular. His decision to start planting white pine on his land was born of his lifelong admiration for the stately tree and a desire to add new tree species to predominantly hardwood forests.

But his earliest plantings failed, a fact he attributes to having misjudged the amount of shade pine seedlings would tolerate. "I simply erred on the side of too much shade," he explains.

Despite his early failures, Mr. Rajala's overall success rate is 50%—meaning that half the seedlings he has planted survived and grew. That's not bad considering that he expects to retain no more than 150 of almost 1,000 seedlings he plants on each acre. "In a 100-year-old stand there will only be room for 100 to 150 trees," he predicts. "The rest will have to be thinned out in stages." Such staged thinnings speed growth among remaining trees. They also approximate the frequency of cleansing ground fires that burned through pine stands before forest firefighting efforts were initiated in the early 1900s, a response to public anger and fear that followed several conflagrations including Minnesota's 1894 Hinckley fire. The entire town was destroyed and 248 lost their lives.

The fact that planted white pine seedlings tolerate modest amounts of shade cannot be over-estimated—at least not in Mr. Rajala's view.

"White pine is the bridge between our past and the future. Its tolerance for shade presents opportunities for long-term management that short-lived shade intolerant species, like aspen, do not offer. Let aspen, balsam and spruce plantations serve the fiber demands of our pulp and paper industries and let longer living white pine forests serve the needs of sawmills interested in producing the highest quality pine lumber possible."

The significance of such a momentous shift in Minnesota's forest landscape may escape some, but not Mr. Rajala.

"Rather than divide Minnesota's forestland base between intensively managed plantations and no-management reserves, which is the direction we are headed in now, I would divide it three ways. There would be short-lived forests

that could be harvested in 40 to 60 years, longer-lived forests including white pine stands reminiscent of the ones that were here before European settlement began and some wilderness reserves where nature rules."

Such a refinement in forest uses would of course rest on the willingness of other

faced none seems to have been more vexing than deer nipping off the buds of young trees. To protect the buds he staples small paper sleeves called "bud caps" to each budding leader. It costs five cents a tree and has to be done every year for five years.

Because white pine seedlings grow very slowly—often no more than a foot in their first five years—controlling competing vegetation, especially fast growing hazel and maple sprouts, is also a problem. Mr. Rajala chops them out—further evidence that what he calls "walk away forestry" will not work where white pine is concerned.

Then there is pruning. As seedlings become saplings removing limbs up to nine feet above the ground helps reduce the risk that wind born blister rust spores will reach their intended target: the needles of low hanging branches. It is one more arduous task Mr. Rajala underestimated.

"In my early years at this, I figured we could just stuff the seedlings in the ground and they'd

take off," he recalls. "They didn't and the fault was mine. I simply did not realize how much hands-on care white pine seedlings would demand."

Mr. Rajala could understandably be forgiven for switching to red pine or aspen, but there is more going on here than successful white pine regeneration. He is also determined not to surrender what he calls "forestry's moral high ground" to his critics.

"White pine offers landowners the opportunity to add a much revered tree species to their forests, increase wildlife habitat diversity, sustainably manage their forests at a profit, and move away from clearcutting—all in the same motion," he explains. "In Minnesota, this is forestry's moral high ground, and I am unwilling to surrender it to misguided environmentalists who say that white pine can only be restored by first locking it up on no-management reserves. Even if white pine



Scott W. Sharkey

White-tailed deer are beautiful animals and a pleasure to watch, but for those who grow white pine they constitute a vexing problem. Among the many animals that feed on white pine seedlings, none does more damage than white-tailed deer. Repeated browsing—nipping new buds and shoots—can permanently stunt tree growth. Bud capping—putting paper caps on each bud—is a deterrent, but it is expensive. Adding to the problem, Minnesota's 1.2 million deer population is increasing.

private timberland owners to invest in white pine—something most have thus far declined to do.

"Most Minnesota landowners have concluded white pine is too difficult and too expensive to grow," Mr. Rajala concedes. "So they've opted for red pine and aspen which grow faster and are less susceptible to insects and disease. That's fine, but for forest landowners who are interested in adding species diversity or a new age class to their plantations, while aging their red pine or hardwoods, white pine is a perfect choice. Moreover, most of the costly insect and disease problems associated with white pine, including blister rust and white pine weevil, decline significantly when it is planted in openings under maturing trees."

But there is one problem that is not reduced by planting pine beneath the canopies of other trees: deer browse. Indeed, of all the problems Mr. Rajala has

is never again harvested commercially from public lands, it will eventually die out unless the kind of hands-on work I am doing is done to regenerate and promote its growth."

Mr. Rajala is particularly enthusiastic about opportunities for white pine's advancement in county-owned forests, which emphasize profitable management, and private ownerships, which account for 40% of Minnesota's timberland base.

"The interest is there, but technical and financial resources are lacking," he says. "The state could do much more to encourage private investment in white pine restoration, especially in northern Minnesota where aspen has overtaken too many mixed conifer-hardwood forests."

Minnesota's aspen invasion has indeed overtaken hundreds of thousands of acres once occupied by other tree species, including pine. But it is easy to see why those who currently own these forests favor aspen. It sprouts prolifically from its own roots—eliminating reforestation costs—and it grows rapidly. Equally important, it produces a wood chip that is prized by the state's burgeoning OSB industry.

Despite aspen's promising future, the state has bowed to public pressure, accelerating its white pine replanting effort to more than two million seedlings in each of the last two years. Still, Mr. Rajala believes the effort is insufficient.

"It's a far cry from what we could be planting," he says. "At this rate, we're adding maybe 2,000 acres in new white pine plantations a year. By contrast, we had more than 200,000 acres in red pine plantations in 1990. I have nothing against red pine, or aspen for that matter, but my reading of the public's mood is that it wants to see more species diversity in Minnesota forests. White pine would help satisfy this longing."

Another reason Mr. Rajala would like to see the state do more to encourage

private investment is that he fears white pine might be held hostage in the widening debate over public lands forest management, especially timber harvesting.

"The state is allowing its white pine forests to age, which is fine," he observes. "Harvesting state-owned white pine is also declining dramatically, which is fine too,

wood workers," he says. "By first dedicating ourselves to growing high quality white pine, we can subsequently grow a high quality white pine-based cottage industry capable of serving global markets for fine furniture, cabinetry, doors and windows. Such an industry would be a real economic shot in the arm for rural Minnesota."

The Rajala Companies—a venture he owns with his brothers and sons—is Minnesota's largest white pine miller and would most certainly benefit from such an expansion, though Mr. Rajala seems surprisingly ambivalent about the prospect.

"I confess there are days when I spend more time looking back than I do looking ahead," he says. "I am proud to say that the Rajala family has been working in Minnesota's forests for almost 100 years. Our Big Fork mill has been cutting pine since 1902. Now we have two mills there, two in Deer River and one in Grand Rapids. I think our grandfather, who was a logger first, would be very proud of what we have done with

the company he started."

The various Rajala entities employ about 250 people and pay out about \$7 million a year in wages and benefits. Most of the lumber they saw—softwood and hardwood—is custom cut for other Minnesota companies that make finished products, mainly windows, doors, millwork and furniture.

"We will continue to do well even if Minnesotans don't embrace white pine restoration in a meaningful way," Mr. Rajala says. "But I hope they do—and I hope they see the same potential I see because the kind of white pine restoration I envision would support a lot of small family-owned businesses, especially in rural Minnesota. But equally important is the fact that it would significantly increase the productivity and biological diversity of many thousands of acres of Minnesota forest. Everybody wins."



Jim Petersen

Jack Rajala stands in a lumber shed at the family's Big Fork sawmill. He believes white pine restoration could eventually breath new life into the state's once vast white pine industry. "White pine is esteemed by skilled wood workers," he says. "By first dedicating ourselves to growing high quality white pine, we can substantially grow a high quality white pine-based cottage industry capable of serving global markets for fine furniture, cabinetry, doors and windows."

but unless the legislature appropriates a lot more than it has to date, the state won't be able to do the kind of stand tending work that is necessary to perpetuate the species," he says. "Furthermore, I'm afraid the philosophical transition from allowing pine to age to simply deciding to never harvest will be easier to make at some future date than it would be if the state committed to more active pine management now. It is critical for Minnesotans to understand that these trees demand lots of hands-on care, including periodic harvesting, or white pine will gradually fade from our forests."

Apart from his commitment to restoration, Mr. Rajala sees renewed economic potential in white pine. Its return, he says, is a first step in the long process of breathing life into a prosperous but scaled-down version of Minnesota's once vast white pine milling industry.

"White pine is esteemed among skilled

“Minnesota is home to more fast-growing wood products companies than any other state in the nation.”

An Interview with Top Industry Observers: Jim Bowyer and John Krantz

Editor's Note: Dr. James Bowyer is Director of the Forest Products Management Development Institute, a branch of Department of Wood and Paper Sciences in the College of Natural Resources at the University of Minnesota, St. Paul. He lectures widely and is considered an authority on energy consumption as it relates to structural building materials, including wood, steel, aluminum and concrete. John Krantz is Program Supervisor for Utilization and Marketing for the Division of Forestry, Minnesota Department of Natural Resources, St. Paul.

How does Minnesota's timber industry rank in the state's industrial hierarchy?

Forest products manufacturing is an \$8 billion a year industry in Minnesota. On this basis, it ranks third behind machinery and computer services and electronic equipment and instruments. The value of forest products manufactured in Minnesota has increased annually since 1985 when it stood at \$3.8 billion. **(Fig. 1, Pg. 21)**

How many Minnesotans does the industry employ?

About 61,000 currently, including about 9,000 in primary processing and about 52,000 in secondary processing. Pulp, paper and oriented strandboard manufacturers are the dominant employers, though door, window, cabinet and truss manufacturers are also major players. **(Fig. 6, Pg. 26)**

What the industry's payroll, statewide?

Primary and secondary wages are \$3.2 billion. Secondary paper manufacturing wages accounted for 58% of the total, \$1.86 billion, while secondary wood manufacturers added another \$858.6 million. Primary wood and paper manufacturers paid out \$326.9 million and \$65.4 million respectively. Industry wages have been increasing since 1981.

How does the industry stack up using basic income and employment measures?

Very well, but first let's explain what basic income and employment mean. Basic industries are those that export their products or services to other regions, states or countries, thereby generating so-called “new dollars” for the areas in which they are located. This is important because the

Jim Petersen

The mammoth chip pile and, in the distance, Boise Cascade Company's International Falls paper mill. The mill employs more than 1,100 and produces about 1,500 tons of paper per day, including cut-size paper, roll form paper for envelopes, copy paper and a wide variety of business forms. Aspen is its primary species. Among its customers: Xerox, Staples, IBM, Kinkos and Canon.



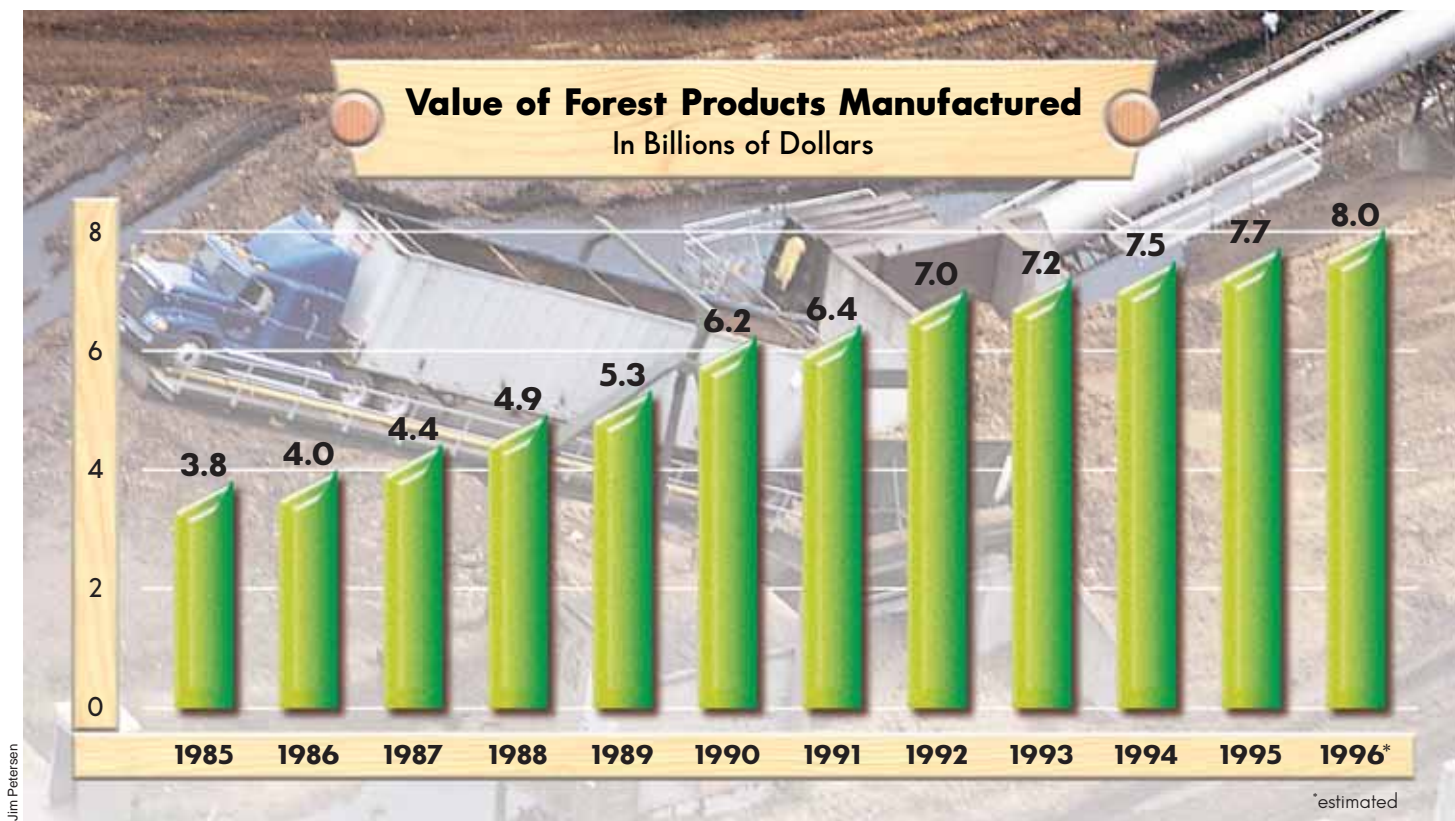


Fig. 1—The value of forest products manufactured in Minnesota has been increasing annually since 1985 and topped \$8 billion in 1996. The industry ranks third behind machinery and computer services and electronic equipment and instruments. Photographed here, the chip truck dump at Boise Cascade's International Falls paper mill. Powerful hydraulic cylinders raise the loaded tractor-trailer until it disgorge its 50-ton load. Source: US Department of Commerce, Bureau of Economic Analysis.

economy strength of every region or community depends on its ability to generate new dollars. Otherwise, the only money in a community is that which circulates between local businesses. These things said Minnesota's secondary wood product and primary and secondary paper manufacturers generate 7.2% of all employment and 11.8% of basic income. By contrast, our highly prized high technology sector accounts for 11.4% of basic employment and 15% of basic income. **(Fig. 5, Pg. 26)**

Would it be accurate to say that employment in Minnesota's timber industry is concentrated in rural areas while technology employment is centered in urban areas?

No, not really. It's true primary forest product manufacturers are concentrated in rural Minnesota, close to their raw material sources, but secondary manufacturers are concentrated in urban centers, which are closer to major Midwest markets. It is cheaper to transport softwood and hardwood lumber and particleboard long distances than it is to transport bulky finished products, like cabinets, windows, doors and furniture to distant consumer markets. Andersen and Marvin are among many lumber importers. Woodcraft, the No. 4

hardwood dimension lumber manufacturer in the nation, brings rough lumber from Kentucky, Tennessee and Wisconsin. Companies like Marvin, Andersen and Woodcraft stay here not just because of Minnesota's proximity to major consumer markets but also because they can draw on a skilled, computer literate labor pool with a strong work ethic.

Are there any statistics that quantify the rural-urban dynamic?

Yes, there are. Primary forest product manufacturers are a major economic force in four rural Minnesota counties: Carlton (27.2% of basic income and 17.3% of basic employment), Itasca (30.6% and 22.7%, respectively), Koochiching (46.7% and 58.8%) and Roseau (50.4% and 53.8%). Secondary wood and paper manufacturers make major economic contributions to four urban counties: Ramsey (34.4% of basic income and 20% of basic employment), Washington (28.8% and 19.1%), McLeod (20.3% and 14.2%) and Sherburne (12.2% and 12.6%). **(Fig. 5, Pg. 26)**

What are Minnesota's primary and secondary wood products?

Our primary products are pulp, paper and oriented strandboard (OSB). Together, these products account for 70% of the harvest.

Though the number is declining, there are still about 700 small sawmills statewide. Of these, the largest 100 mills account for 80% of lumber production statewide. Measured in terms of fiber consumption, our primary manufacturers rank as follows: Potlatch Corporation (OSB, lumber and paper), Boise Cascade Corporation (paper), Blandin (paper), Champion International (paper) and Lake Superior Paper Industries (paper).

On the secondary side, Minnesota is home to more fast-growing wood products companies than any other state in the nation. According to *Wood & Wood Products* magazine, we lead the nation in wood-frame window manufacturing, (Andersen and Marvin rank No. 1 and No. 3, respectively), we're the No. 2 manufacturer of kitchen cabinets, and we rank third in the production of store fixtures and architectural millwork. *Wood & Wood Products* named 12 Minnesota companies to its 1998 list of 100 wood manufacturers with the highest percentage of sales growth. Among them: Lexington Manufacturing, Artifex, Siewert Cabinet and Fixture, Ron's Cabinets, Northern Contours, Colonial Craft and Woodcraft Industries.

Where do Minnesota's pulp, paper and lumber manufacturers get their wood?

The harvest comes mainly from Minnesota forests. Our so-called "timberland base" spans 14.8 million acres. Private individuals own 40% of it, and provide about 50% of the wood fiber consumed annually by our state's manufacturers. The state owns 21% of all timberland and counties and municipalities own another 17%. Together they account for another 30% of the harvest. Federally owned National Forests comprise 17% of the timberland base and account for 7% of the harvest. Industry lands, which account for 5% of the land base account for 10% of the harvest. Tribal lands account for about 2% of the harvest. **(Fig. 2, Page 22)**

What tree species are most widely used by Minnesota manufacturers?

Aspen is the species most in demand, by far. It accounts for 95% of the fiber consumed by our OSB manufacturers and about 55% of the fiber used by pulp and paper manufacturers. Combined, spruce and balsam fir account for about 50% of the fiber consumed by our paper manufacturers. Our

sawmill industry, which is not large by western standards, nonetheless leads the nation in the production of aspen lumber. It also utilizes jack pine, red pine, red oak and several other species. Our secondary manufacturers, especially Anderson and Marvin, rely heavily on ponderosa pine lumber imported from the Black Hills and Intermountain regions. **(Fig. 3, Pg. 23)**

Minnesota also has a small hardwood sawmilling industry, doesn't it?

Yes it does. It isn't large compared to its competitors in the eastern U.S., but about 7% of our annual harvest is in hardwood sawtimber. Our secondary industry also imports a good deal of its lumber from the Appalachian region. Most of it is used in pallets, crating, cabinet parts, molding, picture frames and several other niche markets.

And aren't you a big manufacturer of Christmas wreaths?

We certainly are. In fact, we lead the

nation in the production of Christmas wreaths. It is a \$20 million a year cottage industry. Many families assemble wreaths in their homes, then sell them to distributors. Balsam fir boughs gathered in northern Minnesota are also trucked to the Twin Cities. Women of Asian descent do much of the final assembly work, painting cones and tying ribbons. Minnesota-made wreaths are distributed nationwide.

Minnesota's modern-day forest products industry seems a far cry from the industry that was here at the turn of the last century. How has the industry changed?

In 1900 and for several years thereafter, Minnesota led the nation in lumber production, but by 1930 the harvest was miniscule. The industry we have today uses trees that grew after 1930. We've made the transition from a white pine dominated sawtimber industry to an aspen dominated pulpwood industry.

You're telling us Minnesota's forest

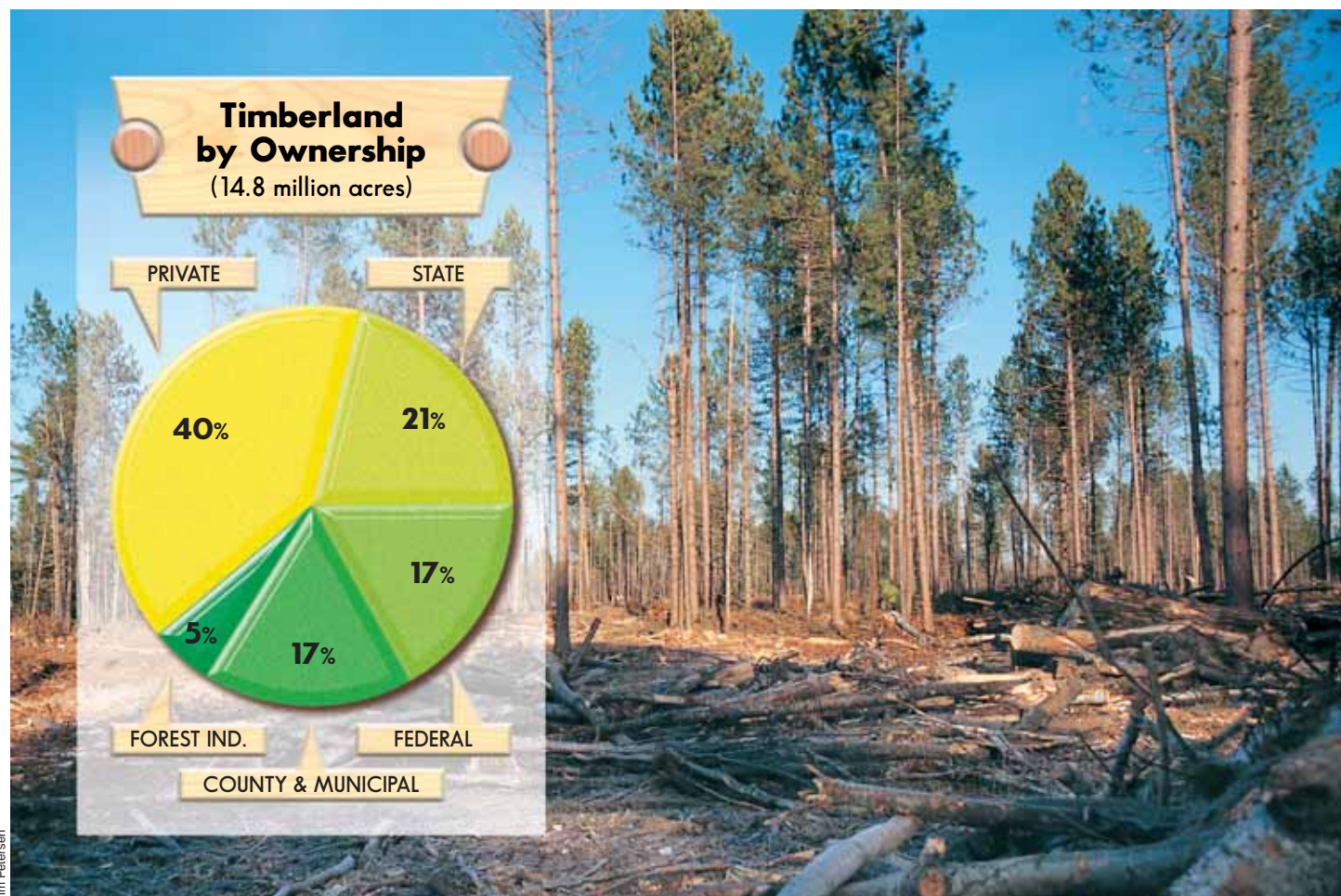


Fig. 2—Minnesota's timberland base spans 14.8 million acres. Individuals own the largest share (40%) and industrial landowners own the smallest share (5%) Together, they account for 60% of the state's annual harvest. Photographed here, a recently completed harvest on Blandin Paper Company land near Grand Rapids. Aspen and balsam were removed and red pine was saved to provide shade for white pine seedlings that will be planted beneath them. Source: Minnesota Forest Statistics, 1990, USFS.

products industry derives its wood from forests that have grown to maturity since the Great Depression?

That's right. But our lumber and pulpwood industries owe their existence to very different Depression-era events, though in both instances we have the federal government to thank.

The Civilian Conservation Corps (CCC), which was part of President Roosevelt's plan for employing destitute, able-bodied men, planted millions of pine trees on abandoned farm and forestland in Minnesota. Then in the 1950s, the Federal Soil Bank planted another 40 million pine seedlings annually on private land to control soil erosion. Our modern-day pine industry makes its living from these forests.

On the other hand, our pulpwood industry owes its existence to an abundance of aspen. During and after the Depression it overtook thousands of acres of abandoned farm and forestland. Intensive fire control efforts in Minnesota beginning in the 1930s led us to the forest we have today, giving

aspen—which is quickly killed by fire—a great advantage over competing species. Minus frequent wildfire, it expanded its range and lived longer than it would otherwise have, providing an enormous resource for our modern-day pulpwood industries.

So the decision to exclude wildfire from Minnesota forests was an event of ecological and historic significance?

It certainly was. Before wildfires were controlled no thought was given to replanting white pine forests for fear the investment would be lost in a fire. So after Minnesota's virgin white pine stands were nearly liquidated, the industry simply moved west, leaving three paper mills that lived off spruce harvested from bogs that were too wet to burn. With fire controlled our aspen forests began to grow in earnest after the Depression, though it would be years before the tree came to be recognized as a valuable lumber species. Then aspen and structural panels converged with

construction of the Blandin Wood Products wafer board plant at Grand Rapids in 1979. Soon thereafter oriented strandboard (OSB) was developed and our modern-day forest products industry was born.

What role has technology played in the advancement of Minnesota's wood products manufacturing sector?

A very important one, especially as it relates to oriented strandboard and lightweight, coated papers, but these technologies were also imported. Minnesotans simply took advantage of opportunities created first by an abundance of aspen, second by the availability of OSB technology and third by the federal government's decision to list the northern spotted owl as a threatened species.

How did the spotted owl listing help?

Sky high Douglas-fir prices that followed the listing created huge marketing opportunities for OSB. In the early 1980s, and with the public's blessing, our

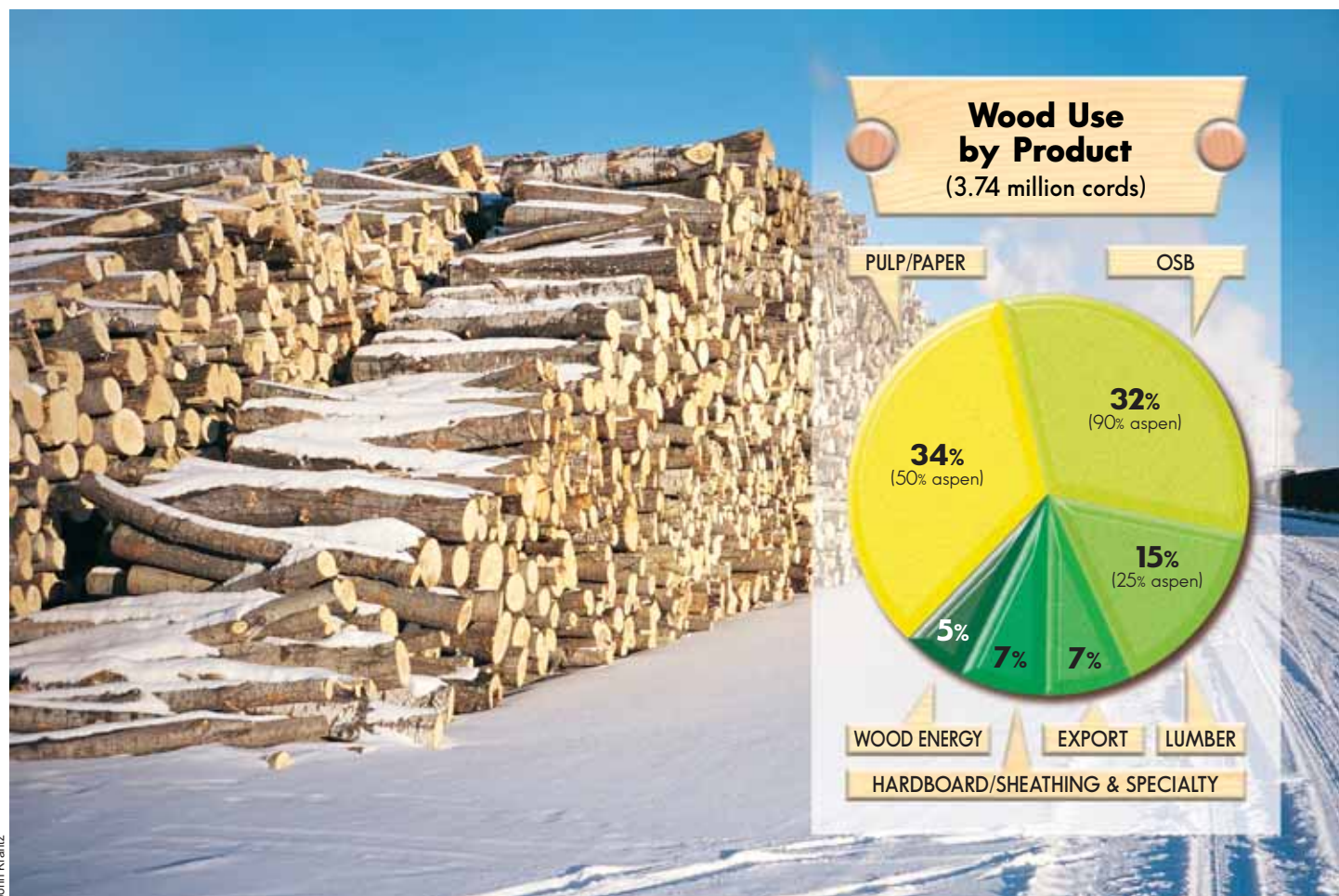


Fig. 3—Most timber harvested in Minnesota is used in pulp, paper and oriented strandboard (OSB). Aspen is, by far, the favored species, accounting for 61.3% of 3.66 million cords harvested in 1998. (A cord is a pile of wood 4'x4'x8'.) Hardwood species, including aspen, accounted for 80% of the harvest. White pine, the focal point of a statewide restoration effort, accounts for less than one-half of 1% of the annual harvest. Photographed here, Potlatch Corporation's aspen log deck at Cloquet.

governor actively encouraged investments in OSB and papermaking. The state even launched an advertising campaign to recruit new wood product manufacturers. There was a real traffic jam around here for awhile.

Would it be accurate to say that technological advancements have improved wood fiber utilization meaning that very little of what is harvested is wasted?

There is no doubt about it. Advanced milling systems have made it possible to make useful products from wood fiber that would have been a disposal problem—and thus an environmental problem—20 years ago. Soaring disposal costs and strict disposal regulations combined to spur investments in technologies that utilize virtually every bit of wood fiber. Co-generation plants that produce electricity from wood waste have helped a great deal, as have biomass power plants.

Since we're now making wood products that didn't even exist 20 years ago can we then say that technology has created at least as many jobs as it has eliminated through increased manufacturing efficiency?

Technology is a two-edged sword. Papermaking, for example, is much less labor intensive than it was 20 years ago. The same is true in pallet assembly plants, which are now almost fully automated. On the other hand OSB technology has spawned an entire industry that relies on aspen, a tree once considered junk wood. But it may be that technology's most important contribution is in increasing productivity, which is the reason why our wood and paper manufacturers are doing so well. And because they are prospering, labor markets are tight. Not many people know this, but several thousand Asian immigrants now work in Minnesota's forest product industry.

Can you estimate the amount of money the industry in Minnesota has spent on these advancements over the last decade?

Since 1980, at least \$3 billion and probably more. Incremental investments are difficult to track.

Have these technological advancements affected the way Minnesota forests are managed?

Yes, in very significant ways. Mechanized cut-to-length harvesting systems have given landowners the tool they needed to thin overly dense red pine forests, promoting growth in residual trees while also creating habitat for plant and animal species that move into such forests after thinning. Concurrently, developments in small-log milling technology have created



Jim Petersen

Salvaging Potlatch-owned aspen blown flat during a July 4, 1999 windstorm. Note the canopies of white pine trees in the distance. The company decided to leave them behind to add species diversity to the aspen-dominated forest that will quickly regenerate itself on this site about two hours north of Cloquet.

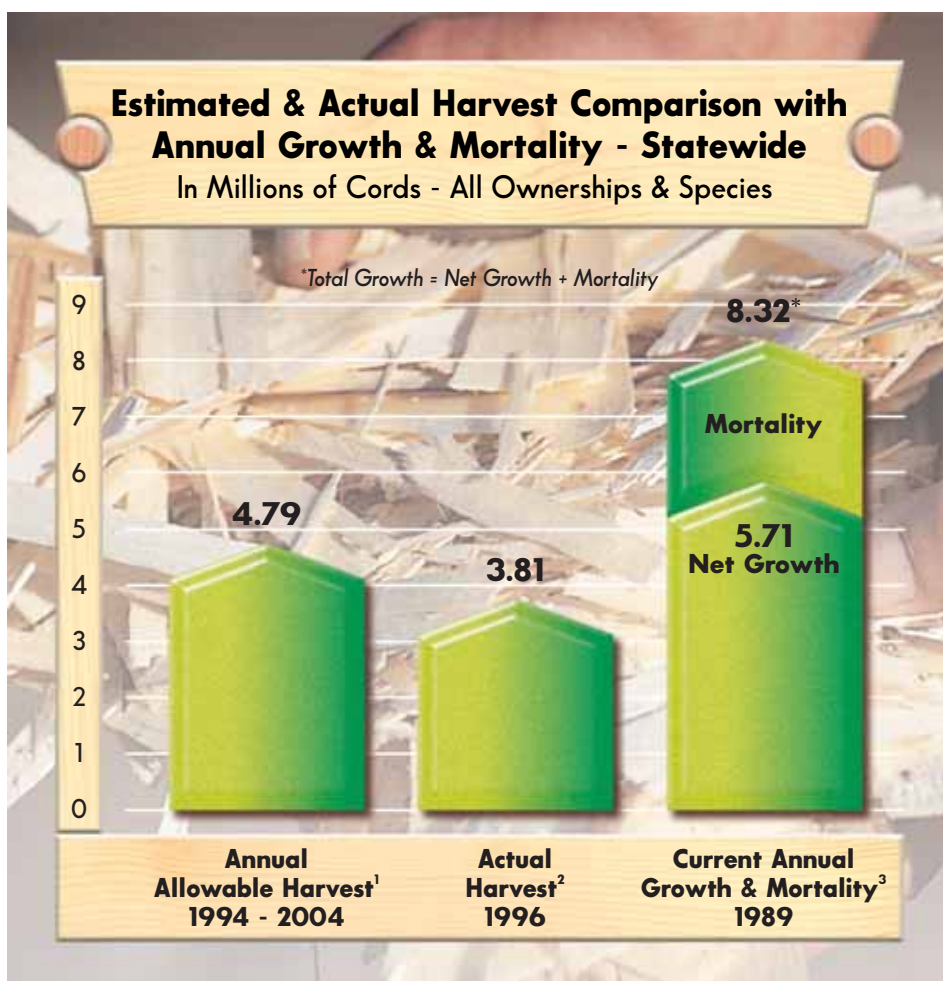


Fig. 4—Annual net growth (gross growth minus natural mortality) stands at 5.7 million cords in Minnesota, while harvesting reached 3.74 million cords in 1997, creating a 2 million cord per year surplus that is steadily building a much larger standing timber reserve. Since 1985, the annual harvest has moved between 3.07 and 4.1 million cords. It is expected to increase to 4.34 million cords by 2002. Source: Minnesota GEIS and DNR

heretofore non-existent markets for small diameter trees.

There seems to be a good deal of interest in hybrid poplar and cottonwood. What's driving interest?

Several factors come into play. For one, Minnesota's farmers have been hard hit in recent years. Hybrid poplar looks to many like a good cash crop with a promising future, not just in papermaking but also in biomass energy production. Eight to ten years out, there will also be a gap in our aspen supply—meaning that papermakers will have to turn to species other than aspen. Hybrid poplar can fill the gap. Potlatch, Boise Cascade and Blandin have major investments in poplar research.

Why will there be a gap in the aspen supply? Over harvesting?

Actually, it is the opposite. We haven't harvested enough aspen. Remember, this is a species that wasn't used much before 1980. As a result, we have almost as much aspen 1–10 years old as we have aspen that is 50-plus years old. The gap is in trees 20–40 years old. It marks the point in time when aspen was first harvested in significant quantities. By slowing but continuing the harvest in 50-year-old trees, the imbalance will gradually correct itself, meaning we will have a good distribution of aspen in all age classes.

With so much public interest in restoring white pine forests, what can we infer about the future of white pine as a wood product manufactured in Minnesota?

That's a good question. In recent years, the replanting effort has been Herculean in scale, but surprisingly little thought has been given to the enormous costs associated with maintaining white pine stands. So will Minnesota taxpayers be willing to foot the bill? No one knows.

Increasingly, Minnesotans seem more interested in preserving publicly owned forests in no-harvest reserves. Going forward, what are the implications for these forests and will this sentiment impact the industry?

It is certainly true that a very vocal minority is interested in creating more no-harvest reserves, but Minnesotans in general don't support land lockups. The larger public interest is focused on how and when harvesting is done. The "how" question relates to logging impacts and a desire to minimize them, while the "when" question

underutilized species—white birch, soft maple and tamarack—that all show great promise. Barring unforeseen events, Minnesota's timber industry has a very bright future. (Fig. 4, Pg. 24)

Dr. Bowyer, we are aware of your particular interest in advancing the idea that the world ought to be using more wood, not less. Your position seems to be out of step with a public that has signaled its increasing interest in saving trees. Explain why you've taken this position?

In the emerging global economy nations should be increasing, not decreasing, their dependence on wood fiber because wood is renewable, recyclable, biodegradable and far more energy efficient in its manufacture and use than are products made from steel, aluminum, plastic or concrete. Furthermore, growing forests and the lumber they provide store large amounts of carbon dioxide that would otherwise escape into the atmosphere, adding to the potential for global warming.

What would you say is the biggest challenge facing Minnesota's forest industry today?

Balancing the competing demands of forest users, beyond doubt. We've made significant progress in this area, particularly as it relates to the relationship between our timber and tourism sectors. But as Minnesota grows and land becomes more valuable, and as competing uses intensify, it will become increasingly difficult for our lumber and pulpwood industries to acquire land and wood fiber at competitive prices. If we want these industries to continue to make huge capital investments in our state, we need to do everything we can to make certain there is sufficient wood available at prices that allow them to remain competitive in the global marketplace.



Jim Petersen

Logger Kent Anderson stands atop his mechanical harvester in a state-owned timber stand northwest of Grand Marais. Mr. Anderson logs primarily for Grand Marais-based Hedstrom Lumber Company, one of the oldest lumber companies in Minnesota.

relates to a general desire to see more forests grow older.

A generation ago the timber industry collapsed because it ran out of wood, specifically white pine. Do you see this happening in Minnesota again?

It will never happen again. Annual net growth, which accounts for natural mortality, stands at 5.7 million cords, while harvesting stands at 3.7 million cords. So we have a comfortable 2 million cord a year surplus that is steadily building a much larger standing timber reserve. Both the volume and average diameter of trees are increasing. We also have several

Forest Industry Basic Employment and Income

Fig. 5—Minnesota's forest products industries employ about 61,000 people and account for 7.2% of basic employment in the state. These industries, which include primary and secondary wood and paper manufacturers, pay out \$3.2 billion a year in wages and benefits, accounting for 11.8% of basic income statewide.

Basic industries are those that export their products or services to other regions, states or countries, thereby generating "new dollars" for the areas in which they are located. The economic strength of every community rests on its ability to generate new dollars. Otherwise, the only money in the community is that which circulates between local businesses.

The two maps on the right illustrate the impact of county-level industry-generated basic employment and income. Note that the importance of the forest products industry varies from county to county. For example, in Roseau County 50.4% of basic employment and 53.8% of basic income are attributable to the industry. Other counties where the industry is especially important include Koochiching, 46.7% employment and 58.8% of income; Itasca, 22.7% employment and 30.6% income; Washington 19.2% employment and 28.8% income; and Carlton 17.3% employment and 27.2% income. Note too the importance of the industry in the Twin Cities area.

Three sectors contribute more to basic employment statewide: services, excluding lodging and computer services, 21.7%; agriculture and fisheries, 14.2%; and high technology manufacturing, 11.4%. But only one sector contributes more to basic income statewide: "other manufacturing," 18.6%. Source: Minnesota IMPLAN Group, and Dr. Con Schallau, forest economist.

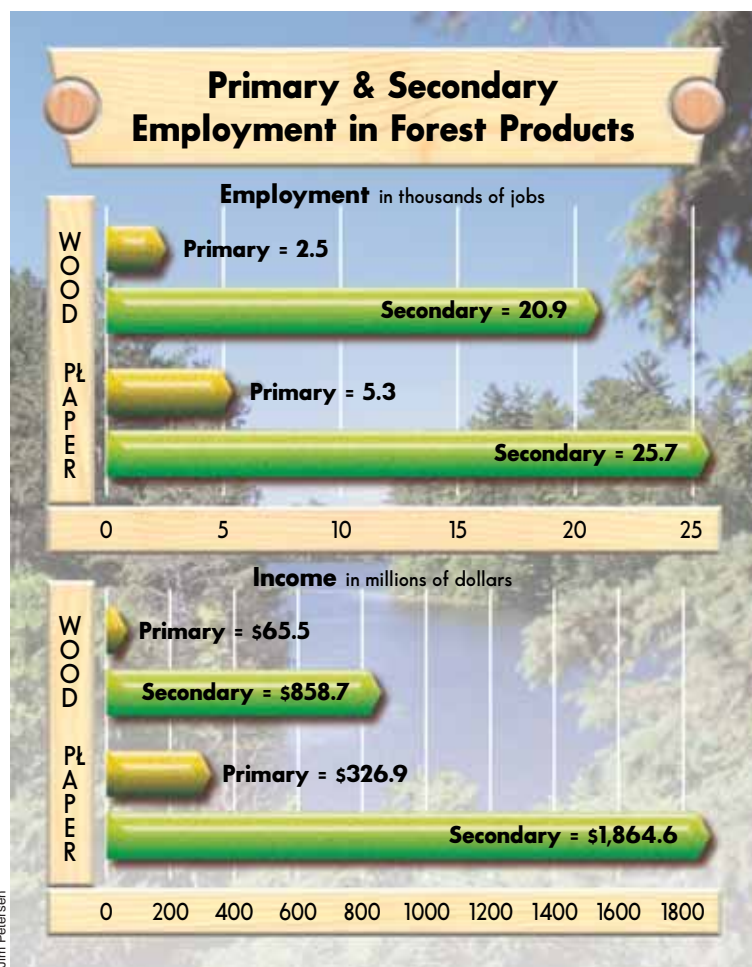
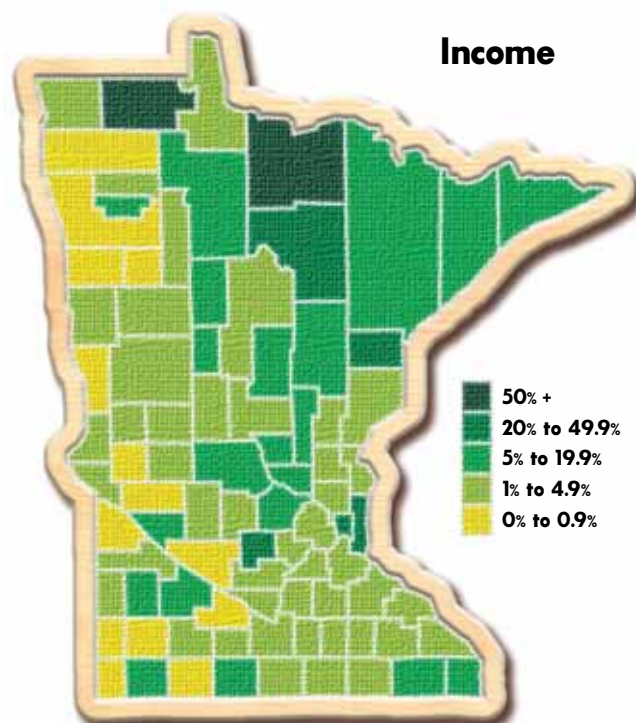
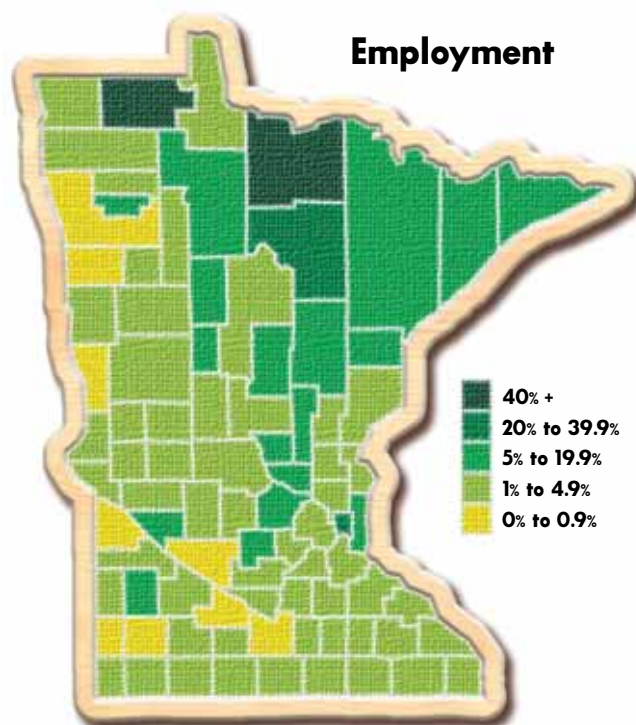


Fig. 6—This chart illustrates a surprising fact about employment and income in Minnesota's forest product industries. Secondary employment and income exceed primary employment and income by wide margins. In fact, secondary wood and paper products manufacturers account for about 76% of total wood and paper employment and about 85% of total income. Source: US Department of Commerce, Bureau of Economic Analysis.

Minnesota Forest Quiz

1. The area covered by forests in Minnesota:
 - a. has declined about 30% since 1950.
 - b. has declined about 15% since 1950.
 - c. is about the same as in 1950.
 - d. has increased 10% since 1950.
2. The primary cause of forest loss in Minnesota over the past 50 years has been:
 - a. highway construction
 - b. logging
 - c. farming
 - d. urban expansion
 - e. forest fires
3. Comparing annual net forest growth to annual harvest in Minnesota, which one of the following statements is true?
 - a. forest harvest exceeds net growth by about 11 percent.
 - b. forest harvest exceeds net growth by about 4 percent
 - c. forest harvest roughly equals net growth
 - d. net forest growth exceeds harvest by about 15 percent
 - e. net forest growth exceeds harvest by about 40 percent.
4. The number of acres in Minnesota that are occupied by the aspen forest type:
 - a. has been declined over the past three decades.
 - b. is about the same as in 1953.
 - c. has been increasing steadily over the past 50 years.
 - d. has increased sharply since the early 1990s.
 - e. is now higher than at any point in the State's history.
5. The number of large trees (over 19 inches in diameter) in Minnesota forests:
 - a. has declined substantially over the past several decades.
 - b. is about the same as several decades ago.
 - c. has increased substantially over the past several decades.
6. True or False - Commercial harvesting of timber is allowed in the BWCA wilderness area? (T) (F)
7. The value of forest products manufactured in Minnesota in 1998 was approximately:
 - a. \$100 million
 - b. \$400 million
 - c. \$900 million
 - d. \$4 billion
 - e. \$8 billion
8. True or False - Approximately one-half of the value added in forest products manufacturing in Minnesota is attributable to the pulp and paper industry? (T) (F)
9. True or False - Minnesota is a net importer of wood and wood products? (T) (F)
10. True or False - The United States is a net importer of wood and wood products? (T) (F)
1. The correct answer is **(b)**. Forests covered about 19.3 million acres in Minnesota in 1950, compared to 16.7 million acres today, a decline of about 15%.
2. Both **(a)** and **(d)** are correct. Urban expansion and highway construction account for virtually all of the loss of forests in Minnesota over the past 50 years.
3. The correct answer is **(e)**. Forests in Minnesota are growing much more rapidly than they are being harvested. Net forest growth currently exceeds harvest by an estimated 41%, meaning that standing timber volume within the state is increasing each year.
4. The correct answer is **(b)**. The area occupied by the aspen type within the State of Minnesota is currently about 5.1 million acres, about the same as in 1953. This compares to 5.4 million acres of aspen type in 1962 and 5.3 million acres in 1977. Because the acreage of aspen is about the same as in 1953, and the total forest area smaller, the proportion of Minnesota's forests that are comprised of the aspen type has increased slightly - from 26.4% in 1953 to 30.4% today
5. The correct answer to this question is **(c)**. In 1962, some 5.5 million trees in Minnesota forests were 19 inches or greater in diameter. By 1990 this number had increased to 12.9 million; it is estimated that this number has continued to increase during the decade of the '90s.
6. This statement is **(false)**. No commercial timber harvesting is allowed within the BWCA wilderness area.
7. The correct answer is **(e)**. The value of forest products manufactured in Minnesota in 1998 was \$8 billion, a number that reflects the value of basic products such as paper, oriented strandboard, lumber, hardboard and insulation board. Also, secondary products including cabinets, furniture, store fixtures, molding, millwork, boxes and other products.
8. This statement is **(true)**. Of the \$8 billion total value of forest products manufactured in 1998, pulp and paper accounted for approximately \$4.2 billion. Some \$3.2 billion was accounted for by lumber and wood products, with another \$700 million attributable to furniture (including cabinets) and fixtures.
9. Although precise figures are not available, this statement appears to be **(true)**. The 1998 annual harvest from Minnesota's forests was 4.1 million cords. This translates to about 68 cubic feet of wood per Minnesota resident. In comparison, average consumption of wood per capita nationally is about 75 cubic feet. Assuming this same rate of wood consumption among Minnesota residents (which is probably conservative) reveals that Minnesota is a net importer of approximately 9.3% of its annual wood requirements.
10. This statement is **(true)**. The United States in 1998 imported about 11% of its overall needs for wood on a net basis. Expressed in terms of roundwood equivalents, the harvest in 1998 was 18.1 billion cubic feet, while consumption (total domestic harvest, plus imports of wood raw material and products, minus exports of logs wood chips and other wood raw materials and products) approximated 20.3 billion cubic feet. When waste paper exports are included in the total, the net import figure drops to 0.7%.

Sources of information include the Forestry Division, Minnesota Dept. of Natural Resources; the Minnesota Dept. of Trade and Economic Devel; the U.S. Forest Service, Forest Products Laboratory, Madison, Wisconsin and the U.S. Bureau of the Census, Washington, D.C.

The Evergreen Foundation

"Exploring the art and science of forestry"

The Evergreen Foundation is a non-profit forestry research and educational organization dedicated to the advancement of science-based forestry and forest policy. To this end, we publish *Evergreen*, a quarterly magazine designed to keep Foundation members and others abreast of issues and events impacting forestry, forest communities and the forest products industry.

In our research, writing and publishing activities, we work closely with forest ecologists, silviculturists, soil scientists, geneticists, botanists, hydrologists, fish and wildlife biologists, historians, economists, forest landowners and state and federal agencies responsible for protecting the nation's publicly owned natural resources. All statistical information appearing in *Evergreen* is taken from publicly supported federal and state forest databases in places since the 1950s. Industry data is used periodically, but only when it can be independently verified.

All *Evergreen* Manuscripts are reviewed before publication to ensure their accuracy and completeness. Reviewers include those interviewed as well as scientists, economists and other who are familiar with the subject matter. While not a peer review, this rigorous



A bicyclist peddles up an old logging road in the George Washington Grove, a red pine grove in the Superior National Forest north of Grand Marais. Civilian Conservation Corps tree planters planted this forest in the 1930s.

process makes for strong, fact-based presentations on which the Evergreen Foundation stakes its reputation.

Evergreen was founded in 1986. Initial funding came from a small group of Southern Oregon lumber companies interested in promoting wider citizen involvement in the federal government's congressionally mandated forest planning process. In the years since its founding, the magazine has assumed a much wider role, providing forums for scientists, policy

makers, landowners and community leaders across North America.

Support for our work comes from Foundation members and other public and private sector organizations that share our interest in science-based forestry. We also generate revenue from the sale of educational products including reprints of past *Evergreen* issues and "Our Daily Wood," a hand-finished, four-pound wood block that is the volumetric equivalent of the amount of wood fiber consumed ever 24 hours by every person on Earth.

The Foundation operates under Internal Revenue Service 501(c)(3) regulations that govern the conduct of tax-exempt organiza-

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Volume 11 • Number 22

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