

CHELSEA CENTER FOR RECYCLING AND ECONOMIC DEVELOPMENT

UNIVERSITY OF MASSACHUSETTS

RBED Report

**CENTRALIZED FOREST PRODUCT WOOD
RECYCLING FOR THE NORTH QUABBIN**

June 2001

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Centralized Forest Product Wood Recycling For the North Quabbin

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With help and support from:
Forest and Wood Products Institute
Mass Natural Resource Coop

Chelsea Center for Recycling and Economic Development

Community Economic Development through Recycling Program

June 2001

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The Chelsea Center for Recycling and Economic Development, a part of the University of Massachusetts' Lowell Center for Sustainable Production, was created by the Commonwealth of Massachusetts in 1995 to create jobs, support recycling efforts, and help the economy and the environment by increasing the use of recyclables by manufacturers. The mission of the Chelsea Center is to develop an infrastructure for a sustainable materials economy in Massachusetts, where businesses will thrive that rely on locally discarded goods as their feedstock and that minimize pressure on the environment by reducing waste, pollution, dependence on virgin materials, and dependence on disposal facilities. Further information can be obtained by contacting the Chelsea Center for Recycling and Economic Development, 80 Everett Avenue, Suite 221, Chelsea, MA 02150, 617-887-2300.

ACKNOWLEDGEMENTS

I want to express my gratitude and appreciation to the Chelsea Center for Recycling and Economic Development for funding this project aimed at promoting sustainable development and job creation in the North Quabbin communities. I especially want to thank Jennifer Capuano and Amy Perlmutter who provided personal interest, support and encouragement for the project and me over the past nine months. I regret that I was not able to present the Chelsea Center and the North Quabbin communities with a comprehensive business plan for a wood recycling based business as I had hoped to do at the start of the project. I hope that the knowledge and contacts that I have gained during the course of this project may still bear fruit at some future date and contribute to the worthy goals and dedicated work of the Chelsea Institute.

I also want to acknowledge and thank the members of my RBED Advisory Committee:

Jan Ameen, Franklin County Solid Waste District
John Drew, Porter Transportation Company
Tom Kussy, North Quabbin Chamber of Commerce
Philip Leger, Athol Board of Health
Bruce Scherer, Kallisti Percussion Instruments
John Waite, Franklin County CDC

They have been capable and willing to provide support and guide my efforts, and if I have any regrets, they are that I did not make better use of the talent and knowledge they had to offer.

Joe Smith and his Forest and Wood Products Institute have been active, resourceful and supporting project partner. I have leaned on Joe many times these past several months, and he has always been there for me. Nick Weidhaas and Ken Hansen, also with FWPI, have chipped in with valuable assistance. I hope to continue working with FWPI in the coming months to complete a demonstration project begun within the Chelsea grant coverage. I hope that project may yet provide some answers and insights to problems that thwarted our efforts under the Chelsea Grant.

The Mass Natural Resource Coop, and especially it's Chair, Tim Robinson have provided me with support and insight into the workings of the logging, sawmill and forestry operations in our region. Scott Lake, Bruce Spencer, Gordon Boyce, and Walter Hubbard, also MNRC members, have helped to educate me in the workings of the forest products industry.

Finally, I thank John Tierney, wood expert and consultant, and now good friend, for all the support and information and, most of all, inspiration throughout the bright moments and the dark, of this interesting and challenging project.

All the people and institutions I have acknowledged above have made invaluable contributions to my personal education and to the creative thinking, information gathering and analysis that have resulted in this final report. I could not have done it without them. However, the report has been written by me, alone, and I accept full responsibility for any errors in judgment or fact that it contains.

EXECUTIVE SUMMARY

This project set for itself the ambitious goal of creating a business plan that manifests as a viable, sustainable and growing forest product wood recycling business in the North Quabbin region of Massachusetts. The principal contractor for the project has been Donald E. Stone, working for the Millers River Community Development Corporation of Athol, MA. Project partners, The Forest and Wood Products Institute (FWPI) at Mt. Wachusett Community College, and the Mass Natural Resource Coop (MNRC), an association of loggers, sawmill owners and foresters operating in the target North Quabbin Region, have supported him in this effort.

As of the writing of this report, the ultimate goal of creating a comprehensive business plan has not been accomplished. Early on in the project, the primary effort was directed at creating a business plan to produce a high-value product, hardwood dimension pieces, parts and components, from low-grade and waste materials including low-grade logs and lumber and sawmill wood residues. This focus seemed to fit well with the mission and guidelines of our supporting Chelsea grant to promote recycling-based economic development by creating high value products out of waste and low-grade materials. It also lined up well with the missions, expertise and contacts of our project partners, the FWPI and the MNRC. And, as outlined in this report, the business idea held out considerable promise of success.

This report presents the steps we took and our thinking behind the selection of the product focus on hardwood dimension products, our market research and identification of a potential customer base, our review of the production and technology options available for producing the product, and an economic feasibility study of the proposed operation. We were not able to conclusively profile a potentially profitable business and we have tentatively concluded that economic feasibility is not present in the business idea we investigated. However, we will continue to explore and search for a potential business opportunity in producing hardwood dimension products from low-grade logs and lumber. This will be done under a parallel funded project under the FWPI, called the Massachusetts Wood Recovery Project. That project, and its relation to the present project, are fully explained in this report. Results of that project, expected in September 2001, will be submitted to the Chelsea Center.

The report concludes with an analysis that presents the principal investigator's reasoning for declaring that that business idea, as developed and elaborated in this project, is not economically feasible. That analysis is followed by recommendations for changes and next steps that might be made to find a business idea that embraces the goals of wood recycling-based economic development and shows a better potential for profitability.

Finally, the principal contractor offers his analysis of the positive and negative lessons gained from working on this project, with the hope that sharing these observations will help future contractors avoid some of the mistakes that were made and benefit from the insights that have been gained.

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BACKGROUND AND HISTORY OF THE PROJECT

I first became interested in working on a wood-based business / economic development project in the summer of 1999. Jack Edwards, a forester at the Harvard Forest, asked me to assist him in doing an economic analysis on a commercial property in Athol he was considering purchasing. I was employed by the Millers River Community Development Corporation (MRCDC), doing economic development and small business financial planning assistance work. The property consisted of about 10 acres with good rail access. He wanted to look into using the property to create a business or set of businesses that could profitably process and utilize the lower-grade trees that crowd our region's forests. He had a forester's concern for improving forest management in the region, which most believe requires much greater harvesting of lower grade trees. This is problematic, however, because of the low value of these trees relative to the harvesting and transportation costs. He also had an entrepreneurial interest in owning and developing a profitable business venture.

Jack saw a range of potential uses for these lower-grade trees ranging from chips and pellets for fuel on the low end to manufactured wood parts, pieces and components on the high end. He wanted to create a concentration yard where the harvested trees could be brought for sorting and processing into their optimal economic use. The railroad access feature of the location was essential for the low cost transportation of the large volumes of chips and pellets to customers (primarily energy generation plants). Other businesses would locate at the site to produce higher value wood products from the trees. This was my first introduction to the idea of a wood-based industrial park, an idea that still motivates my interest and efforts today.

Problems developed in purchasing clear title to the land (which was owned by the railroad), and the site had some significant drawbacks as well as benefits. It was located near the center of Athol with the closest road entrance passing through the center of town and a low railroad underpass. The other approach involved a much longer approach over low quality roads. Also, the property was adjacent to a small residential area. Given the large volume of trucking involved, the size of the temporary storage piles of logs, chips, sawdust, etc., and the industrial noise of the proposed business, the site was far from ideal. Jack eventually abandoned the project, but the idea has stuck with me and many others that I have encountered during the course of my research.

While Jack's project was still active, I became aware of the Chelsea Center for Recycling and Economic Development, and their grant program that seemed to fit the project. I was not sure that processing low grade trees and lumber into high value-added product qualified as recycling, but it was clearly the kind of community economic development that Chelsea Center envisions in their mission statement. In discussing the project with Chelsea managers, we determined that the project could be considered recycling, especially if it were expanded to include sawmill waste and possibly street trees. These additions made good sense to Jack in his business vision.

PROJECT PARTNERS: FWPI and MNRC

While pulling together the grant application I made two new important contacts related to the project. One was with Joe Smith and the Forest and Wood Products Institute (FWPI) at Mount Wachusett Community College in Gardner. FWPI had been exploring ways of utilizing low-grade lumber and logs to produce high value added products. They called their project the “Massachusetts Wood Recovery Project”, and in pursuit of the project they had established contacts with most of the region’s sawmills, loggers, and foresters. One of the key contacts was with the Mass Natural Resource Co-op (MNRC), a cooperative with over 70 members from the region’s loggers, foresters, and sawmill operators. Both the FWPI and the MNRC became active partners with my employer, the MRCDC, in the grant application submitted to the Chelsea Center. By the time we submitted the grant application in the spring of 2000, Jack had abandoned his plan to develop the Athol property into a wood-based business, but I felt a strong sense of mutual interest and support from my project partners, the FWPI and the MNRC. I later realized the significance of losing a person with clear entrepreneurial interest and motivation for the project.

The MNRC was very concerned with the problems connected with utilizing sawmill wastes (chips, sawdust, bark mulch) and creating markets and value for low-grade materials (poles, pulp wood, round wood and cord wood) coming out of (or left standing in) the regions forests. They had, in fact, created a business to do just that. The business, which was located in Greenfield, worked primarily to create markets for members’ sawmill wastes, especially chips. At the time, the market for chips was poor and unpredictable. The major markets (paper mills) were distant and often the price paid for the chips was less than the transportation cost, giving the material a negative value at the mill. The MNRC business venture enjoyed modest success at first, consolidating chip deliveries and securing better prices and also producing a mulch product from the chips, which was sold locally. In its best year, 1998, the venture had sales of almost \$1 million. However, costs were even higher, and the business never turned a profit. Some feel this was due to poor (and over-priced) management. The business abandoned operations in 1999, leaving the MNRC saddled with debt and surplus equipment. The experience also disillusioned and weakened membership in the coop.

The MNRC has continued to meet with a smaller core of interested and committed members, still trying to find a way to address their original concerns and to either revive the old business or create a new one and pay off their loan. They also continued to provide some income opportunities for the members by brokering sale and delivery of chips, poles and pulpwood. These activities have not produced enough income to repay the loan. Joe Smith was then serving as the clerk and treasurer of MNRC, and was doing most of the brokering of sales and transportation.

The MNRC had engaged the services of John Tierney and his consulting firm, The Drawing Board. John had extensive business experience in the wood products industry as co-owner of an custom wood furniture manufacturing business. This experience gave him good understanding and knowledge about lumber from the perspective of a commercial purchaser and user of the commodity and as a marketer of wood products

(furniture). As a consultant, he has worked with a number of different clients in the wood products industry as well as in other industries. His emphasis was on the marketing aspects of the business rather than the production side. His firm had also developed an expertise in web page design and Internet marketing. John and I formed an immediate bond of mutual interest in the project because of our complementary skills: John's knowledge of wood, the wood products industry, and marketing, and mine in financial analysis and planning. We also enjoyed working together. I later engaged John as a consultant on the Chelsea grant project.

John had already done extensive interviewing of MNRC members to analyze their interests, strengths and weaknesses in terms of creating a new MNRC business venture. He developed a number of concept papers, an economic climate assessment, and had proposed a wide range of potential products and services that might serve as potential business ideas or provide economic benefit to members. Most of these papers will be included in the attachments to this report. John was also engaged by Joe Smith and the FWPI to do research connected with the Massachusetts Wood Recovery Project.

PROJECT PROPOSAL AND OBJECTIVES

It was into this mix of mutual interests, shared purpose, and collected talents that I brought my Chelsea grant proposal for "Centralized Forest Product Wood Recycling for the North Quabbin." The original grant proposal is summarized below:

Abstract

There are over 100 sawmills and logging companies operating within a 50-mile radius of Athol, MA in the region known as the North Quabbin. These businesses face common problems in dealing with the byproducts of logging and sawing lumber: culled trees, less-desirable (low-value) species, slash, stumps, bark, slab, and sawdust, and rejected boards and logs. Only 15 to 25% of the physical volume of trees cut by loggers becomes salable lumber. The rest is left in the forest, turned into low value chips, mulch, sawdust or fuel, or ends up in landfills. Local municipal tree-cutting and stump-removal operations add to this forest product waste stream. While markets exist for some forest byproducts, they are disorganized and distant so that collection and transportation costs offset what little market value exists. At the same time, markets and technologies exist and are being developed that can extract significant value from this forest product waste stream. These technologies require physical flow volumes and investment beyond the reach of even the larger individual sawmills operating in this region.

The Mass Natural Resource Coop (MNRC), currently composed of 78 logging and sawmill operators, has been formed to explore and develop these technologies and markets. The Forest and Wood Products Institute (FWPI) at Mt Wachusett Community College aids them in this effort. In related projects, these project partners have already begun marketing research and a review of related existing and developing technologies. The MNRC is actively looking for a site to locate a centralized forest product wood-recycling center. The MRCDC, lead applicant for

this grant application, has a long track record of promoting business-based community economic development in the North Quabbin region.

The MRCDC proposes to work with the MNRC and the FWPI to develop detailed business plans for a forest product wood-recycling center in the North Quabbin area. The facility will be a centralized concentration yard and processing / manufacturing facility which will develop, manufacture and market a variety of new, high value-added wood products in addition to providing efficient centralized production and marketing of chips, biomass and other lower-value wood recycling products. The facility is expected to be an “incubator” that will spawn other wood manufacturing businesses. This project will include all necessary market and technological research, strategic planning, site location identification and assessment, determination of employment and management requirements, community and environmental impact assessment, and identification of funding sources. The successful completion of this project will help create a profitable business venture that will benefit the local economy by creating jobs, strengthening the existing logging and sawmill businesses, and significantly reducing the solid waste disposal problems currently caused by this forest product waste stream.

Project Goals and Objectives

This project aims to create a business plan that manifests as a viable, sustainable and growing forest product wood recycling business venture.

- ◆ Through market research and test marketing identify a set of high-value added wood recovery products that can drive sales and profitability for the new business. Identify the markets and prospective customers for these products and develop marketing strategies to reach and generate sales in these markets and with these potential customers.
- ◆ Identify and evaluate the other, lower value-added products that can be extracted from the forest products waste stream and identify suitable markets and potential customers for these products.
- ◆ Determine the necessary production technologies and the related plant construction, equipment and personnel needs to start the business operations. Estimate capital equipment and start-up costs.
- ◆ Assess the economic and operational feasibility of the profiled operation.
- ◆ Find a site suitable for the present and projected needs of the new business venture.
- ◆ Determine detailed capital equipment and other start-up costs, and projected revenues and operating expenses for the first three years of operation. Combine these financial estimates into a set of financial projections that can be used to explore potential profitability and financial stability, and sensitivity to risk and variations in critical operating assumptions and variables.
- ◆ Assist the MNRC in developing the membership rules, regulations and operating procedures needed to make this enterprise function successfully as a cooperative organization. Obtain and build the necessary membership support, commitment and enthusiasm to launch the enterprise.

- ◆ Determine the financing needs, identify and evaluate alternative sources of financing, and assist the MNRC in obtaining the needed equity and debt financing.

The grant application was approved and work on the grant formally began on September 1, 2000, with a project deadline of June 30, 2001. In fact, the various parties involved had already done much work before September 2000. Yet in retrospect, the project goals and deliverables have proven to be overly ambitious and many unforeseen problems have surfaced during the course of the project. It is clear that, as I am writing this in early June 2001, we will not have a detailed business plans for a forest product wood-recycling center in the North Quabbin area by June 30.

THE REGION'S FOREST PRODUCT INDUSTRY AND ECONOMIC ENVIRONMENT

Very early in the grant period I spent a lot of time reviewing the materials already generated by FWPI and John Tierney. They had just concluded a tour of sawmills and wood product manufacturers in Tennessee and Kentucky where they observed several operations aimed at recovering valuable clear hardwood dimension pieces out of sawmill wood residues (slab and edgings). We hoped to learn from their experience and “borrow” any good ideas that seemed to be working. I reviewed these reports (a summary report is included in the supplementary materials for this report.) I also studied the business plans and financial reports of the MNRC’s business venture that had initially generated great interest and excitement.

I also visited several of the sawmills and logging operations operated by members of MNRC as well as other individuals and businesses. I needed to gain a better understanding of the forest products industry and the local economic environment as experienced by players in the industry: land owners, foresters, loggers, sawmill operators, and secondary wood product producers. Write-ups of those visits and interviews are included in “Chelsea Project: Plant Trips and Interviews”, included in the supplementary materials to the final report.

I learned that the primary forest products industry (loggers and sawmills) have played a decreasing but still significant role in the state and New England economy. The forest resource is abundant in Massachusetts, which still has over 60% of its land area, more than 3 million acres, in forests. (Many would add, however, that the quality of the forest in terms of timber logs is declining due to poor forest management practices.) For almost all the desired timber species that are common in Massachusetts, the annual growth of new trees exceeds the annual harvest by a significant factor. (See Table 1. Forest Inventory Data for Ten Common Species in Massachusetts) A more detailed report on the size of the state’s forest inventory, growth and harvest rates, “Massachusetts Wood Recovery Project – Draft Interim Report 12/20/2000”, is included in the final report.

The net board foot volume of saw logs for all species growing on timberland in Massachusetts is 16.5 billion board feet. This averages to 6.3 thousand board feet per acre (2,631,100 acres of timberland). Hardwoods account for 52.7% of this volume, softwoods, 47.3%. White pine alone accounts for 34% of the total volume, and the four major species, w. pine, r. maple, r. oak, and hemlock, account for 69% of the total volume (11,451,400,000 board feet).

Table 1. Forest Inventory Analysis Data for Ten Common Species in Massachusetts.
(In thousands of board feet)(1998 Data)

Species	Net Volume, Saw logs	Average Annual Growth	Average Annual Removals	Annual Net Change	Percent of Growth Harvested
White Pine	5,602,800	111,310	43,469	67,841	39%
Red Maple	2,110,100	43,978	6,731	37,247	15%
N. Red Oak	1,946,100	47,750	27,541	20,209	58%
E. Hemlock	1,792,400	46,862	3,147	43,715	7%
Sugar Maple	603,800	4,824	1,224	3,600	25%
Black Cherry	566,600	19,454	427	19,027	2%
White Ash	534,100	16,055	2,514	13,541	16%
Beech	365,000	5,057	775	4,282	15%
Black Birch	363,700	12,367	1,609	10,758	13%
Yellow Birch	212,600	5,133	13,865	-8,732	270%

While the forest resource is abundant and growing, this has not translated into improving economic performance by the regions sawmills. There are several reasons for this. One problem is poor forest management practices. Much of the three million acres of forestland in the state are divided up into numerous small private holdings (5 to 100 acre parcels). While many of the large parcels, such as the 600,000 acre Quabbin Reservoir / MDC lands are actively and effectively managed by trained foresters, most of the private lands are not. This has led to divergent and sometimes questionable and environmentally unsound harvesting practices including “high grading”, or harvesting only the prime logs and leaving the rest standing. This results in a forest with declining quality of timber logs due to overcrowding and excessive growth of less valuable but more aggressive species such as red maple. The low-grade trees left in the woods create a problem because of their low commercial value; removal is perceived to be more costly than the value of the timber harvested. This was, in fact, one of the concerns this project intended to address: how to create more value from low-grade trees and less valued species so that there would be an economic incentive to pull these trees from the forest. Table 2, “Volume of Selected Species by Forest Service Tree Grade”, shows that about 50 to 75 per cent of the forest consists of lower grade trees.

The questions around improving forest management practices and getting better utilization from our forest resource is much broader and more complex than can be covered here and in our project. There is a significant local initiative funded by the Ford Foundation and administered by the New England Forest Federation that is more directly addressing these issues in the North Quabbin. See www.neforestry.org, Ford Community Based Forestry Project, for more information.

**Table 2. Volume of selected species by Forest Service tree grade
(millions of board feet).**

Species	Net Volume, Sawlogs	Tree Grade 1	Tree Grade 2	Tree Grade 3	Tree Grade 4	Tree Grade 5	Volume in Grades 3 - 5	% of net volume in grades 3-5
White Pine	5,602.8	166.6	1,261.4	2,246.5	1,078.9	849.4	4,174.8	75%
Red Maple	2,110.1	92.5	421.8	1,058.2	148.0	389.6	1,595.8	75%
N. Red Oak	1,946.1	370.4	645.9	726.7	15.9	187.3	929.9	48%
E. Hemlock	1,792.4	1195.1	-	-	-	597.3	597.3	33%
Sugar Maple	603.8	81.2	137.2	271.4	34.1	80.0	385.5	64%
Black Cherry	566.6	126.7	140.9	193.5	27.6	77.9	299.0	53%
White Ash	534.1	148.6	135.7	198.0	3.4	48.4	249.8	47%
Beech	365.0	11.8	54.4	172.5	62.0	64.3	298.8	82%
Black Birch	363.7	20.1	92.8	218.8	21.2	10.7	250.7	69%
Yellow Birch	212.6	4.5	45.3	109.2	3.8	49.8	162.8	77%

From the early stages of the primary forest product industry in Massachusetts, the industry has been characterized by the existence of many small (usually family owned and operated) sawmills, logging and related business operations. The 1996 data that produced the “Directory of Sawmills, Dry Kilns, And Lumber Treaters in Massachusetts 1997” listed 88 sawmills, 19 dry kilns, and 3 lumber treating businesses active in Worcester, Franklin, Hampshire, Hamden and Berkshire Counties. This number has undoubtedly declined between 1996 and 2001, but we do not have any more current figures available. None of these mills is large, at least in comparison with the mills found in Canada, Maine, New Hampshire and other parts of the US. The largest, Green Meadow Lumber in Westfield, had estimated sales in 2000 of about \$10 million. Most mills are significantly smaller than this. Sawmill owners often exhibit the quintessential traits of Yankee entrepreneurs: resourceful, shrewd, frugal and fiercely independent. These traits have not always prompted the most effective response to the challenges that have entered the local economy over the past 20 years.

As you talk with loggers and sawmill operators today, they all say that several businesses have closed and know of several others that will close in the coming months. There is a strong sense of fragility in this market place. When the question is asked, how is it that in the midst of the unprecedented continual growth of the US economy (1990-2000), these forest product businesses are so fragile? The story that emerges points to large out-of-state, and especially Canadian, businesses are competing for our log resources and driving up log prices. (While this benefits landowners and loggers, it hurts the local

sawmills.) These large mills are capable of such improved utilization, efficiency and output that they can afford the huge cost of driving the logs north to Canadian mills and returning to US markets with grade lumber and dimension products that compete favorably with locally produced lumber. The local mills are getting squeezed on both ends.

The Canadian government made a big investment in designs for high speed and high efficiency mills to produce the kind of trees that are in the forest today (smaller diameter, lower grade) rather than the kind of trees that were in the woods in the past (large diameter, high-grade logs). The resulting mills can process these smaller diameter, lower-grade logs into grade and dimension lumber much more efficiently than the average New England sawmill.

I visited and interviewed several of the more effective and successful sawmill operators in the course of my study. (Detailed narratives of these interviews can be found in *“Chelsea Project: Plant Trip and Interviews”*, included in the supplementary materials to this final report.) These mill owners have adapted to the intense competition by upgrading their equipment and milling procedures to increase efficiency and yield substantially. While they are not large enough to match the scale of equipment and three-shift utilization of the plants found in the Canadian firms, they have made impressive progress. I had entered in to this project expecting to see a lot of waste, but what I have found at the better-managed mills is almost no waste. Cutting equipment and procedures optimize the yield from the logs, and markets are sought out for everything else that does not become grade lumber. Bark is processed into mulch, which maintains an attractive market price. Sawdust is gathered and sold for animal bedding, waste treatment material, production of fuel pellets, etc. or used on site to generate heat for kilns. Slab and edgings are minimized by improved primary breakdown methods, and some efforts are being made to recapture clear lumber pieces from slab and edgings. Some mills have also set up recovery equipment and operations to produce shorter dimension pieces out of boards that are too short or defected to qualify as grade lumber. At the mills I visited, the mill owners were acutely aware of the importance of maximizing yield, optimizing grade production, and eliminating waste.

All mills continue to produce chips from slab, edgings, trim ends, and other parts of the log that remain after maximizing lumber yield. At the start of this study chips were seen as one of the major solid waste problems facing the mills. Based on a recent Survey of Massachusetts sawmills by FWPI, annual chip generation by the state’s major sawmills is approximately 107,000 tons, for an average of 1.27 tons per thousand board feet of lumber produced.

Markets for chips, primarily the paper mill industry, were distant and demand and price fluctuated widely. Often the price at the paper mills failed to cover the shipping costs. The MNRC had as one of its founding goals the establishment of stable and favorably priced markets for member mills’ chips. During the course of this project, the woodchip “problem” situation has changed and perhaps disappeared. A major regional company has moved in to take over and expand the woodchip marketing function that the MNRC had started to provide. The demand for woodchips as fuel has increased dramatically as

biomass has become a more desired fuel source in response to rising fossil fuel prices. Most mills now report that the market for woodchips is stable and the price may be sufficient to eliminate the problems previously associated with sawmill wood residues.

The better-managed mills have also improved their marketing efforts and developed specialty niche markets for their lumber products and byproducts. Several have found advantage in supplying overseas markets in Europe and the Pacific Rim. Others have cultivated domestic markets and pay careful attention to customer service to maintain stable sales. These mills might not claim to be flourishing, but they are surviving and reinvesting in their business to stay competitive and grow. The smaller and less efficient mills have either already gone out of business or are in a state of gradual liquidation.

Never the less, even the “successful” mills in our region face continuing problems and challenges. Even with new investment in equipment and technology that improves yield and efficiency, the region’s mills remain small and lack the volume and plant utilization efficiency of their larger rivals to the north. All mills remain challenged by high stump prices and a shortage of good logs in the most desired species. Most mills report little problem in profitably sawing and marketing grade lumber from high quality logs. However most also experience difficulty and lack of profitability in dealing with lower-grade logs and the low grade and pallet grade lumber that is an unavoidable component of sawmill production. Based on a survey of local mills by FWPI, about half of the hardwood lumber being produced by local mills falls into the lowest or pallet grade. (See Table 3.)

Table 3. Pallet lumber and pallet cant production by responding mills.

Species Group	Total Production (MBF)	Pallet Lumber Produced (MBF)	%	Pallet Cants Produced (MBF)	%	% Of Total in Pallet Lumber or Cants
All Hardwoods	23,084	7,427	32.2	4,275	18.5	50.7
All Softwoods	18,138	2,442	13.5	1,331	7.3	20.8

In the large volume lumber markets, lumber is a commodity where sales go to the producers who can promise and deliver large volumes, on time, and at the lowest price. Regional mills do not produce sufficient steady volumes of lumber to supply large industrial customers, and generally must sell through brokers, which further erodes the small margins available. Even the special niches carved out by successful local firms may become threatened by the larger, more productive and efficient mills.

John Tierney and others have suggested to the sawmill members of the MNRC that they form an organization among mill owners that would allow the collective group to behave as one large business, and then compete directly with other large companies. In the past, and in other agricultural economic settings, forming an agricultural cooperative has been a successful strategy for welding several small producers together to allow them to operate as a much larger company. While some regional mills have cooperated and shared information to service large orders, the MNRC has not served this function and

there has been no clear movement to create any other permanent cooperative arrangement. Perhaps the rugged individualist, entrepreneurial character and tradition of the region's loggers and sawmill operators operate to prevent such an approach.

I came across a new breed of sawmill in the course of my investigations that could be called "micro mills". These are small and flexible operations based on portable band saw mills. These mills can be towed to a logging site by a large pickup truck, set up quickly, and operated by a single operator. They are capable of precision cutting high quality boards from logs up to 16 feet in length and 24 inches or more in diameter. They can cut logs that traditional stationery mills avoid due to short length, crook and sweep, and the existence of imbedded metal. This makes these mills suitable for profitably recovering quality lumber (sometimes referred to as character wood) from street trees (municipal cuttings), and trees taken down in suburban yards, apple orchards, etc. Because these mills can be purchased for a relatively small investment (\$5,000 used to \$25,000), they are often set up as a part-time business. Operators often view their mill as an avocation or hobby as well as a source of additional income. Several portable band saw mills are currently operating in our region.

We see a good potential business opportunity for one or more small portable sawmill owners to begin operations in the North Quabbin region working with local municipalities to process municipal cuttings (street trees) into character wood for the craft and home wood hobbyist market. Such a business could also take in trees from residential landowners and commercial arborists.

If such a company could also add the capacity to deal with stumps and brush, they would service one of the more pressing solid waste problems facing municipalities in the North Quabbin region. This business would require a portable stump splitter and grinder / chipper, as well as a suitable piece of land for storing and composting the chip materials. With this equipment, the business could also process wood construction and demolition wastes, another serious local solid waste problem. At one point in the course we discussed the possibility of setting up such a business with one of our RBED Committee members and a local entrepreneur. However, the entrepreneur apparently lost interest or the capacity to proceed, and the project stalled.

FINDING HIGH VALUE-ADDED PRODUCTS FOR THE PROJECT

The grant agreement provided wide latitude in exploring potential wood products to provide the focus of the business venture. Since the input materials were to be drawn from the "forest product waste stream", including low-grade logs and lumber, sawmill wastes and possibly street trees and municipal cuttings, it was clear from the start that any operation we designed would produce a large volume of low value material. However, the key to creating an economically viable business was seen to depend on finding high value-added products that would "drive the economic engine" that powered the enterprise and then find optimal uses and markets for the remaining low value material. This became the fundamental premise guiding the project. Moreover, certain provisions in the

Chelsea Center's funding required them to place a condition on the project they were supporting:

“Other than quantifying and qualifying the amount and types of wood for fuel and non-fuel uses, funds used under this grant may only be used to explore options for non-fuel end-uses of wood”.

It is difficult to imagine any system of processing these “forest product waste stream materials” that did not include a significant fraction of the physical volume of materials ending up as a fuel product for sale or used on site to provide energy and heat for the operations. However, we interpreted the restriction as focusing our investigation on the high value-added products but not precluding or limiting the resulting business from utilizing a substantial portion of the “forest product waste stream” materials as fuel for onsite energy and heat generation or for sale.

The first goal of the project was, therefore, to identify a set of high-value added wood recovery products that can drive sales and profitability for the new business. The following excerpt from an early report by John Tierney provides an idea of the broad range of product possibilities considered. The title, “New England Forest Floor Products”, represents a marketing strategy we were considering to give our products and our region a distinctive “identity.”

New England Forest Floor Products

Hardwood Species:

- Multi-species hardwood panels for furniture components
- Multi species hardwood panels for kitchen counters, residential tops of all sorts, some with backsplash built in and yacht finish surfaces?
- Multi species hardwood flooring, wall panels,
- Multi-species bread and meat boards
- Chair parts; seat stock, upholstery frames, cleats and glue blocks
- Small furniture flat stock; bed slats, drawer sides and backs, etc.
- Bending stock
- Turning stock; dowel stock
- Handles; brooms, shovels, rakes, hammers axes, and knives.
- Small piece producers - - from toilet seats to toys
- Picture frames, canvas stretchers,
- Ladder manufacturers
- Timbers for retaining walls, railroad shims and ties?
- Garden stakes, snow fence lath
- Truck beds, Trailer beds, Wire Reels, blocking and machine skids
- Pallet stock?
- Cooperage
- Charcoal?

Softwood Species:

- Multi species softwood panels for interior finish paint-grade and clear-coat varieties for interior architectural applications, bookshelves, custom cabinets, fireplaces, and all built-ins. Tongue and grooved multi piece panels should make relatively stable stock to cut wide boards from. 1by10, 1by12, or larger panels sawn as boards, and sold through retail, or wholesale lumber stores to both professional and retail customers.
- Door and window sash stock, mullion stock, frame stock, screen frame and moldings, floor bridging.
- Solid wood interior doors are now made with short finger jointed rails and stiles which are then laminated with a 1/16" thick veneer of clear high-grade stock so that the door gives the appearance of high grade solid wood composition. We could sell material to these manufacturers?
- Can we make shingles, or shakes from eastern species?
- Poultry feeders, hog feeders, poultry litter, animal bedding, and other agricultural equipment, and consumables.
- Hemlock makes great construction grade material? Can only be used / sold wet or air-dried?
- We will look into a process that will allow sawing "Street Trees" into high value wide and long stock with lots of "Character Marking" to produce high value timber for the craftsman marketplace, both weekend enthusiasts, and professional designer/makers desire this special stock.

Notwithstanding the long list of possibilities, we quickly centered on hardwood dimension stock, furniture parts, panels and components. This focus seemed to provide the best match between available local materials (primarily hardwood red oak and red maple low-grade logs and lumber) and regional market opportunities with New England wood product manufacturers identified in our marketing survey. This choice of focus was summarized in a memo entitled "The Business Idea as of February 2001", and circulated to our RBED Advisory Committee and Chelsea project managers.

The Business Idea as of February 2001

Our efforts under the Chelsea Grant to profile a business opportunity, explore economic feasibility and develop a business plan will follow the lead of our project partners, FWPI and MNRC. It will focus on a wood processing business that manufactures dimension wood pieces (RDL, D2S, D4S), panels and component parts from low-grade lumber, odd-lot lumber, and wood pieces recovered from sawmill slabs and edgings. (Throughout this project we have vacillated on whether to include low-grade trees as a direct source of materials in addition to low-grade lumber from existing sawmills. Including trees as a direct source material would require the proposed business to have primary sawmill capacity as well as secondary dimension production capacity. As of February we were leaning towards the more modest proposal of obtaining all source materials from existing local sawmills.) These source materials will come from sawmills in the region. The target customers are secondary wood product manufacturers in the New England region. Some sales may go to other dimension lumber and wood component manufacturers in the

region. Wholesale / retail sale of panels and parts aimed at the do-it-yourself homeowner and hobbyist is a third potential market.

Products will be both custom produced to customer specification and also produced in standard sizes for inventory. To generate and keep customers, the enterprise will have to work closely and cooperatively with customers, produce consistently high quality product in terms of meeting specifications and acceptable defect rates, and adhere to delivery quality in terms of on-time delivery and complete shipment of quantities ordered. It will have to supply at prices that are competitive with alternative sources and with perceived costs of making the product internally. Competitive advantage will have to lie in the greater responsiveness and flexibility of a local provider over the larger domestic and foreign competitors.

Since production capacity will be limited in quantity and range of species available, sales effort will be concentrated on small to medium sized manufacturers who use the species that are abundant in our region: red oak, hard maple, red (soft) maple, ash and white pine. Marketing effort will concentrate on targeted potential customers through direct personal contact. For companies that already purchase RDL and processed dimension and component parts, the sales effort will have to show we can match existing quality, delivery and price. For companies that currently produce their own dimension lumber and parts from grade lumber, sales effort will have to show the advantages of purchasing rather than making these parts.

The enterprise will have to pay going market prices for quantity purchase of these lower grade lumber supplies, so that supplying mills (Coop members) are not expected to make an economic sacrifice. However, there will need to be provisions that guarantee a steady supply of needed species and prevent presorting of the materials to remove the better pieces. Sawmill production of lumber (and possibly cants) as supply to the production of dimension and component parts need not and should not focus on producing grade lumber as an intermediate product. Rather, sawmill production should be geared toward maximizing the production of dimension pieces. Live sawing of logs, for example, may be more productive than sawing methods used to maximize the output of grade lumber. The feasibility study will have to demonstrate that there is enough spread between the cost of low grade lumber and processed RDL and parts to cover the production costs and achievable production yields that can generate a satisfactory return on investment.

The manufacturing facility will be located in the North Quabbin region. The facility will include crosscut and rip saw operations to break boards down into dimension pieces and planing, molding and sanding operations for producing finished pieces and parts. It may include finger-jointing equipment to improve yields and utilization. It will also include panel production capacity. If cants are included as input source, band resaw equipment would be required. Since most of the wood input supply will be green, kiln-drying capacity will be needed. This manufacturing facility will produce significant quantities of wood waste, primarily sawdust and wood chips. Wood waste will either be used on site as a source of fuel for heat and power or sold through existing markets, with a preference for on-site use of wood wastes for heat and energy.

The business as profiled here ties in to the Chelsea Center recycling mission in the following way: by creating value-added product from lower grade lumber, demand for lower grade logs by area sawmills will be increased. This will pull more lower grade logs from the region's forests. The alternatives would be to leave these lower grade trees in the forest, which is contrary to the goal of improved forest management, or the lower grade trees would be harvested for lower value-added products such as cordwood and chips for fuel. Creating new value-added product lower grade lumber will create new jobs and increase production and sales at existing sawmills in the region.

This business idea relates to several other ideas that have been suggested during the course of our investigation. There have been suggestions of cutting dimension pieces directly from short logs and small logs. This direct conversion from log to dimension has been favorably reported in the literature, but requires a larger initial investment than the "dimension from lumber" project described here. However, the dimension from lumber could be viewed as the second stage in the dimension from log production process. It makes more sense to first focus on creating a marketable product (dimension stock and wood component parts). If this is successful, the operation could be expanded to include processing logs into lumber into dimension stock. The central idea is to eliminate the step of producing grade lumber as an intermediate step, but rather cut lumber with the direct intent of processing it further into dimension stock. Even with the design of a mill to produce dimension stock from lumber obtained from local sawmills, the lumber being cut at sawmills should be sawed to maximize the dimension output and not the grade lumber output.

There has also been discussion of creating a concentration yard and wood energy powered industrial park. This is a very ambitious and exciting vision. The dimension production selected as our initial focus could be a logical part of a larger wood energy industrial park scheme.

LOWER VALUE-ADDED PRODUCTS AND RELATED OPERATIONS

The business we envisioned at the early stages of the project was to be directly related to and probably owned and managed by the MNRC. As mentioned earlier, the MNRC had already created and operated a venture to market member mill's and loggers wood residues and low value products (chips, pulp logs, poles, stud logs, sawdust, etc.) The business generated sales that reached a maximum annual volume of \$1 million, but never turned a profit and was discontinued in 1999. The MNRC continues to broker markets for members' poles and pulp wood and coordinate trucking, but these operations are small, intermittent, and produce insignificant income for the MNRC.

At the meetings of the MNRC there appeared to be energy, support, and even excitement about the efforts of John Tierney, John Smith and the FWPI, and myself with the Chelsea grant support. It was clear that the MNRC no longer had the active involvement of all its members, and there was some disillusionment resulting from the failure of the woodchip business venture and the resulting debt burden. But the active and attending members had enthusiasm and new ideas for ways that MNRC could create a new successful

business venture that would build on and benefit the full membership. Especially active in this effort were Tim Robinson, a successful logger and MNRC president, Scott Lake, general manager of Beaman Lumber in Winchester, NH, Bruce Spencer, Chief Forester for the MDC (Quabbin Reservoir) lands, and Gordon Boyce, Forestry Marketing Specialist for the US Department of Agriculture. Walter Hubbard, owner of Hubbard Forest Products in Royalston, has also been very active in these efforts.

At MNRC meetings (September – December, 2000), we maintained a vision of the emerging business as centered around a large concentration yard where logs would be delivered, sorted, stored temporarily, and triaged into their optimal use based on value creation. Wood and wood chips as fuel (biomass) were central in these discussions, but the creation of a business venture to create high value-added products (the Chelsea-grant sponsored portion of the project that John and I were working on) was also a key component. This vision was often described as “wood-based industrial park”. Energy and heat for the industrial park would be generated from the low-grade logs delivered to the concentration yard and the wood residues (chips, etc.) from the other wood processing operations taking place in the industrial park. The other businesses clustered around the concentration yard and power plant would produce and sell wood products and related products and services. They would make use of the on-site energy and heat generation, providing a high degree of industrial ecology and efficiency. It was an exciting and ambitious vision.

Two key elements of the wood-based industrial park were an anchor tenant and a good location. The anchor tenant would ideally be a successful existing business that uses substantial amounts of wood in its production process and also consumes significant amounts of energy and heat. The location would need sufficient space and good access to rail and highway transportation. For a short while, it seemed that both were available and ready to go.

The anchor tenant to be was Catamount Pellet Fuel Corp. of Adams, Massachusetts. MNRC met with Averill Cooke, the company’s founder and president several times. Catamount had been in business for 9 years, producing fuel pellets for wood stoves and other wood combustion systems. Pellets are produced from a mix of sawdust and woodchips, processed and kiln-dried to produce a high quality fuel that has high efficiency and very low ash content. The product was beginning to enjoy a surging popularity in the Northeast and throughout the country. 1999 sales were 40,000 tons, and were expected to double each year for the next several years. Each ton of pellets required 2 tons of green wood raw materials; what was eliminated was mostly moisture, which requires a lot of heat. The company was currently spending over \$50 per ton in energy (oil-based) costs to dry the product. They were very interested in the potential of deriving their heat needs from an on-site wood-based source.

The location also seemed nearly ideal. The East Deerfield Rail Yard, located just south of Greenfield and the Deerfield River was still in tact and functional as a rail yard providing excellent siding, loading and rail access to anywhere in the country. It had been unproductive for many years, and aside from one factory producing birdseed, there was no industrial activity taking place at the site. The size and configuration of the yard

were not ideal, but preliminary studies indicated that they were sufficient. Road access to Interstate 91 was about 2 miles distant and there were some obstacles to efficient access that would need resolving.

The flurry of excitement ended when the owners of Catamount Fuel Pellets chose an alternative location: an abandoned large old compressed strand board plant in Claremont, NH about 50 miles north of Greenfield. No new anchor tenant has emerged, and the interest and energy at MNRC for the project has waned as well. The East Deerfield Railroad Yard still awaits an entrepreneurial vision and development.

In retrospect, I believe the project was just too big and complex for the MNRC to guide to a successful negotiation and conclusion. Most of the members of MNRC were already heavily involved in running their own businesses. Perhaps the key shortcoming was that there was no one who emerged to provide clear entrepreneurial leadership. There was no consistent negotiating voice. Finally, there was a very limited financial capacity.

The idea of a wood-based industrial park remains attractive and elusive. Tobey Williamson, a graduate student at the University of Massachusetts in the Landscape Architecture and Regional Planning Department devoted his Master's Thesis, "Demonstrating the Power of Living Systems: The Environmental and Regional Economic Importance of a Natural Resource Based Ecological Industrial Park" to developing a conceptual model for wood energy industrial park located in the North Quabbin Region. The diagram that follows provides a good visual representation of the concept. An abstract and excerpts from that document are included in the supplementary materials to the final report.

The hardwood dimension stock, furniture parts, panels and components product focus we have chosen for the Chelsea grant project would fit nicely into the industrial park theme, but does not require that setting to function. As the industrial park idea faded, we refocused our efforts on establishing the market potential and determining the production technology and capital equipment needs to start a freestanding hardwood dimension business.

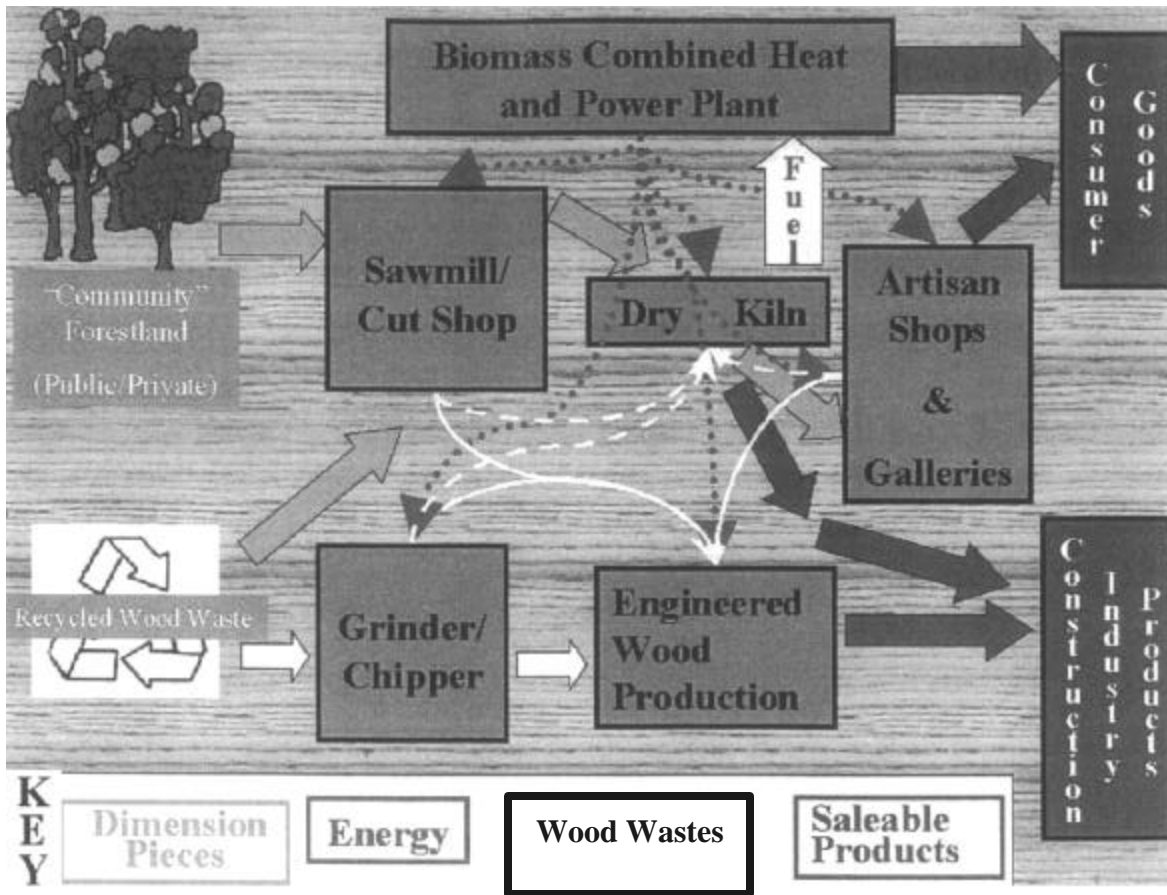


Illustration 1. Natural Resource Based Ecological Industrial Park
 (Proposed by William Tobey Williamson)

HARDWOOD DIMENSION PRODUCTS – INDUSTRY

Hardwood dimension components are defined by the Wood Component Manufacturers Association as “...hardwoods, normally kiln dried, which have been processed to a point where the maximum waste is left at the dimension mill, and the maximum utility is delivered to the user. They are manufactured from rough boards (grade lumber), bolts, cants or logs of varying thickness to the requirements of a particular plant or industry. Components are produced in specified thickness, widths and lengths, or multiples thereof. They may be solid or glued up (as panels, turning squares or parts). Components are further classified as Rough dimension, Semi-machined dimension or Fully-machined dimension (depending on the degree of additional processing following cut-up.)” They are an industrial product produced for and sold to manufacturers of hardwood products including furniture, cabinetry, flooring, molding, stairs, woodturnings, and a variety of other manufactured hardwood products.

Hardwood dimension component manufacturers represent an outsourcing alternative to product manufacturers who would otherwise have produced the components “in house” from logs (if they owned a sawmill) or from grade lumber purchased from sawmills. Over the past several years there has been a pronounced trend from “in house” production of hardwood components by product manufacturers to outsourcing this work to the hardwood dimension component industry.

Companies that produce hardwood dimension are generally classified under SIC Code 2426, Hardwood Dimension and Flooring Mills. However, companies producing dimension materials might also be found other classifications including SIC 2431: Millwork, and SIC Code 2434, Wooden Kitchen Cabinets. Dimension component manufacturers may be vertically integrated with a primary sawmill or purchase input lumber materials from other sources.

Total sales for the hardwood dimension and flooring mills industry in 1995 (the latest year for which comprehensive figures were available) was \$2.91 billion.¹ This represented a 67% increase over the 1990 total of \$1.74 billion. About 55% of industry sales (\$1.6 billion) go to hardwood dimension stock, components and furniture parts. Hardwood flooring accounts for 33% (\$1.0 billion) and the remainder of industry sales (12%, \$0.3 billion) are not further classified.

Industry sales growth is predicted to continue at a modest 3% per year through 2001, with total sales reaching \$3.5 billion.

Industry sales appear to be related to housing starts, which grew steadily throughout the robust economy of the 1990's. During this period there has also been an increase in the popularity and use of hardwood flooring in new home construction. The steady growth in housing starts has been reversed with the economic downturn of 2001, but there are as yet no statistics to gauge the impact of this on industry sales. It is primarily the hardwood-flooring segment of the industry that is directly tied to housing starts.

Industry growth also has come from an increasing outsourcing of dimension component production by the furniture and other wood product manufacturers. This trend affects the hardwood dimension component segment of the industry, which is the segment that is of greatest interest to this study. I was not able to find industry statistics that isolate this hardwood dimension component segment, but anecdotal evidence, based on conversations with Steve Lawser, Executive Director of the Wood Component Manufacturers Association, suggest that it may be the fastest growing and strongest segment of the industry. This opinion was shared and reinforced in conversations with Tom Labrie, president of Auburn Machinery, Inc. a major equipment supplier to the industry.

The industry is characterized by relatively small establishments. However, many of the larger establishments in the industry are subsidiaries of much larger firms operating in

¹ Industry analysis and statistical data are drawn primarily from: Gale's Encyclopedia of American Industries, Third Edition, 2001, and Gale's Manufacturing & Distribution USA: Industry Analysis, Statistics and Leading Companies, Vol. 1, 2000.

related industries or as conglomerates. Nation-wide, there were 1005 firms in the industry in 1997. That number is predicted to drop slightly over the next 5 years to 930, reflecting a tendency toward consolidation and takeover of smaller firms by stronger competitors and the attrition of marginal performers. Average sales per firm in 1996 were \$3.0 million. Average employment per firm is 34, with over 63% of firms employing less than 20. The average hourly wage rate in the industry is also low at \$9.19/hour in 1996. Compared with statistics for averages for all manufacturing categories, the hardwood dimension and flooring industry are significantly lower in almost every measure of value added, productivity, payroll and investment.

Based on value of shipments, the hardwood dimension and flooring industry is concentrated in the mid and south-Atlantic states, the mid west and southern states, with the largest amounts of shipments coming from Tennessee, Missouri, Arkansas, Kentucky and Michigan. New England does not appear as a major player in the industry, with only Maine (9) and Vermont (15) listed among the top 25 states based on dollar value of shipments.

In Massachusetts only 17 companies indicate SIC 2426 Hardwood Dimension & Flooring Mills as their primary or secondary industry classification. Several of these are clearly in the flooring side of the industry, while only three indicate specifically a focus on hardwood pieces, parts and components for the furniture industry. All are relatively small; 12 list annual sales under \$1 million, while 5 list annual sales between \$1 and 4.9 million. This is out of a list of 510 Massachusetts companies operating in the wood products (SIC 2400) and Wooden Furniture (SIC 2500) industries.

There are a much larger number of Massachusetts companies listing primary millwork (SIC 2431) as their primary industry classification. Many of these seem specialized in products such as windows, doors, cabinets, or moulding, but some are likely to have the capability of producing RDL, panels, parts and components. Most companies in this classification are also small (sales under \$1 million.)

I do not have a clear explanation of why there is a relatively low presence of hardwood dimension and flooring mill companies operating in Massachusetts and New England. It is somewhat surprising given the proximity to raw materials and the large number of wood product manufacturers (potential market) operating in this region. It could be due to higher operating costs, especially for labor and energy, which create an economic disadvantage relative to companies operating in the south and foreign competitors. Or it could indicate an untapped market potential.

We did discover in our interviews with wood product manufacturing companies (our market survey interviews) that New England wood product manufacturers do purchase hardwood dimension pieces, parts and components for their production requirements and that there is a distinct trend in this direction away from in house production from grade lumber or logs. But most of the companies we surveyed reported purchasing their dimension needs from Canadian and foreign suppliers. The reasons for this choice were rooted in lower cost, species desired, and scale – capacity to guarantee on-time delivery of large volume orders. Local suppliers were viewed as too small, too costly, and not

dependable, and many of the desired species are not available in large quantities in New England (e.g. cherry, walnut, mahogany).

Ironically (perhaps), the few regional dimension and component producers we did talk to produce primarily for foreign markets in Europe and the Pacific Rim.

Canadian and other non-domestic producers of hardwood dimension components are significant players in the industry, but their shipments of product to United States and world markets are not included in the statistics reported above. I have not been successful in finding statistics to document and gauge the impact of foreign producers of hardwood dimension components, but indirect evidence gathered in market survey interviews with New England hardwood product manufacturers suggest that the foreign company share of the market is both significant and growing.

The hardwood dimension and flooring industry has not been a robust economic performer as compared with other industries. Based on 1999 statistics from Robert Morris and Associates, median industry profitability was just 3.0% return on net sales, and 7.2% return on assets. The top quartile of firms surveyed showed only a 6.5% return on sales and 19% return on assets. This suggests that the most efficient and effective firms in the industry are reasonably successful, but the majority of firms are performing only modestly at best. I was not able to find data on financial performance of foreign competitors in the industry.

In terms of cost structure, the following breakdown of costs has been derived from aggregate industry statistics for 1996:

Shipments (sales)	\$ 2,802.8 (million)	100%
Cost of materials	\$ 1,494.6	53%
Cost of payroll	\$ 631.4	23%
Other expenses	\$ 593.0	<u>21%</u>
Profit before taxes	\$ 83.8	3%

Table 4: Hardwood Dimension Industry Revenue and Cost Structure

Labor is clearly a significant element of total production cost. Wage levels in the industry are significantly lower (\$9.19/hr) than for manufacturing in general (\$12.68). These figures are for domestic production only. Low wage rates seem to be a crucial element in a firm's ability to compete in the industry, and helps explain industry tendency to locate in low-wage states and non-urban settings. Proximity to supply of hardwood materials also influences this location choice. Foreign competition also comes from predominantly low wage countries with wage rates significantly less than those in the United States.

Successful firms in the industry also control and reduce labor cost by increasing use of automation and technology. Larger and more successful firms make extensive use of computer scanning, optimizing and production sequencing equipment that greatly improve yields and reduce labor cost. This has increased the investment required to start

up and compete effectively in the industry, and increased the tendency toward larger firms and the attrition of smaller, labor intensive firms. Even when armed with advanced technology and automation, domestic firms experience intense competition from foreign competitors with significantly lower labor costs, less stringent environmental regulations, and equal access to the latest technology. This creates a challenging economic environment for the new start-up firm entering the hardwood dimension component industry.

The Wood Component Manufacturers Association

The Wood Component Manufacturers Association (WCMA), located in Marietta, Georgia, (www.woodcomponents.org) promotes and supports coordination and cooperation in the industry. The association was organized in 1929 to establish rules and commercial standards for the hardwood dimension manufacturing industry and continues to provide that function today. Over the years it has changed its name and broadened its coverage to include a broader range of hardwood and softwood component products and related services.

WCMA members produce a variety of rough-, semi-, and fully machined wood component products for the furniture, cabinet, building products, and related decorative wood product industries. Some of these components include cut-to-size blanks, edge-glued panels, solid and laminated squares, dowels, mouldings, turnings, table and chair parts, cabinet doors and parts, frame stock, staircase parts, interior trim, millwork, engineered components, and many other specialty wood products. WCMA has approximately 150 member companies located throughout the United States and Canada. Only a few members (6) are located in the 7 New England states. Most (about 70%) are located in the south or Midwest states, while about 15% are far west US and about 12% are Canadian. This reflects the industry patterns generally.

The major goals of WCMA are to:

- Develop and promote a general demand for the industry's products and services
- Promote a friendly exchange of ideas within the industry
- Collect and distribute useful economic and technical information concerning industry trends and developments
- Serve as a Business Referral Clearinghouse by responding to sales inquiries received from competent buyers and passing this information on to members
- Establish and maintain standard rules for the measurement and inspection of dimension and wood component products
- Cooperate with other wood product trade associations to promote and protect the interests of the industry.

The WCMA is clearly a valuable resource for industry information and for identifying sales and profit improvement opportunities.

WCMA literature also stresses the importance of the trend toward outsourcing for components by manufacturers of wood products. Outsourcing is, in fact, the primary

basis for the existence and growth of the hardwood dimension and component industry. It is therefore significant to understand the nature of outsourcing decisions in formulation marketing strategy by companies in the industry. The primary advantages of outsourcing, as contrasted with in-house production, include clearer knowledge and control of material costs, waste reduction, decreased inventory holding requirements, reduced labor and overhead costs, improved quality and quality control, and the ability to put greater focus on the revenue generating side of business rather than the production side.

Wood product companies that produce their own dimension pieces and components from logs or grade lumber require more extensive and complex production facilities than a company that purchases its parts and components from an outside supplier. Such companies often have only a vague and erroneous understanding of the cost of the parts and components they produce for use in their finished products. This is often due to poor and antiquated accounting systems, but even with good accounting systems it is difficult to get accurate and stable component cost figures. Purchased components have a precise, quoted price that is known and often more stable (with long term purchase contracts) than in-house production costs. The purchase cost can often be less than the true in-house production cost due to the greater efficiency and technological superiority of dimension and component manufacturing specialists.

Outsourcing also allows wood product manufacturers to devote more plant space and production effort to creation of finished product, more focus on revenue generation than on production steps. Also, waste and the problems of dealing with scrap are reduced. Quality and quality control can be managed by contract and supplier selection; because wood dimension and component manufacturers are forced by competition to keep pace with technological change, they are often better equipped to deliver consistent quality at competitive price.

Any company that is going to compete successfully in the hardwood dimension and wood component industry will have to understand the economic and marketing aspects of the outsourcing decision, and to be able meet or exceed the expectations of quality, on-time delivery and price that motivate the buying decision.

MARKET RESEARCH AND SURVEY ANALYSIS

The market research study was planned and coordinated by John Tierney, whom I engaged in the Chelsea grant project as a consultant. Working with a variety of sources including directories, Internet searches, telephone books, and personal contacts, John developed a list of about 325 businesses in Massachusetts and the surrounding states that manufactured wood products. He then set up a database (File Maker Pro), and entered the contact information for these businesses.

Wood Manufacturing Plant Visits and Interviews

John ran a small custom furniture manufacturing business for several years and subsequently has been providing marketing consulting to firms in the wood products

industry, so he was already familiar and knowledgeable about the industry. Joe Smith and I had less experience and knowledge. So as a first step to gain insight into the target market and gain more understanding of the industry we selected several firms within a 50-mile radius of the North Quabbin, and arranged a series of plant trips and interviews with key production people at each plant. We wanted to learn more about how wood was sourced and used in the production of furniture and other wood products and we wanted to gain a sense of the receptivity of firms to meeting some of their wood supply needs in the form of dimension materials supplied from local sources.

Some of the firms visited and people interviewed included:

Architectural Millworks (Montague, MA)	Chuck Belenger, Owner
Athol Table Co. (Athol, MA)	Gerry Grimes, President
Florence Casket Co. (Florence, MA)	Russ Christianson, Owner
Main Street Millworks (Greenfield, MA)	Howard Matheson, Owner
Modern Contract Furniture (Gardner, MA)	Mike Rolla, President
Nichols & Stone (Gardner, MA)	Roger Johnson, Procurement
S. Bent & Co. (Gardner, MA)	Ken Hansen, Production Mgr.
Standard Chair (Gardner, MA)	Jim Roy, Production Mgr.

The plant visits and interviews provided a wealth of impressions, observations and information relative to marketing dimension wood products to manufacturers. They also helped bring me up to speed in understanding the wood products manufacturing process and industry practices. Interview notes for most of these plant visits were written up and are included in “Chelsea Project: Plant Trips and Interviews”, included it the supplementary materials for this report.

Most of the older manufacturers we visited followed the traditional practice of producing all the parts and components for their products from grade lumber. Most started with kiln-dried lumber; one firm, which also owned sawmills, received green lumber and did the kiln drying at their plant. These firms would break down the grade lumber into dimension pieces using a combination of rip and crosscut saw operations. The dimension pieces were then processed further by a variety of planing, moulding, shaping and sanding operations into panels, parts and components for assembly into finished products. These break down and part production operations required a lot of factory space for the machinery and for the storage of the in process inventories, and employed several workers. The operations also created challenges in controlling yield and utilization of the grade lumber and in dealing with the waste and scrap produced in the process. Athol Table and the Florence Casket Co were good examples of this traditional approach to wood product manufacturing.

Some newer and larger firms we visited were making increasing use of purchased dimension pieces, blanks, panels, and part in their production process and doing less purchase and breakdown of grade lumber at their factory. This freed up considerable space and reduced the amount of in process inventory, so these resources could be devoted more to product assembly and shorter production cycles. Nichols & Stone and Modern Contract Furniture represented the trend toward increasing reliance on

outsourcing to provide the pieces, parts and components needed for manufacturing and assembly of finished wood products.

The advocates of purchasing grade lumber cited the advantages of more control over the whole production process and utilizing the (often old) equipment and space devoted to the breakdown operations. It was “the way we have always done it here.” These managers and owners generally felt they got good yields out of their grade lumber, but often did not track these yields or have a clear idea of what the full actual costs of the produced dimension pieces, parts and panels were

The firms that were purchasing dimension pieces, parts and panels did so because they felt they were able to get consistently good and dependable quality at a known and favorable cost. They developed long term supply relationships with suppliers who could assure that quality and meet on-time delivery to support “just-in-time” manufacturing procedures. They no longer had to contend with the problems of optimizing the usage of grade lumber and dealing with the resulting scrap and waste.

The millwork firms we visited were fundamentally different than the product (mostly furniture) manufacturers in that they had less need for repetitive pieces and parts. Production tended to be more custom to order, and therefore these firms needed the flexibility provided by buying grade lumber and doing their own breakdown operations. The millwork firms all purchased grade lumber as their primary source for materials. Some millwork firms also produced dimension stock and components for other wood product manufacturing firms.

Since we were interested in the market potential for producing dimension stock and parts for sale to wood product manufacturers, these visits to firms with contrasting methods of sourcing and using their wood requirements provided valuable insights and lessons.

One point became quite evident. Potential customers for dimension stock had to produce a line of products that required repetitive pieces of wood with the same dimensions. Companies that produce custom products with constantly varying dimensions, such as the millwork firms we visited, are not good potential dimension stock customers.

We also observed that firms that did produce a line of products that make use of repetitive parts do make good potential dimension stock customers even if they currently are purchasing grade lumber and doing their own breakdown. Grade lumber, as required by industry grading standards, comes in boards that have a minimum dimension of 8 feet or more in length, and a width of 4 inches or more. So firms would purchase grade lumber in long, wide (and increasingly costly) boards and then proceed to break those boards down into small pieces in the first manufacturing step. If you examine most furniture and other hardwood products, you will find that they are constructed mostly of relatively small pieces of wood, generally 4 feet or shorter in length, and often less than 2 feet. Most pieces are also narrow, less than 4 inches wide. Wider pieces, such as chair seats and tabletops are generally produced from glued up panels, constructed from relatively short and narrow dimension pieces. Even the casket company we visited used mostly small pieces in the construction of their product, and no piece longer than 7 feet.

It was this observation on the prevalence of small dimension pieces in manufactured hardwood products, more than any other, that encouraged us to pursue the possibility of producing dimension stock from lumber and logs that did not meet grade lumber standards but still contained ample amounts of high quality, clear and defect free, shorter dimension stock pieces. Further research showed us this was not a novel discovery and that a substantial industry has been building for several years to supply wood product manufacturers with dimension stock, pieces, parts and components. However, the hardwood dimension industry was not yet well organized or established in our region. Also, most dimension stock producers did not produce their products from low-grade logs and lumber.

Encouraged by these findings, we began thinking of the implications for marketing research and strategy. For companies already outsourcing for their pieces, parts and panels, there would be no need to sell the firms on the benefits of outsourcing. Marketing success with these firms would require matching or beating the competition on quality and reliability of product and delivery and being competitive on price. This would be challenging to a small start-up firm.

Marketing to the more traditional companies that are doing their own breakdown would require more effort at changing behavior patterns. The older owners and production managers we spoke with were often highly committed to their wood procurement and production methods. Most firms in our region, and especially those making hardwood furniture, are facing increasing production costs and intense price competition, especially from foreign competitors. One of the larger firms we visited (S. Bent & Co.) actually went out of business during the course of this project. Owners and managers are definitely looking hard for ways to reduce costs without sacrificing quality.

If owners and production managers could be convinced that outsourcing could provide a reliable, comparable quality and cost-competitive alternative to purchasing grade lumber and in-house production of dimension pieces and parts, they could become customers. However, demonstrating cost-competitiveness could be difficult where the actual cost of in-house production is not known or under-estimated. The fact that the newer, larger, and presumably better managed firms are making increasing use of outsourcing is encouraging. So is the steady growth of the hardwood dimension industry as reported by the Wood Components Manufacturing Association (WMCA). (www.woodcomponents.org) The WMCA provides a wealth of guidance for its member firms on marketing strategies that highlight the benefits of outsourcing.

Market Survey of New England Wood Product Manufacturers

In addition to the direct contact and plant visits to a small sample of wood manufacturing firms, we also constructed and executed a survey of all the firms we had identified, about 350 in total. This represented an estimated 55% to 60% of the total number of firms within the target area. Subsequent searches of comprehensive lists of companies sorted

by SIC code revealed over 525 companies producing a variety of wood products in Massachusetts alone, and other New England states had similar totals.

After designing and testing a survey questionnaire, we hired a graduate student from the University of Massachusetts Wood Sciences and Technology Department to conduct the survey by phone. The survey form was designed to facilitate direct entry of answers into a Filemaker Pro database as the telephone interview took place. We felt this technique would produce the most complete and accurate capture of data while minimizing transcription and data entry effort. Unfortunately, the graduate student resisted supervision and guidance, and chose to do an undetermined portion of the survey by faxing the survey form to the respondent who then faxed back the form with answers. He also used an abbreviated form of the survey in some of his contacts. Finally, he failed to keep accurate and complete records of who was contacted, who was faxed survey forms, who responded by phone, and who refused or failed to respond. These variations in approach and conduct compromised the value of the information collected from respondents, especially in terms of statistical validity. However, we still feel the survey produced valuable and useful information.

Of the 350 companies in the survey list, we identified 253 (72%) as potential dimension stock customers. From this set of “potentials”, 86 (34%) provided usable responses to the questionnaire. Over half of these (46) responded indicating a positive interest in purchasing and using dimension pieces, parts and components in their production process. The breakdown of interest in dimension stock was as follows:
(Some respondents checked more than one box so we have more than 46 total.)

- 4 – Rough Dimension Pieces
- 7 – Dress 2 Sides
- 36 – Dress 4 Sides
- 18 – Exact Components

14 of these 46 respondents agreed to send us specification sheets.

One finding that surprised and influenced us was that these firms showed a much greater interest in more finished (dressed) pieces, parts and components than in rough dimension lumber (RDL) which is minimally processed to size specifications. Prior to the survey, we had expected the demand would be highest for RDL and less for more highly processed pieces. We liked this finding because more processing means more value-added to the raw materials that can translate to more opportunity for jobs and profitability.

In addition to gauging interest in and use of RDL, the survey also collected information on the species and monthly volumes of hardwood usage and price information on both grade lumber and various forms of RDL. We hoped to obtain from these data a more accurate estimate of the market value of RDL. Our research had already determined that current price information on grade lumber is easily obtained, but we had no such ease in determining prices for RDL. A price spread between grade lumber prices and RDL prices would be of perhaps even more usefulness since lumber prices vary widely and

frequently over time. Our survey provided only partial and even contradictory information on RDL prices and price spreads.

We found that there is a wide range of definitions for each of these product categories, and most agreements between a supplier of dimension material and their customers are tailored to expectations and costs negotiated in each circumstance. In our survey we described RDL, D2S, D4S, and Exact components, as examples of four categories, and we expected to fit most transactions into these groups. We found a broader range than these four are commonplace.

For instance one customer buys heavy 4/4 (dry) skip planed to 7/8" thickness and ripped to 3", 4", and 6" widths. He then runs these pieces through a four sided moulding machine, and a cutoff saw to obtain exact sized blanks to make his furniture parts. He pays approx \$4.50-5.00/board foot in the aggregate for all his pieces. This is approx \$2.25-\$2.50 above Select and Better price for Grade lumber. So this customer is willing to recognize a value added of \$2.25-2.50/board foot in order to more conveniently "size" grade lumber input to his process.

The median mark was several respondents who felt a range of \$1.25-2.25 was fair value added. A point to remember is that respondents are identifying a value added to the price they currently pay, for largely high value grade lumber. In most cases these purchases are for FAS and Select & Better Grades. For example, if FAS is selling at \$2.50/board foot, the dimension part value would be in the \$3.75 – 4.75 range. This could be the target value for finished dimension pieces produced directly from lower grade and small logs rather than pieces produced from grade lumber.

We had also hoped to get some indication of yields obtained from source materials. That is, for companies purchasing grade lumber and doing their own breakdown, what was the yield of dimension pieces and parts obtained from the source material. We knew from the literature review (and from common sense) that dimension yields decrease as lower grades of source materials are used. Reliable yield information would help us to make estimates of the value of dimension materials relative to various grades of lumber by indicating the full cost of internally produced dimension stock. If a customer recognizes that they only get a 55% yield from the #1 Common source material, and it cost them a significant labor input to achieve this, then the actual cost of deriving the useful dimension components is the total of all the material costs, including labor and variable overhead, and the cost of disposal or reutilization of the other 45% of the raw material that enters their manufacturing process. Most manufacturers we surveyed did not seem to have a clear or precise estimate of yields or of the cost of internally produced components and dimension pieces.

In-depth Telephone Interviews

Following our review and analysis of the survey results, John Tierney and I decided to call all 46 respondents who expressed interest in some form of RDL purchase and conduct more in-depth follow-up interviews. These calls provided a much fuller

understanding of user needs, concerns and expectations, but did not provide much additional statistical information. We found that most companies already purchasing RDL were using sources from Canadian firms and from overseas. While several expressed interest in using local sources, they expressed concern over a local producers ability to be a reliable supplier in sufficient quantities. Not surprisingly, the primary “key variables” these firms identified for sourcing decisions were product quality and accuracy to specifications, on time delivery, and competitive price (in that order). While the willingness to source locally was evident, there was no indication of a willingness to pay more for local materials.

We were pleasantly surprised at the interest in our project and willingness to share useful information and opinions expressed by our interviewees. We had expected to encounter gruff and curt responses from stressed and harassed production managers and owners, but almost everyone we contacted was generous of their time and responsive to our questions. Several of these contacts later became “customers” in a demonstration project (to be described shortly) producing dimension materials from local red oak and red maple lower-grade logs and lumber.

Detailed notes summarizing the follow-up interviews are included in the Filemaker Pro database (Survey.fmp5), which is included with the supporting materials submitted with the annual report. This database also includes all the survey data collected as well as contact information for over 600 businesses, organizations, and individuals related to or involved in the wood and forest products industry.

Library Research: Building a Potential Customer Database

In addition to the companies contained in the database, we have also assembled complete listings of all New England wood product manufacturing companies identified by SIC code 2400 (Lumber and Wood Products, except furniture) and SIC code 2500 (Furniture and Fixtures). These files, drawn from “ReferenceUSA” and “Dunn and Bradstreet Companies with Sales over \$5 million” online reference sources obtained through the University of Massachusetts Library and from the Chelsea Institute. They contain brief descriptive information that identifies the company’s principal products and detailed industry classifications, complete contact information, company size measured by sales and number of employees, names of owners and key employees, and other potentially useful marketing information. These data are contained in several files, mostly in EXCEL format. Collectively, the files contain over 1600 records. We have not done much with these files other than to compile them, but they can be used to identify potential dimension stock customers throughout New England. We used a portion of these files to identify potential customers for our demonstration project (to be described below) producing dimension materials from local red oak and red maple lower-grade logs and lumber. Electronic copies of all these files are included with the materials submitted with the final report.

THE MASSACHUSETTS WOOD RECOVERY PROJECT AND FURTHER MARKET RESEARCH

After having compiled a potential customer base list of well over 1000 New England based companies, surveying about 100 of those, conducting detailed follow-up phone interviews with 46 firms, and conducting plant visits to 9 firms, we felt confident that there is a sizable market for hardwood dimension products produced and sold in New England. At this point we decided to join forces even more closely with Joe Smith and the Forest and Wood Products Institute at Mount Wachusett Community College. Joe Smith had funds in his Massachusetts Wood Recovery Program that support a demonstration project to produce hardwood dimension products from local low-grade logs and low-grade lumber. While this project was originally aimed at testing production feasibility and generating yield and processing information, we decided to use this opportunity to extend our market research and make use of our database of potential customers. Instead of producing dimension pieces to arbitrary specifications, why not get customer orders and produce to fill real customer needs? That way we can still test production feasibility, collect yield and processing information, and begin a more detailed investigation of customer needs and preferences.

On the supply and production side, the Massachusetts Wood Recovery Project chose to focus on northern red oak and red maple. Red oak was selected because it is the region's most abundant valuable hardwood by a wide margin. Red maple was chosen because it is also an abundant and aggressive species in the North Quabbin forests, but it is undervalued as a commercial species, and there has been a desire to cultivate more markets for the material. Material will be supplied in the form of lower-grade and smaller diameter logs to be harvested by a local logger, and pallet grade lumber to be purchased from a local sawmill. Sawmill production, kiln drying and the production of dimension pieces will be contracted out to local companies. All this will be paid for at prevailing local prices and rates by FWPI's grant sources.

John Tierney and I used our customer database to identify a list of about 50 potential customers. The list included furniture manufacturers, wood turners, stairs manufacturers, cabinetmakers, and a variety of other New England wood product manufacturers. Several of these "potential customers" were firms we had talked with earlier during our market research interviews, but some were new contacts drawn from our lists.

We made contact by telephone and explained the nature of the project we were working on and the species and types of dimension materials we could supply. We then asked for orders. The materials will be produced to the customer's exact specifications and shipped to their plant free of charge. In exchange for the free material, we asked each customer to agree to take part in a detailed follow-up interview to determine how well our materials met their needs, what price they are paying or would be willing to pay for the materials. We will also ask what other factors or concerns would have to be met to make that firm become a regular paying customer.

Out of about 40 contacts, we compiled a list of orders from 17 companies. Naturally the access to free materials was a big attraction to induce companies to participate. But most

companies, including several that did not give us orders, were very interested in the broader goals of the project and were eager to support us. Orders were about equally divided between red oak and red maple, which surprised us. We had anticipated a greater disinterest and resistance to red maple.

The order list from 17 companies was reviewed and eventually culled down to 9 companies. The primary reasons for rejecting orders turned out to be limitations in our source materials. The idea of using lower-grade materials is that you can cut substantial volumes of clear, high-grade pieces by cutting around the defects. This is true and a well-documented fact. Extensive tables exist to help predict yields given log or board quality and the size of dimension pieces sought. But one consequence of using the lower-grade materials obtained for the Wood Recovery Project is that our dimension pieces are limited to relatively short (under 30 inches) and narrow widths. Wider pieces can be produced by edge gluing them into panels (a common practice in the industry), but there is no easy way to get around the length limitation. Finger-joining shorter pieces to form longer pieces is a possible solution. A second limitation came with the decision to limit thickness to pieces that could be made from 4/4 boards.

The low-grade source materials and limited species availability definitely restricted the range of products we offered and the overall market potential. These limitations will definitely affect overall economic feasibility, and this important fact will be analyzed elsewhere in this report. But even with the limitations we were able to accept orders for 2,000 board feet of red maple dimension product and 4,100 board feet of red oak.

The source materials have all been obtained. The low-grade logs have been sawed into boards, and the boards are in the process of kiln drying. We have lined up to local wood shops to produce the dimension orders and this will begin in July. Delivery of product to customers will be in July and August. Follow-up interviews and final project analysis and conclusions will be completed by the end of September 2001. A complete report of this project will be forwarded to the Chelsea Center when it is completed. An interim report dated June 22, 2001 is included in the supplementary materials for this report. See: *Massachusetts Wood Recovery Project: Interim Update Report June 22, 2001.*

PRODUCTION TECHNOLOGY AND EQUIPMENT REQUIREMENTS

There is a wide variety of production technologies, equipment configurations and scales of operation that can be found in the production of hardwood dimension products. On the simple, low technology, small-scale end, a shop could be set up with a few employees, a rip saw for breaking wide boards into desired widths, a crosscut or chop saw for cutting to desired length, and a planer to rough dress the dimension pieces to desired thickness. Additional equipment could be added for further dressing, smoothing and shaping the pieces and for gluing up pieces into panels. Some additional equipment would be needed for moving, stacking and packing materials and finished product, and for dealing with sawdust and wood scrap created in the production process. Such a plant would require little or no automation, relatively unskilled labor, and relatively low investment.

At the other end of the spectrum, a dimension plant can be very large scale and highly sophisticated, employing computer scanning and sequencing of cutting orders to maximize yields and control the automated high speed saws and planers and shapers to produce not just rough dimension pieces (RDL), but a wide variety of finished wood parts and components. Such a plant could employ 200 or more (combination of highly skilled and technologically sophisticated workers) to set up and maintain the equipment and numbers of low skilled workers to feed the materials in and stack and package the output. Investment in such a plant could be several million dollars.

Dimension plans can be free standing, buying lumber from sawmills or brokers and not having to deal with breaking down logs and kiln drying the lumber. They could be added on to an existing sawmill to provide a greater range of production and marketing options (grade lumber or dimension stock) to the resulting entity. Dimension operations are also often found on the front end of furniture and other wood product manufacturing firms that begin their production process with breaking down grade lumber. Finally, a dimension mill could be vertically integrated, procuring and sawing logs directly in to dimension products with no intention of producing grade lumber as an intermediate product.

We were never able to close on what kind of dimension operation to create, and so we never really got close to deciding what kind of production technologies and plant equipment configuration to employ. Our demonstration project producing dimension stock from lower-grade red oak and red maple logs and lumber would appear to be moving us in the direction of a smaller scale and less sophisticated, lower-investment operation, but no specific decisions or choices have yet been made regarding this crucial element of profiling a business and developing a business plan. This inability to narrow down and sharpen our focus highlights the lack of a strong entrepreneurial force within the project team. We came across a number of options and ideas in our research, plant visits and discussions with equipment manufacturers. The range of alternatives was very wide, and we were unable to choose where to begin and build our plan.

We came across several research and proposals for producing dimension materials directly from small, short and lower grade logs. Often referred to as “System Six”, it offers a way to use these lower-grade and less desired logs in a way which bypasses the wasteful and inefficient intermediate step of producing grade lumber (for which lower grade logs are poorly suited). By directing the primary sawmill breakdown of logs directly at producing shorter dimension pieces rather than longer grade lumber, much higher yields are obtained from the logs and the value of the finished material is much higher in terms of price per board foot. The literature presents the idea as practical, possible and financially attractive. However most of the research, which has been going on for years, has come out of academic and forestry research settings. We could find few examples of practical and successful applications of the ideas either in the literature or in our plant visits and interviews with sawmill owners. A complete, annotated bibliography of reference materials is contained in a Filemaker Pro Database that is included in the materials submitted with this final report. A partial printout of the bibliography is included in the supplementary materials for this final report.

Hull Forest Products Dimension Mill

The closest and best example we found of producing dimension stock directly from lower-grade logs was at the Hull Forest Products Sawmill in Pomfret, CT. Hull Forest Products is a modern, efficient and successful sawmill that currently devotes approximately half of its production capacity to producing a specialized hardwood dimension product directly from a mix of low-grade logs and lumber.

The primary sawmill is set up in a special way for a “dimension” production run. Logs are selected especially for a given dimension production order and delivered to the primary mill. There the logs are opened and sawn to maximize the yield of 3 inch wide, 4/4 boards which become the source material for the adjacent dimension mill. This is a significantly different sawing protocol than that used when producing grade lumber. The 3 inch, 4/4 boards are taken directly to the on site kilns and dried to the standard 8% moisture content. The kiln-dried boards (kiln drying takes about 3 weeks) are then delivered by fork truck to the dimension mill. In the dimension mill, 3 employees mark defects on each board with a special crayon. The marked boards are fed into a computer-scanning machine that records the cutting locations to remove the defects and the lengths of clear lumber between defects. This information is fed to a second computer that drives the automated cutting machinery. That computer also contains the cutting order of the various lengths needed to fill the production order. The boards flow, with no further manual handling, into the automated saw which maximizes yield while producing the desired lengths and sorting them into bins. Two workers remove and stack the resulting dimension pieces on pallets, while a third delivers them to a staging area where they are shrink-wrapped for shipment. The entire process is extremely fast and efficient. Six workers can produce about 4,500 board feet of product in a single 8-hour shift. The product is highly specialized: only 3”, 4/4 dimension pieces of varying lengths and no further processing are produced. The product is marketed and sold mostly to over seas customers in the Pacific Rim.

This dimension production process appears to be profitable, and the Hull Forest Products Company plans to replicate the operation with a second mill in the Southern Berkshire region of Massachusetts. (A write-up of that visit and interview is included in “Chelsea Project: Plant Visits and Interviews” in the supplementary materials to this report.)

The Hull Forest Product operation is radically different than the production processes we considered for our North Quabbin project. We do not believe such a process could be economic as a freestanding business that had to purchase lumber as its source material. It can only work as an add-on to an existing modern and efficient primary sawmill that also produces grade lumber. It could also possibly work as a dedicated, integrated production operation producing only dimension product directly from low-grade logs. Such a mill would approximate the “System Six” proposals discussed previously.

While we have chosen not to profile such a mill and conduct a full economic feasibility study on it, we observe that the North Quabbin forests provide nearly identical source materials as those supplying the Hull operation in Connecticut. The technology involved

is all known, tested and available. We are not sure about the markets for the dimension product, but note that Hull appears to be increasing its productive capacity. We conclude that the Hull type of dimension production may represent a viable investment opportunity for an existing sawmill in the North Quabbin region.

Leon Fisk Panel Production Yield Study

During our investigation and field trips we came across another local study of the feasibility of producing dimension stock directly from lower-grade trees. This study was conducted for Leon Fisk, who owns and operates Forest Products Associates, a lumber drying kiln and wholesale/retail lumber business in Greenfield, MA. This study was conducted to determine whether short logs cut from low grade trees in the Greenfield, MA area would produce suitable yield of panel stock to support a plant manufacturing edge-glued panels. Panel stock and edge-glued panels are a form of dimension stock production. The study was elaborately and expertly conducted and extensively documented. It examined all the primary hardwood species grown in this region. It demonstrated that a sustained yield of panel stock ranging from 45% to 56% of log volume could be obtained from the short and low-grade materials studied. A brief summary report on that study and a table showing the final yield calculations and results by species is included in the supplementary materials for this final report.

The study made no effort to analyze the yield information to determine the economic feasibility of an edge-glued panel plant in this region, but its authors feel it provides the raw data that, when combined with expert market knowledge, product prices, operating costs, etc., would allow an interested person to make this determination for himself.

Mr. Fisk reported that he had made such an analysis and developed a business plan that had generated interest from local banks. He felt the operation could be feasible and profitable only if operated at a high level of efficiency and plant utilization, and on a relatively large scale. Log breakdown would require a special type of single pass, gang ripping to produce the boards to be fed into the panel production mill. He had visited a very large mill in Michigan that was successfully operating in the way he proposed. That operation was much larger than even the largest mills currently operating in Massachusetts.

Despite the interest from banks and other potential investors, Mr. Fisk did not pursue his panel production plan. One reason he offered was his age. He was already at that time in his seventies. His existing business, operating kilns on a commercial basis for sawmills and selling local and exotic hardwood lumber to wholesale and retail customers was successful and profitable. Mr. Fisk is still active in his company, but his daughter, a University of Massachusetts Summa Cum Laude business school graduate, is taking and expanding role in the management of the business. Neither Mr. Fisk or his daughter are interested in expanding into panel production.

A second reason for not expanding was the scale required for economic feasibility. That would have strained Fisk's present location and he did not want to start up in a new

location. The poor roads and semi-residential nature of the Greenfield location would hamper accessibility to the present location. Mr. Fisk was also concerned with problems of obtaining a steady, year-round source of supply of logs to feed the high volume operation. My discussion with other sawmill owners in the region would support this concern.

We decided not to pursue the plans suggested by the log-to-panel production yield study for many of the same reasons given by Mr. Fisk. However the study with its extensive yield data may represent an untapped opportunity to an ambitious forest products entrepreneur.

LandVest Primary Wood Processing Feasibility Study

I came across another interesting study of a business idea based on utilizing low-grade hardwood trees that comes at the problem from a very different premise than our Chelsea Grant study. This study was conducted by LandVest, a New Hampshire-based consulting firm, to explore the feasibility of constructing a primary wood processing plant in St. Lawrence County, NY. St. Lawrence County has a combination of chronic under-employment combined with a large and under-utilized local forest resource base, similar to the situation here in the North Quabbin.

In this study, the consultants first analyzed establishing a mill to produce furniture squares, a form of dimension material or a bolt wood mill, which produces hardwood blocks that are then turned into specialty products such as bed posts, furniture legs, drawer pulls, handles and knobs. They abandoned that effort when they discovered the high investment cost and low initial return associated with the project. (I did not see that part of the feasibility study.) Instead, they focused on a Scragg Mill, a cutting system that produces cants that are sold to pallet manufacturers. The source material would be low-grade hardwood logs, very abundant in the region's forests. The feasibility study proposed that a complete production facility employing 15 workers and producing 5.5 million board feet of product annually could be launched for a total investment of about \$1 million.

The consultants favored the Scragg Mill option because, in addition to the lower initial investment, the production process required less skilled workers. Moreover, the relatively low value product, pallet cants, was not demanding in terms of quality standards and had a broad-based, stable and easy-to-penetrate market. The furniture squares option, by contrast, is a high value product requiring much greater worker skills, attention to more demanding quality standards, and more intense marketing competition. It also required, in the consultants opinion, much higher quality logs as source material.

The consultants did not disdain the high value bolt wood mill production option and, in fact, saw it as a good potential business opportunity. They actually recommend the development of that production capacity as a later stage in the project after the Scragg Mill / pallet cant production was well established.

Here we see a sharp contrast with the premises and concepts guiding our Chelsea Grant project. We have been concentrating first on creating a high-value product (hardwood dimension stock) and then finding markets for the lower value byproducts of the production process. The LandVest consultants opted for the reverse approach: first create a stable business around producing a relatively low value product and later expand by adding capacity to produce higher value products from the same source materials.

I did not become aware of the LandVest proposal until fairly late into our project. I believe it is a sound approach, at least for the situation they studied in upstate New York. It may also be a sound concept to apply here in the North Quabbin in place of the high value product focus we have followed without great success in terms of profiling a potentially profitable business.

ECONOMIC FEASIBILITY

Because we were not able to resolve the basic issue of what type of hardwood dimension business did we want to profile and assess, we are not able to present a complete economic feasibility analysis. However, we have studied several aspects of the hardwood dimension production process, and have some pertinent observations to make regarding economic feasibility. We are also awaiting the results of our Massachusetts Wood Recovery Demonstration project that will provide more concrete experience and information relative to economic feasibility.

We are unable and unwilling to assert or even hold a high probability for creating a profitable local business producing dimension hardwood pieces, parts and components from low-grade lumber and/or low-grade logs. My project team's opinions on this issue are mixed, with several holding a more optimistic view than I do. It is my opinion at this time that it is unlikely that a successful and profitable business can be established in the North Quabbin region that turns low-grade hardwood source materials into high-value hardwood dimension products.

I am not saying such production cannot be done. I believe our demonstration project will show conclusively that producing acceptable quality hardwood dimension stock from low-grade materials is technically feasible. I just don't believe it can be done profitably, at least not as a freestanding business venture. This has much more to do with the economics of relatively small-scale production of dimension materials from low-grade source materials than it does with any lack of market potential for such products.

The premises on which our search for a business opportunity in producing high value hardwood dimension products from low-grade lumber and logs has already been presented and can be summarized as follows:

1. There is an abundance of low-grade source materials – hardwood logs and lumber – in our North Quabbin Region.
2. While these source materials cannot create significant value as grade lumber, they do contain substantial amounts of clear, high quality wood between the defects that cause the low-grade rating. These pieces are too short and narrow to meet

- standards of grade lumber, but the wood quality is equivalent to that of higher-grade lumber.
3. These clear, high quality wood pieces can be extracted from the low-grade materials by a combination of rip saw and cross cut saw operations. There is a wide range of options in terms of scale, production equipment and technology, and cutting sequence (rip first, cross cut first, or a combination) by which this extraction can be accomplished.
 4. Most manufactured wood products (furniture, cabinets, stair parts, toys, etc.) are constructed from relatively small (48 inches or less in length, 4 inches or less in width, 2 inches or less in thickness) pieces of wood. Many parts and components are considerably smaller than these dimension ranges.
 5. Wood product manufacturers have an option of purchasing grade lumber and producing their own dimension pieces, parts and components, or they can purchase these items directly from outside suppliers (outsourcing).
 6. Wood product manufacturers are willing to pay a premium for dimension pieces, parts and components above that which they would pay for an equivalent amount (in board feet) of high-grade lumber because of cost savings and other perceived benefits.
 7. That premium is large enough to support profitable business operations as evidenced by the well established and growing wood components manufacturing industry.
 8. There are a large number of wood product manufacturers (both in number of firms and in total industry sales) operating in Massachusetts and the adjacent New England states.
 9. These New England wood product manufacturers provide a promising potential market for a local hardwood dimension product manufacturer.

We have studied and verified each one of these premises. We believe each one is valid and sound. However, they may not add up to a conclusion that the hardwood dimension product business we have been profiling is economically feasible. There are problems and challenges with production yield and efficiency, with product species and piece size limitations, with scale and capacity to reliably meet the needs of industrial customers, and with intense competition, especially from foreign sources, that affects pricing. Most of these problems and challenges can be linked to our decision to use low-grade, local logs and lumber as our raw material source.

Dimension pieces, parts and components, especially as used in the manufacture of exterior parts of furniture, must generally come from the outer portion, or sapwood, of the log. This is required for both the color and workability characteristics of the wood. The smaller and lower quality the log, the fewer cuttings are available from the log before the dark heartwood is hit. Furniture dimension stock also has tight quality specifications with respect to defects. Thus the manufacturing process becomes extremely labor intensive as boards are sawn and re-sawn to remove the defects. This labor intensity is amplified significantly as lower grades of boards are used as source material. While the market rewards the final product with higher prices, they oftentimes are not enough to overcome higher manufacturing costs.

In addition to requiring more intensive labor processing effort, low-grade lumber also has a second serious limitation as a source of dimension stock. While low-grade (No. 2 and No. 3 Common and pallet grade) lumber, still contains substantial amounts of clear wood, the size of the pieces consistently obtainable shrinks markedly as lower grades are used. For example, FAS hard maple could consistently produce dimension pieces of random width and 60' length with yields of about 55% of board feet of input. If, in addition, shorter pieces down to 12-inch lengths are also produced, the total yield of good dimension stock rises to almost 80%. By contrast, Number 3A Common can consistently produce pieces only up to about 28 inches long, with a yield of only 26%. Cutting additional shorter pieces down to 12 inches increases the overall yield to 42%. Cutting tables are available from the U.S. Department of Agriculture's Forest Service for most hardwood species. The tables are too complex and detailed for full reproduction here, but Table 5 gives a representative summary for cutting hard maple from various grades of lumber. Results vary by species and several other factors.

The companies producing hardwood dimension pieces, parts and components that we have knowledge of use a mix of higher-grade boards (FAS – the highest grade --, Selects, and No. 1 and No. 2 Common.) The selection of mix depends on the range of dimensions called for in the cutting order. We know of no dimension producer using only low-grade (No. 3A common and lower) to produce dimension stock. We were not even able to find cutting and yield tables for pallet grade lumber, the source material we are using in the Massachusetts Wood Recovery Demonstration Project. This is not to say it can't be done, but the lack of known successful examples is discouraging.

Lumber Grade	Maximum Length	Yield at Length	Range of Lengths	Expected Yield	Maximum Yield
FAS (Firsts and Seconds)	80 "	48%	12" to 80"	75%	78%
Selects	80"	45%	12" to 80"	71%	73%
Number 1 Common	72"	31%	12" to 72"	68%	70%
Number 2 Common	36"	37%	12" to 36"	58%	60%
Number 3A Common	28"	26%	12" to 28"	42%	45%

Table 5: Lengths and Yields of Dimension Pieces Obtainable from Various Grades Of Hard Maple. Source: Englerth and Schumann, "Charts for Calculating Dimension Yields from Hard Maple Lumber", Forest Products Laboratory, U.S. Dept. of Agriculture

The preponderance of shorter pieces and lower expected yields affect production costs in two ways. As the average length of the dimension piece drops, the more cuts per unit of input materials must be made. This decreases labor productivity and increases labor cost for a given amount of lumber processed. The higher number of defects in the lower grades further impacts on productivity. Again this varies by species and cutting methods employed. Table 6, based on cut-first, random ripping of 4/4 hard maple illustrates the labor cost economics involved.

Average Length	No. 2 Common	No. 1 Common	Select	FAS
18"	71	76	78	82
24"	78	86	88	96
30"	84	96	99	111
36"	89	102	105	119
42"	NA	108	111	126
48"	NA	112	116	130

Table 6: Rough Mill Productivity Standards

Board Feet Cut per Worker Hour
4/4 Hard Maple

Source: Nick Weidhaas, Forest and Wood Products Institute

Table 7, Rough Mill Labor Cost Comparisons, shows the dual impact of grade and average piece length on labor cost. These figures are based on Table 6 productivity figures and an assumed wage and benefit cost of just \$20 per hour. This wage/benefit scale is on the low end and below the level for the jobs we would hope to create. Whatever the wage/benefit hourly rate, the table shows that it is, for example, 32% more expensive to cut 30 inch pieces from No. 2 Common (\$238) than it is to cut the same 30 inch pieces from FAS (\$180). It is 47% more expensive to cut 18 inch pieces from No. 1 Common (\$262) than it is to cut 48 inch pieces from the same material (\$178).

Average Length	No. 2 Common	No. 1 Common	Select	FAS
18"	\$282	\$262	\$256	\$244
24"	\$256	\$232	\$228	\$208
30"	\$238	\$208	\$202	\$180
36"	\$224	\$196	\$190	\$168
42"	NA	\$186	\$180	\$158
48"	NA	\$178	\$172	\$154

Table 7: Rough Mill Labor Cost Comparisons

Labor cost per 1000 board feet *input*
4/4 Hard Maple

Even Table 7 fails to reveal the full labor cost disadvantage to cutting shorter average sized pieces from lower grade materials. Table 7 figures are cost per 1000 board feet of *input* material. A better indication is the cost per 1000 board feet of *output* product. To get that, one must also take in to account the lower yields (greater waste) generated from lower grade materials. Table 8 estimates these costs using yield figures from Table 5 and the labor cost figures from Table 7.

Average Length	No. 2 Common	No. 1 Common	Select	FAS
18"	\$486	\$385	\$361	\$325
24"	\$441	\$341	\$321	\$277
30"	\$410	\$306	\$285	\$240
36"	\$386	\$288	\$268	\$224
42"	NA	\$274	\$254	\$211
48"	NA	\$262	\$242	\$205

Table 8: Rough Mill Labor Cost Comparisons

Labor cost per 1000 board feet output

4/4 Hard Maple

In making choices of what grade of lumber to use, one must consider the cost of the lumber input as well as the labor cost. Naturally, the higher the grade of lumber, the higher is the cost. Grade lumber prices can fluctuate widely based on supply and demand and related economic factors, but the prices at any given time and location are generally widely known and readily available. Prices for dimension materials can be expected to follow movements in grade lumber prices, but not necessarily in exact proportions. The range of dimension products is vastly more diverse and complex than the range in grades of lumber, and we could find no source that provided reliable current estimates for dimension products.

It is primarily the high labor cost premium required to process lower grade lumber that has caused me to be skeptical of finding economic feasibility for a business producing dimension products from very low (pallet) grade materials. On the following page I have reproduced an Excel spreadsheet titled, "Dimension Wood from Lower Grade Lumber". It is a dimension cost calculator that allows the user to input variables including the cost of lumber, kiln drying cost, wage and benefit hourly rates, worker productivity rates, energy and variable shop overhead costs per hour, and yield rates from the lumber source material. The spreadsheet then calculates the resulting total Cost of Product (per MBF). It is important to point out that this is not a full cost calculation, but rather just the direct variable costs of materials and production. It does not include any amount for fixed factory overhead (including depreciation on plant and equipment), marketing, administrative or distribution costs. The cost figures also provide for no additional processing beyond the cutting of the rough dimension pieces. Any additional dressing, finishing or processing into edge-glued panels would involve additional cost.

Dimension Production Cost Calculations

The illustration on the following page is based on the Massachusetts Wood Recovery Demonstration Project described previously. We are purchasing pallet grade red oak and red maple at \$200 per thousand board feet (MBF), which is the current market price. Pallet wood is sold green, so it requires kiln drying before it can be processed into dimension stock, which generally must have moisture content below 10%. Kiln drying currently costs \$150 per MBF.

The spreadsheet postulates a small-scale dimension-processing mill outlined to me by Professor Nick Weidhaas, the former director of the Forest and Wood Products Institute, and a recognized expert in wood technology. It is a low-technology mill the first cross cuts material at entry to remove defects and then rips to desired or random widths. In addition to being equipped with standard cross cut and rip saw equipment, the plant also has the space and equipment to handle, store, and move raw material, in-process material and finished product. The mill could be expanded to provide further dressing and finishing of the rough dimension pieces and to produce glued-up panels. However, these additional operations are not included in the cost calculations shown in the worksheet.

The spreadsheet calculates yard-handling costs, inventory holding costs, direct production labor and benefit costs, and energy and other variable production costs in addition to the lumber purchase and kiln drying costs. I have set hourly wage rates at \$12 for yard workers and \$14 for production workers. These may be a bit higher than rates prevailing in the North Quabbin, but they represent the kind of “living wages” we hope any new economic development project would generate.

Labor productivity rates and the yield rate from the source material (pallet grade lumber) are derived from the tables described previously. There are no yield tables for Pallet grade lumber, so we had to “guestimate” a 35% yield, a bit lower than that expected for No. 3A Common.

With these assumptions and estimates, the “Dimension Cost Calculator” shows an estimated total cost of \$2,317 per MBF of rough dimension product. That makes the cost per board foot of the product \$2.32. Remember, this cost figure does not include any allocation for fixed production costs including depreciation of plant and equipment, for administrative, marketing or distribution costs.

Our marketing research to date has been unable to pinpoint an accurate potential price or price range for rough dimension lumber (RDL) or any of its more highly dressed and processed versions (dressed pieces, parts, components and panels.) Actually we found a very wide range of prices, ranging from a low of \$1.80 per board foot to a high of \$4.50 or even more. Pinning price down is elusive because of the very wide variety of dimensions, forms, quality specifications, and degree of additional processing possible. It would seem that one must get a price quote for a specific, clearly specified dimension item before an accurate price can be assured.

We hope to obtain improved price information from our demonstration project. Each participant in the project is receiving one or more dimension items produced to exact specifications provided by the “customer.” Although no actual price is being charged, the respondents have promised to provide us with the price they are currently paying their suppliers for the dimension product if they outsource it, or the price they would be willing to pay. One specific price figure already received for an order of 1x1x24 red oak turning squares works out to \$3.00 per board foot.

We do not expect the demonstration project to match or validate our estimated cost figures. The work is being contracted out to three different contractors (all woodworking

shops in the region). No single shop had all the equipment or processing capability to handle the full range of products ordered. We are virtually certain that the costs we pay to the contractors for the dimension pieces produced will greatly exceed the product market values and the cost estimates we have made. No one would propose designing a business to produce dimension products in this way.

We do expect to gain valuable information on yields and labor productivity for the pallet grade source materials we are using. We also hope to learn whether such materials can produce dimension products that meet user specifications and quality standards and expectations. As mentioned above, the demonstration project will also give us direct customer feedback on price, which will be valuable information.

DIMENSION WOOD FROM LOWER GRADE LUMBER

PRODUCT COST CALCULATIONS FOR PRODUCING DIMENSION PIECES (4/4 HARDWOOD) READY FOR GLUING TO PANELS OR FURTHER PROCESSING

Purchase Cost/mbf	\$ 200.00	Delivered cost of low-grade lumber. (Pallet grade) Cost varies directly with grade, also by species.
Kiln drying cost/mbf	\$ 150.00	Commercial drying cost to 6% to 8% moisture content. Dry lumber before cutting
Yard Handling cost		Receiving, stacking and moving lumber to intake cutup station.
Wage Rate	\$ 12.00	Decent, competitive wage rate for yard workers.
Taxes, benefits,	90%	Covers payroll taxes, workers comp, and fringe benefits.
No. Yard workers	1	
MBF handled/day	10	This is amount of wood at input cut per day.
Yard Cost/MBF	\$ 18.24	=Wage rate + taxes and benefits per day / Ave. MBF handled per day
Inventory Holding Cost		This represents cost of money tied up in materials inventory.
Interest Rate	10%	
Average Days Inventory	20	The smaller the inventory, the lower the holding coat.
Holding Cost/MBF	\$ 1.94	=Int. Rate x (Purchase cost +Drying Cost) x (days in inventory)/360
Direct Labor + Taxes and Benefits		
Wage Rate	\$ 14.00	Decent, competitive wage for rough mill workers
Taxes, benefits,	100%	Covers payroll taxes, workers comp, and fringe benefits.
Cut Rate: Board Feet per Hour	77	Varies inversely with Ave. length of cut and directly with grade of wood.
Direct Labor + taxes & Benefits/MBF	\$ 545.45	=Wage rate + taxes and benefits per hour x 1000/Cut rate in BF per hour
Energy and other Variable Costs		
Energy cost/hour	\$ 2.00	Energy (electricity) cost per hour for operating equipment.
Other Variable overhead per hour	\$ 1.50	Other variable shop expenses per operating hour
Total Energy and Variable Overhead	\$ 3.50	Total
Cut Rate: Board Feet per Hour	77	From Chart, see above.
Energy and Other variable Cost/Hr	\$ 45.45	
Total Cost per MBF IN	\$ 811.09	
Yield (MBF Product/MBF Input)	35%	Varies directly with grade of wood and inversely with ave. length of pieces cut.
Cost of Product (per MBF)	\$ 2,317.41	= Total cost MBF In / Yield

So the verdict is still out on whether we can design a business that can profitably produce dimension lumber products from local low-grade lumber and logs. But I must admit, based on my cost calculations, I am skeptical and doubtful that it can be done

My current skepticism is fueled by some other concerns related to our choice of source materials. One is the limitation in species variety. Using local trees limits the venture to primarily red oak and red maple, since these are the only “abundant” hardwood species in our region. While there are lesser amounts of other valuable hardwoods, including white ash, hard maple and black cherry that grow in our region, it would be difficult to assure a reliable and steady supply of lumber or logs that would meet the needs of industrial customers. This lack of species variety significantly reduces the size of the potential market.

The exclusive use of low-grade source materials (No. 3 Common and below) limit the length of the dimension pieces that can be produced to about 30 inches and less. Even in the demonstration project, we had to eliminate several orders because length, width and thickness limitations. This size constraint also reduces the size of the potential market.

We could remove the limitations listed above by expanding the range of source materials to include higher-grade lumber and lumber species purchased from outside our region. This would make for a business that looks more like “traditional” hardwood dimension producers such as those listed in the Wood Component Manufacturers Association Directory. (There are very few member firms currently operating in New England). But with this shift, the project no longer addresses the fundamental concerns of the granting agencies supporting the study. Chelsea Center is concerned with recycling and converting waste and low value materials into high value products. The grants supporting the Massachusetts Wood Recovery project are also directed at finding profitable uses for lower-grade materials from Massachusetts forests and sawmills.

CONCLUSIONS AND RECOMMENDATIONS

The first and most obvious conclusion is that we have not been able to deliver a comprehensive business plan for a forest products wood recycling business venture as we had proposed to do in the grant application. The project should not be judged a failure, however, for at least two reasons. One is that a project contractor or sponsor who sets out to determine whether or not an economically feasible business can be created must be prepared to accept an answer that “it can’t.” At this point, we lean toward that conclusion. At least we cannot profile an economically feasible business within the time frame of this project.

A second reason is that the efforts undertaken in this project and the knowledge gained are continuing. The FWPI’s Massachusetts Wood Recovery Project, already described above, is well funded, and it is committed to complete the demonstration project already under way.

The MNRC is also still actively looking for a profitable way to deal with low-grade lumber, logs and sawmill wood residues. They have found renewed hope for support from Jay Healy, head of the Massachusetts Department of Agriculture, who will begin in July to entertain grant applications for “improving markets for Massachusetts Forest Products.” The MNRC, under the

leadership of Tim Robinson and Scott Lake, is planning to develop an application to develop further the idea of a wood-powered, wood-based industrial park. It is a good idea that doesn't want to die. What we have learned from the work done for this grant can contribute to these renewed efforts.

With the benefit of hindsight, I believe we made a mistake when we committed to finding a "high value-added product" to "drive the economic engine" of the proposed business venture. I also believe it was an error to de-emphasize or exclude wood-as-fuel in the search for a profitable solution to low-grade and waste wood in Massachusetts. I understand the restriction on wood-as-fuel represented a contractual constraint in the Chelsea Center's funding sources rather than a negative judgment by its project managers.

Low-grade logs and lumber, by their very nature, represent a huge volume of material, most of which cannot be made into high value products. Any system that does attempt to make high value product from these low-grade source materials will have a very large waste disposal problem.

It makes more sense to me to deal with the huge volume first. That is, create a business around capturing the *low value products* that constitute the bulk of the materials first. Once that is established, then look for ways to add value by triaging the source material flow to sort out those components that can be profitably processed further into higher value products. Some form of the dimension stock production that we investigated in this project could well be one of the ways to capture higher value from the source material flow. But this would be a stage 2 (or 3 or 4) development and not the starting point. This is essentially what was proposed in the LandVest Feasibility Study reported on in this report. I now believe it is a more sound approach.

This also points us back to the "wood-based industrial park" idea that we explored early in our project and then abandoned when the "anchor tenant" located out of our region. It also points to wood-as-fuel, the only feasible product I can see that can absorb the bulk of the low grade materials flowing from our forests, sawmills and wood manufacturing plants. You can also include municipal cuttings, and perhaps even construction and demolition wood wastes. Wood makes an environmentally superior and, increasingly, an economically viable alternate source of heat and energy. Especially here in New England!

So I believe that a business that successfully and profitably deals with the huge flow of low-grade and waste wood materials must produce, use and sell wood-as-fuel products. On-site use of wood-as-fuel creates value from the source materials as a cost-competitive alternative source of energy and heat. That value will grow to the extent that the adjoining industrial park demands and uses increasing amounts of heat and energy. Primary and secondary forest product businesses are energy and heat intensive users. Primary sawmills require energy to run equipment and heat to kiln dry the lumber and dimension materials. Wood product manufacturers are also energy users. And both primary and secondary manufactures feed waste wood materials back in to the flow of source materials. But local consumption of wood-as-fuel will not be sufficient to utilize all the low-grade, non-recoverable material. I believe a commercial and/or industrial wood-as-fuel product must be produced on location and marketed at least regionally for the overall project to work.

I also believe that we should revisit the idea of cutting dimension stock directly from logs, bypassing the step of extracting grade lumber. The *only* successful dimension operation we saw in this region was Hull Forest Products, and that is essentially what they are doing. The wood technology literature continues to generate research-based articles detailing and extolling variations of “System 6,” the direct production of dimension pieces from small, short, and low-grade hardwood logs. It remains a mystery to me why so much research has produced so few practical applications.

What Have We Learned and Where Do We Go From Here?

I have already answered most of this question in the discussion under conclusions and recommendations. I have but a few comments to add here.

I have learned to be more careful and perhaps more conservative in making promises and commitments that are too ambitious to deliver. Perhaps with more effort and fewer errors on my part, I could have delivered a business plan as promised. Perhaps not.

I believe one of the most serious shortcomings in this quest to find a business idea and create a viable business plan has been the lack of an entrepreneur. The project had plenty of supporters, excellent expert advice and experience, good business contacts and ample financial support for the study. But there has never been, throughout the course of the project, a clear and decisive entrepreneurial perspective and voice to motivate and direct the project. We operated on a premise that if we could profile a business opportunity, the entrepreneurial force would emerge to seize it. That still sounds reasonable, but it just did not work that way.

The limitation could be mine. I have helped to create many business plans over the course of my career. I have taught several business planning seminars. I know what business plans look like, what they need to contain, and how they fit in to starting and operating a successful business. But I have always worked with an entrepreneur who has provided the vision and drive to create the business. I can take an entrepreneur’s ideas and choices and fashion them into a set of financial projections and narrative discussion that make up a business plan. But I have found through the course of this project that I am not an entrepreneur, and I have a very hard time making the *entrepreneurial* decisions needed for developing a business plan. In this project I was overwhelmed with the choices and options before me. Even after we selected our product focus (which may have been a *poor* entrepreneurial decision), there were seemingly endless options and decisions: options on scale, options on source materials (logs, lumber, or both), options on level of technology (traditional or computer-optimized and automated), options on degree of processing capacity (rough dimension only, dressed parts, finished components, glued-up panels), options on equipment manufacturers. This is only a partial list. I was unable to develop a business plan because I was unable to specify the business enough to bring a plan into focus. I was not able to make key entrepreneurial decisions. And none of my project partners or associates were able (or perhaps willing) to do that either.

In the early stages of the project, I was looking to the MNRC to provide the entrepreneurial perspective. They were already a legal business entity that had it within their mission and corporate charter to create and run a forest products business. There was within the membership plenty of expertise in all aspects of the forest products industry. They wanted to create a profitable business that would pay off the debts from their first business attempt and provide significant income and benefits for the members. But as reasonable as all of this may sound, cooperative organizations are not entrepreneurs, even if they may provide a suitable organizational framework for operating a successful business. The expertise and experience of the active members was needed mostly to keep their own businesses alive and thriving. MNRC could not be their top priority.

I was disappointed, frustrated and perplexed when MNRC did not provide the entrepreneurial direction I was hoping for. I can now see that was an unrealistic expectation. I think the MNRC members may have experienced their own sense of disappointment and frustration. I presented myself as someone who could develop and write a business plan for them. I was even getting paid to do so by my Chelsea Grant. They offered help and suggestions when they could. They really wanted a business that would produce income and benefits for the members. I did not deliver the plan.

I am not sure of the answer here or even if there is one. I am convinced the entrepreneur is the scarce and critical element in creating a successful business. Even if a business plan could be created without an entrepreneur, it could not be started or run successfully without one. For me, personally, I prefer to work with an entrepreneur in developing a business plan, and doubt my ability to fashion a good plan without one.