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A Study of the Economics of Utilizing Saskatchewan Hardwoods

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Norplan Consulting
Bell & Associates

EXECUTIVE SUMMARY

Many of the 70 independent sawmill operators in Saskatchewan's eastern forest zone are facing difficult times. There is intense competition for the remaining softwood saw timber in the accessible portion of the commercial forest from highly capitalized crown and multi-national corporations. This competition, combined with the problems of harvesting a diminishing resource, results in higher operating costs. The difficulty of obtaining an adequate allocation of accessible softwoods is resulting in some production facilities standing idle.

This study examines the feasibility of re-deploying a portion of the independently owned production facilities to tap the largely un-used hardwood resource for processing into factory-grade lumber and other wood products. Four primary factors are investigated. 1) The capability of the birch/elm/ash of the north eastern forest block in terms of both its quantity and quality is assessed. This involved a review of existing data, discussions with independent operators familiar with the area, as well as a two-day "reconnaissance" cruise in the Kelsey Trail region east of Carrot River. 2) The technical feasibility of converting a softwood mill to hardwood processing was determined through discussions with government and private sector representatives involved in the hardwood processing industry as well as with independent mill operators in eastern Saskatchewan. 3) The market potential is assessed, based upon a review of literature as well as a follow-up telephone survey of large volume buyers. 4) The potential profitability of a representative, converted mill is estimated, based upon a product mix of #1 common and better hardwood lumber, rail ties and firewood.

The review of existing data supported by limited field work indicates that two hardwood processing mills could be supported in the 1100 sq. km. area investigated. Although the area was selected because it contains some of the best birch stands in the province, the study team is confident that at least one more mill could be supported in the Carrot River region from the birch/elm/ash resource outside of the study area.

There are no major obstacles to converting a sawmill that is in good condition from softwood processing to hardwood. Costs in the order of $10-12,000.00 can be expected. Significantly higher investments ($30-50,000.00) to enhance grade recovery may be cost effective but that was not determined in this study.

Previous market surveys as well as the follow-up telephone survey conducted as part of this study indicate that the market would absorb the hardwood products proposed for the mills. Emphasis will have to be placed on getting a good return on the residual portion of the resource after the #1 common and better lumber is extracted. At this time rail ties and firewood represent the best option since their production requires minimal extra investment, yet generates a reasonable return.

The economic analysis of a mill conversion suggests that if the assumed conversion factor (2.25 cords/thousand board feet of product) and the recovery factor (43% of product is #1 common and better lumber) are achieved, the mill could expect a before tax profit of $48.00/M for its combined product. If the #1 common and better lumber were kiln dried the profit margin would rise to $103.00/M. Finally if the elm/ash resource were processed in the same ratio it was encountered in the logging operation, the before tax profit would be $142.00/M.

Based upon the above findings the study recommends that a mill in Carrot River region be converted to hardwood processing as a demonstration and technology transfer project.

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I. BACKGROUND

Independent sawmill operators in Saskatchewan's eastern forest zone (the Hudson Bay Block), are experiencing difficult times. Much of the softwood saw timber from the accessible portion of the commercial forest zone has been depleted, and competition for the balance from the highly capitalized Crown Corporation and/or large multi-national Corporations, is intense.

A total of 15,000 m^3 net green softwood saw logs have been held out of the Forest Management Lease Agreements (FMLA's)(1) with the three major wood processing plants in the area, to be allocated among 70 small sawmill owner/operators.(2) Additional small volumes available from salvage operations, have been sustaining many of these mills at a very low annual volume for the past decade. Some softwood is also available to the small operators from the northern forest reserves, but log cost or sawmill relocation cost cannot be justified at current softwood lumber prices. Lack of tenure over softwood in the northern reserves is also inhibiting utilization by the small independent wood products processors.

Deteriorating circumstances surrounding small softwood lumber production facilities is not a recent phenomen in this region or in much of Canada's commercial forest. The trend has been evident over the past 20 years as more of the remaining economically viable resource is allocated to large forest product companies.

One result has been that the harvesting and processing equipment purchased by the 70 small operators in the period following the war, and up to the early 1960's, valued at between $3.5 and $5 million, has not been significantly upgraded. Further for the most part, this equipment is currently under-utilized.

While there is not much relief on the horizon for sawmill operators who depend entirely on the manufacture of softwood lumber, those operators in the north-eastern quadrant of the Hudson Bay Block are relatively close to a largely untapped hardwood resource that may be suitable for processing into factory grade lumber and other specialty

(1) Paul Brett - Personal Communication
(2) A Director of Primary Wood - Using Industry in Saskatchewan, 1980

wood products. If the hardwood resource (notably birch, elm and ash) is of appropriate quality, and a number of other inhibiting factors can be overcome, this under utilized resource may provide the basis for converting some portion of the existing inventory of processing equipment to factory grade lumber production.

The purpose of this study is to evaluate the economic viability of a small sawmill should it undertake such a conversion. The scope of the study has not allowed for a detailed analysis of the resource base. Of necessity, we have relied on limited data on the hardwood inventory available from Department of Parks and Renewable Resources (D.P.R.R.), from small "grade recovery" testing programs carried out in the past, and upon the experience of the few operators in the province who have had sufficient familiarity with hardwoods to be able to provide broad, general assessments of both quantity and quality.

For estimates of grade recovery applied to the "viability" phase of this report, we have used ratios developed by Forintek (1982) for the Canadian Forestry Services (C.F.S.) for Eastern Yellow Birch (for Saskatchewan White Birch) and Eastern Hard Maple (for Saskatchewan elm and ash) (Petro and Calvert, 1976). There is virtually no experience in Saskatchewan in factory grade lumber recovery on anything but a "small sample" test scale.

It was acknowledged at the outset that the limited knowledge available on both the quality and the quantity of the standing hardwood inventory indicated that this would probably be an inadequate supply to support large scale exploitation. It was also known however, that there have been several limited (in size) attempts to convert the indigenous birch to construction grade lumber, and that that experience has indicated a satisfactory volume and quality to sustain several small operations. The objective of the study was to investigate the potential for converting the inventory to higher value products (primarily factory grade lumber) to ascertain whether hardwood conversion represented a viable alternative for small operators.

The study will identify the major assumptions that have been necessitated by gaps in the data base. Public agencies concerned for the development of a diversified wood products industry may wish to undertake additional studies to more precisely define some of the significant variables effecting processing profitability.

It is hoped that the information contained herein will be made available to small sawmill owners in the area, and that it will stimulate the investment of time, energy and money to validate the findings. The study team believes however, that very few, if any small operators are in a position to realize the maximum potential of this conversion opportunity without some assistance from agencies with a mandate to stimulate forest industry development. Assistance in the form of technology transfer is most important. This could best be accomplished through a demonstration project, which would also have the advantage of enabling a more precise evaluation of variables effecting profitability.

II. THE FEASIBILITY OF THE CONCEPT - A LITERATURE REVIEW

With the realization that our traditional forest resources are being depleted, there has been a growing interest in maximizing the return from the remaining forest, and in evaluating the conversion potential of species which had been ignored in our rush to exploit our abundant softwood resource.

Hardwood utilization and specialty wood products processing in Canada has been concentrated in the Maritimes, Quebec and Ontario. Species considered suitable for conversion to specialty products, with the possible exception of trembling aspen, were generally considered to occur in insufficient quantities in the west to support large scale conversion facilities. Softwoods, on the other hand, were relatively plentiful. Consequently, virtually all of the research and development effort, and subsequent capital investment, have been directed toward softwood-based conversion processes.

2.1 THE MARKET POTENTIAL

As the western Canadian softwood resource approaches its limits for exploitation, there has been some consideration by government planning agencies of the potential of utilizing hardwoods. Most of this research has examined the potential of trembling aspen, the most abundant species. While much of what has been learned in these studies would apply equally well to the more exotic (and less plentiful) indigenous hardwoods, we were unable to find in our search of the literature any studies which provided a comprehensive analysis of the potential for converting western elm, ash, birch or maple.

Some of the observations from two studies commissioned by the Government of Alberta are relevant to any assessment of the feasibility of utilizing Saskatchewan hardwoods. Carroll-Hatch Ltd. (1983) conducted an extensive assessment of the market potential for poplar products. Woodbridge, Reed and Assoc. (1985) updated the market assessment and attempted to identify the best conversion options for Alberta aspen. Both studies identify a good existing, and potentially growing market for "specialty" lumber. Both suggest that sawing hardwoods for construction lumber is inappropriate since production costs are higher, and market value is lower than for traditional SPF product.

Both studies also identify the need to identify a market for the residual fibre after the high grade lumber has been salvaged from saw logs. The preferred option for aspen is a pulp process, a medium density fibreboard process or a thin particle board process, in combination with a lumber mill which is aimed at high quality lumber recovery.

Carroll-Hatch notes that a Western Canadian specialty wood products processing facility would enjoy a competitive advantage in growing markets in the mid-western U.S., California, Western Canada and the Far East due to our proximity and lower freight costs.

In general, both studies support the contention that there is a good, and growing market potential for Western Canadian hardwoods. Both identify the need to find some economic use for the residual material and recommend some form of integration of the various processing options. Both studies recognize that Western processors preoccupation with softwood and traditional wood products will require that some stimulation from government be provided before the industry is likely to take advantage of the "specialty products" opportunity. In their report titled "UTILIZATION OF HARDWOODS IN NORTHERN ALBERTA", Woodbridge, Reed and Associates say, "Government assistance (possibly from the FRDA) should be made available over the first 4 or 5 years of specialty product production."

A market survey of Western Canadian Wood Products Manufacturers conducted by Bell, Ahenakew and Associates (1983) for the Saskatchewan government, was also reviewed. A wide range of respondents, including furniture manufacturers, cabinet makers, millwork shops and specialty lumber wholesalers and retailers supplied information on volumes, grades, sources and prices. Extrapolating from this data, the study attempted to estimate the size of the western Canadian market for factory grade lumber, and to identify an average price that end-user manufacturers were paying.

In summary, the market survey revealed that a very small proportion of the specialty lumber consumed in Western Canada, is produced here. Most comes from Eastern Canada and the Eastern U.S.

Very conservative estimates of the volume of "factory grade" lumber used for furniture, cabinets, mouldings, turnings, panels, etc. in Western Canada are given in Table 2.1.

TABLE 2.1

Volumes of factory grade lumber used in Western Canada

Pine - Clear	7 MMbf
Pine - Sound Knots	33 MMbf
Birch - #1 Common and Better	5.5 MMbf
Birch - Below #1 Common	2.0 MMbf
Elm/Ash - All grades	6.0 MMbf

Manufacturers indicated an additional 4 to 6 MMbf of elm, ash and birch would be used if it were available. An insufficient supply at competitive prices was a common complaint.

The study also noted that additional markets exist for pre-manufactured components, for example panel board and furniture components. Further it identified the fact that the market will pay a premium for material that is produced to tight quality specifications, but is generally not interested in material of inferior quality.

2.2 PRODUCT VALUE

Prices paid for factory grade hardwood lumber in 1982-83 are shown in Table 2.2.

TABLE 2.2

Average prices paid by respondents for factory grade hardwood lumber in 1982/83.

Pine - Clear	$1182/M
Birch - #1 Common and Better	$1095/M
Elm/Ash - #1 Common and Better	$1420/M

The study attributes these high average prices to the fact that most of the respondents were purchasing small quantities of top grade material from hardwood lumber brokers. Prices are F.O.B. the major lumber distributor's yard. Freight costs make up $250 to $350/M of the product price(3), since most is transported from Eastern Canada or the Eastern U.S.

Sharp differences in price were also noted, depending upon the degree of processing. Examples are shown in Table 2.3.

(3) Rick Dawson - Personal Communication

TABLE 2.3

Variations in the average prices of birch lumber.

	1983	1986
a) sawn to construction grade, ungraded, green, rough, random lengths	$250/M	300/M
b) sawn to factory grade, ungraded but all "seconds" culled, green, rough, random length and width	$450/M	540/M
c) sawn to factory grade, kiln dried to about 12% M.C., rough, random widths (in 1/4 inch increments), random lengths (in 1 foot increments) #1 Common and better	$700/M	840/M
d) factory grade, kiln dried, rough, random (as above), selects and better	$1250/M	1500/M
e) F.A.S. grade as in (d) above but S2S or S4S	$1800/M	2200/M

A follow up telephone survey of large-volume buyers identified in the 1983 market report was conducted as part of this study. The survey found that prices have increased by about 20% since the 1982-83 study. This increase is attributed to the exchange rate and the fact that the American market sets the Canadian price. (See Appendix #1)

Respondents indicated that there is no evident trend in demand. Demand for each species varies year by year. However there is currently good demand for birch, elm and ash.(4)

Both the 1982/83 market survey and our 1986 follow-up survey identified a wide range in the retail price of the top grades of hardwood lumber. For example Reynaldo's Supply at Arlee (30 miles N.W. of Saskatoon) is selling #1 Common and Better elm/ash for $1300/M, while Elswood in Saskatoon is selling the same product, in small quantities at $3200/M. Both are serving essentially the same market. No explanation for this kind of price difference could be identified beyond the fact that the cost of raw material in the manufacture of solid wood products represents a relatively small component of manufacturing costs. (Island Lake Wood Products at Davis, Saskatchewan manufactures bathroom accessories from oak. Based on the retail (Prince Albert) price of their finished product, the company converts oak obtainable for approximately $3000/M to a value of approximately $36,000/M. This may be an extreme example, but it illustrates the relative significance of the cost of raw material.)

Subsequent price information obtained from Forintek Canada Corp. indicated the following prices for Birch, F.O.B. the mill yard in the U.S., in Canadian dollars.

(4) Rick Dawson - Personal Communication

TABLE 2.4

Prices for birch lumber, F.O.B. the mill yard, in northeastern U.S., in Canadian dollars.(5)

Yellow Birch

Green - #1 Common & Better, random, grade stamped	$495/M
Selects and better	$635/M
Kiln dried - #1 Common & Better	$620/M
Kiln dried - Selects and Better	$785/M

When freight costs to Saskatoon ($350/M) are added, these prices equate approximately to what a producer in Western Canada may be able to get for his rough, green, 1 Common and Better factory grade lumber. For reasons that are unclear to the study team, western brokers are prepared to pay a slight premium, beyond freight, for kiln dried material.

The main purpose of our literature review and our brief follow-up market survey, was to identify the price that a sawmill operator could expect to realize for his product, for feasibility analysis purposes. We also hoped to determine how difficult it would be for a Saskatchewan producer to break in to the market.

Brokers have told us that there is a demand for good quality Elm/Ash and birch which is kiln dried.(6) Our comparison of eastern millgate prices and western brokers prices lead to a high degree of confidence that a western producer could expect a millgate price of at least $540/M for rough, green, "culled" birch lumber and $840/M for kiln dried birch, #1 common and better.

(5) Bill Love, Personal Communication
(6) Elswood - Reynaldo's

2.3 THE RESOURCE

A critical factor in determining economic viability is the ability of the raw resource to support and sustain a processing facility. Budget and time constraints established for this study did not permit a definitive analysis of the quantity or the quality of the standing inventory. To assess the capabilities of the resource, the study team:

a) consulted staff of the inventory section of Forestry Division - D.P.R.R.

b) reviewed the existing literature compiled since 1970.

c) consulted loggers and sawmill operators who have had experience converting the local resource to construction grade lumber.

d) engaged the services of a professional forester who conducted a brief reconnaissance of the study area.

These activities identified some differences of opinion on the quality of the standing inventory, but a general consensus that there are large stands of forest in which birch is the primary or secondary species, on the north slope of the Pasqua Hills, and smaller areas where merchantable volumes of elm, mixed with some ash, occur along the Carrot River drainage system.

2.3.1 CONSULTATION WITH DPRR (7)

Quantifying the resource proved elusive. DPRR inventory people have not considered elm, ash and birch to be commercial species and have therefore not maintained detailed inventory data on these species. Inventory map information indicates large stands of birch, but Forestry Division staff express concern that much of the resource is mature and over-mature, and may therefore be subject to a significant cull factor. In the case of elm and ash, the volumes in the Hudson Bay Block which show up on the inventory data, are relatively low (140,000 m^3) and would

(7) Jamie Bensen, Bob Reed - Personal Communication

not sustain a large operation (3 million to 5 million board feet annual production) for any appreciable period of time.

2.3.2 LITERATURE REVIEW

2.3.2.1 Report on White Birch Cruise Conducted on the Pasqua Hills - August 1972 - V.C. Begrande.

This report was prepared following extensive ground cruise work over 15 townships along the lower Carrot River drainage system. It identified large volumes of merchantable white birch (334,446,776 bd.ft). Loggers familiar with the area, and the author himself, suggest however, that the cull factor applied in calculating merchantable volumes (27% from gross volumes) may not be large enough.

Subsequent personal communication with staff of CFS familiar with birch inventories in Ontario(8), suggests that the 27% cull factor is the standard applied to accommodate lost volume in stumps, branches, coppice growth and crooks, and would not generally accommodate lost volumes from "die back" and rot which occurs in over mature stands.

It is suggested that the cull factor applied to gross volumes should perhaps be in the 60% range in recognition of the over-mature nature of the inventory. Using Begrand's gross volumes and applying a 60% cull factor would leave gross merchantable volumes of approximately 255 MMbf in the 15 townships surveyed, or an AAC of 3.6 MMbf (based on a 70 year rotation).

(8) Tom Johnson - Personal Communication

TABLE 3.2

Lumber recovered and graded from sample logs at Red Earth, Saskatchewan.

Birch	#1 Common and Better	31%
	Less than #1 Common	69%
Elm	#1 Common and Better	39%
	Less than #1 Common	61%
Ash	#1 Common and Better	32%
	Less than #1 Common	68%

In his comments, the report's author made the following observations about the species under consideration:

> "The white birch was too crooked and therefore the grade recovery was low. Considering the low quality of the sample provided, it is questionable whether it represented the true quality of the species throughout Saskatchewan. This species should be evaluated critically as to holds considerable promise for high value utilization."

> "In general, the ash and elm provided was too small and too crooked to produce much upper grade lumber. Some butt logs of both species 12"-14" in diameter had excellent grade recovery but these were not separated from the small samples involved."

This is the only data available from the literature on the volumes of furniture grade lumber that might be extracted from the local resource. The author contends that, had more experienced hardwood loggers been involved in felling and bucking the sample with which he was provided, grade recovery ratios would have been better. This lack of experience is likely to be an impediment to high grade recoveries in any new milling operation that is established, and indicates a necessity for some "technology transfer".

Based upon Petro's report and subsequent personal communications, and upon the experience of sawyers in converting the local resource to construction grade lumber, we have assumed that the ratio of #1 Common and Better lumber recovery from the local resource will not get much worse. This recovery ratio is therefore used as our "worst case" in the analysis which follows. This assumption can only be validated through actual field testing.

III. FACTORS INHIBITING DEVELOPMENT OF A HARDWOOD BASED INDUSTRY IN NORTHEASTERN SASKATCHEWAN

3.1 GENERAL

Throughout its 100 year history, the Saskatchewan forestry industry has been pre-occupied with and committed to softwoods. Softwoods have been relatively abundant and well suited to construction lumber production. It has only been within the past two decades that it became evident that the demand for softwood fibre was soon going to exceed supply.

There have been several sporadic efforts to utilize the birch, elm and ash from the study area. Until about ten years ago when a road network was developed primarily to access the good quality spruce stands in the area, and to service an electrical transmission line, the best hardwood stands were difficult and expensive to reach.

Recent efforts have involved harvesting the most accessible stands of birch to fill contracts with furniture manufacturers in Winnipeg. In general, they contract for rough, green lumber, sawn to construction grade specifications in two inch increments, with "down-graded" material culled out. After transport to Winnipeg the material is resawn, kiln dried, and used for furniture components. The Saskatchewan logger/sawyer receives between $250/M and $350/M. Contracting opportunities have been inconsistent and sporadic. The buyer has frequently changed his source of supply (Minnisota, Northern Ontario, Manitoba, Saskatchewan) depending upon competitive pricing.

This low value conversion has certainly discouraged a number of local contractors, and caused them to consider ways in which they could improve their profitability by further local processing. However a wide range of inhibiting factors have prevented small operators from pursuing this option on anything but a very small, experimental basis.

3.2 SKILLS

It is acknowledged that the skills involved in processing high value hardwood lumber and specialty wood products are significantly different from those applied in "high throughput" softwood lumber operations. Different skills are required at each step in the process, from felling and bucking for high grade recovery, to sawing, grading and handling the lumber product.

Only two or three sawmill operators in the area have received basic instructions (from Forintek), and have some limited experience. However, since necessity spurs initiative, there are others who are willing to learn.

Since it would appear from inventory data that merchantable volumes of hardwood will limit the size and number of processors who might take advantage of this conversion opportunity, it is unlikely that cash flows will permit extensive training programs. The regional economic development potential of the conversion however, may justify public participation in a process of technology transfer.

3.3 EQUIPMENT

Our study noted a significant increase in the value of factory grade lumber when it is kiln dried to buyers' specifications rather than green. There are presently no dry-kiln facilities designed for processing hardwood lumber in the province. Sawmill operators are therefore required to hold their production, stickered and under cover for 8 months to one year while it is air drying and stabilizing. Carrying an inventory for this period of time has serious implications for cash flow and inhibits the small operator from getting into hardwood lumber production.

It is anticipated however, that a "solar powered" dry kiln will be available for use by small operators on a "fee for service basis" within the next year. It's location in the general area of the best hardwood resource should alleviate this particular inhibiting factor.

Existing logging and sawmilling equipment is generally not inhibiting conversion from softwood to hardwood processing. While some additional hardware would facilitate improved recovery of high value product, it could be added as circumstances permit. At least two existing sawmills in the vicinity of the resource are capable of producing hardwood lumber with some relatively minor modification and at reduced (from softwood production) processing speeds (to approx. 8000 b.f./shift).

3.4 UTILIZATION OF RESIDUALS

Weight, density, the need for selective harvesting, and a range of other considerations cause hardwood log costs to be greater than softwood log costs by a factor of 1.5 to 2.0. While the value of the high grade material from these logs is generally sufficient to cover increased processing costs, the profitability equation in utilizing an over-mature resource base may be critically effected by finding a market for the residual material. This concern has inhibited development of the resource.

There are however, a number of options to be pursued. Some of the more promising ones have been used in the analysis which follows in Section IV of this report.

Eastern Canadian mills utilize their whole log.(11) Bark, sawdust, chips and shavings, and other residuals are used for hog fuel, sweeping compounds, wood flour, "natural smoke", extracts, char, and a number of other products. Saskatchewan processors would be precluded from most of these options due to our distance from any significant market. Our much lower log costs may compensate for the absence of these options. (See Section 4.2.2)

We have conducted a preliminary investigation of other possibilities:

3.4.1 Chips for a pulping process.

While we have not eliminated this as a possibility for future consideration when more is known about potential volumes and consistency of

(11) Bill Love - Personal Communication

supply, it would appear from our discussions that this is not a practical solution at this time.

Our communication with staff at PAPCo(12) indicate that it would be quite possible, and possibly desirable, to incorporate birch fibre into the paper process at the Prince Albert Mill. However, that would require separate storage and a capability to meter birch fibre into the mix at a consistent level. At a mixture of less than 2% of the bulk input it would have no effect on the value of the paper.

At amounts greater than that, there would have to be a guaranteed, constant supply, and capital investment to ensure that a uniform blend was maintained at a tolerance of less than 1%. Chips or roundwood would have to be absolutely bark-free. Stain or rot would also cause problems. Heartwood and tops, (the portions which would most commonly remain after lumber salvage), do not make good fibre since they lack strength.

PAPCo is currently paying approximately $20/odt for softwood chips. Our initial assessment is that, even if a slight premium was added for hardwood chips, the processing and transport costs would make this option non-viable.

3.4.2 Wafer Board Component

Discussion with staff at MacMillan-Bloedel(13) at Hudson Bay indicated that there would be no local market for residual materials for this purpose. Birch has been used in plants in Ontario, but problems have been experienced. It is difficult to debark, and must be absolutely bark-free. They would only consider roundwood to a minimum of 6" d.i.b. Differences in moisture content, density, etc. pose serious problems in processing. Heartwood would be no good at all.

(12) Smith, Ashim, Hyde - Personal Communication
(13) John Didula - Personal Communication

3.4.3 Hardwood Char

Chlorox Incorporated has a charcoal processing plant at Moose Jaw. Chlorox is a subsidiary of Kingsford Ltd., the largest North American processor of charcoal products.(14)

This company has expressed interest previously in obtaining hardwood char from the Carrot River region for use in manufacturing briquettes.

Lignite char is currently the major component in the process used at Moose Jaw. The hardwood char component is being brought in from plants in Kentucky and Tennessee by both truck and rail. The price they are prepared to pay for wood char is determined by the price of lignite char (currently $84/ton) and they would not be prepared to pay a premium for hardwood. The Moose Jaw plant uses 14,000 tons of hardwood char per year.

Softwood sawdust is also being used in the process. It is being trucked from Glaslyn, and the company is paying $26/ton landed at the Moose Jaw plant. They would happily substitute hardwood sawdust, but would pay no premium.

Equipment for processing hardwood char is estimated to cost approximately $3.5 million. Waste heat from the process is typically used as an energy source for a lumber dry kiln.

Weight reduction ratio is estimated at about 5:1. Thus it would take 5 tons (approx. 2 cords) of birch waste to make 1 ton of char. This is equivalent to about $85/Mbf, less transport and processing costs.

A more detailed analysis of this potential may be warranted if large volumes of waste are identified for which there is no more profitable application, but on the basis of this brief analysis charcoal does not appear to be the answer to the problem.

(14) Barry Webster - Personal Communication

3.4.4 Firewood

Hardwoods (except aspen) command a premium price in the Saskatchewan urban firewood market. Birch tops, knotty or otherwise defected portions of the log, and portions of the log with excessive wane may be converted to stove length firewood logs.

Seasoned birch is currently worth approximately $120/cord wholesale f.o.b. Saskatoon. The demand is high, in season.(15)

In view of the low processing cost, this is considered one of the better options for reducing log costs by utilizing as much of the log as possible.

3.4.5 Rail Cross Ties

Eastern Canadian hardwood sawmills often take the high value grades of lumber from the outside of a sawlog, and sell the heartwood portion, with some sapwood, as railway ties or square timbers (4"x4" or 5"x5" or 6"x6").

There is a fair demand in the east for birch ties. Sawmills are getting the equivalent of $300/ to $370/M for ties at the mill (depending upon grade and volume).(16)

The study team consulted with CN railway's wood products purchasing office(17) in Edmonton to determine if a market for White Birch ties existed in Western Canada. The response amounted to a qualified "yes".

CN has a very low requirement for softwood ties in Western Canada due to a large inventory and low rail upgrade or construction activity, as a result of restrictive budgets. However, they are bringing some hardwood ties in from eastern Canada, and would be interested in a western source of supply. CN is converting to birch ties

(15) Cheryl Coleman - Personal Communication
(16) Bill Love - Personal Communication
(17) Vince Petinger - Personal Communication

in high traffic areas, particularly on the west coast.

The company has had limited experience with white (western) birch. They believe that, unless they are properly processed, they may have a tendency to twist or warp. CN would be interested in visiting a Saskatchewan mill site to evaluate the product and assist the sawyer to identify the desired specifications.

Size is really the only factor which distinguishes a #1 tie from a #2 tie. If the tie is not sound for its full length, it is culled. Prices are based on February/86 market value of eastern birch, and are subject to change.

Minimum dimension of a #1 tie is 9"x7"x8' - "value - $12.90"
Minimum dimension of a #2 tie is 8"x6"x8' - "value - $ 9.75"

Prices are based on a formula which tracks the value of dimension lumber. Prices break down to $305./M (Feb. 86); and are F.O.B. the mill gate, loaded on truck, or F.O.B. the rail siding.

Ties are generally air dried. However there are some applications where a kiln dried product is preferred. In these instances the purchaser would pay a premium covering the additional processing.

If the railway companies' standards can be met, this represents the best opportunity to realize a reasonable return on "down graded" residuals that we have been able to identify.

3.4.6 Other Processing Possibilities

Two local sawmill operators have independently done some preliminary investigation of converting the lower grade birch to specialty products.

One visited a "short bolt" (4') birch veneer plant operating in Ontario. Veneer is peeled at 1/30" thickness and clipped at 2', 4' 6' or 8' lengths for shipment.(18)

An equipment list was obtained which indicates an investment of approximately $1 million would be required. Product value, fob Sault St. Marie, Ontario, was $110./sq. ft. in 1984. This translates to about $2750./Mbf.

Detailed analysis has not been conducted, due primarily to uncertainty about the quality of the resource. The concept may be worthy of future consideration as a means of recovering very high value from the lower quality, over mature trees, once some confidence is developed in quantity and quality characteristics of the resource.

Another sawmill operator(19) with experience manufacturing channel board and tongue and groove wall panelling from pine is convinced that birch panelling containing red stain, heartwood, or other characteristics for which factory grade lumber would be down-graded, would be easier to sell at a good price, then clear lumber. This potential utilization of residual material after high grade, clear lumber is extracted, should also be pursued.

3.4.7 In summary, there is a fairly wide range of potential uses for residual material. Based on what is currently known of the resource, the markets, and local start-up costs, the best options would appear to be a combination of firewood and rail ties. As more is learned about the resource through actual processing experience it may become evident that options which add more value to material which would otherwise be waste, should be analyzed.

For analysis purposes, we have used the firewood/rail tie combination.

(18) Sauder - Personal Communication
(19) Halland - Personal Communication

PART IV. FEASIBILITY ANALYSIS

In the original proposal which initiated this study it was suggested that a "case study" approach be used wherein a working mill in the study area would be converted to hardwood lumber production and all resulting costs and revenues carefully monitored. The information so acquired would then provide the evidence to either support or refute the viability of hardwood lumber production in the study area. That approach was set aside in favour of one which relied upon the literature, experience in hardwood lumber production in eastern Canada, and experience primarily in softwood lumber production in the study area. Using this body of information, estimates would be made of the primary factors affecting profitability. These would include tree harvesting costs, transportation and conversion costs, carrying and marketing costs, as well as likely product prices. In addition, major assumptions had to be made regarding a likely recovery factor (the number of cords required to produce 1000 board feet of product) and the probable conversion factor (the proportion of the product that is #1 common and better lumber).

Although some of the factors could be estimated based upon experience elsewhere the study team felt it necessary to at least conduct a brief reconnaisance of the study area to supplement the limited existing information base.

4.1 STUDY TEAM RECONNAISSANCE

The study team conducted a brief reconnaissance (two days) of the study area in an attempt to collect data that would permit an estimated answer to two questions:

a) What would be an appropriate annual volume that a sawmill in the area might utilize, and therefore, how many mills might the resource support?

b) Based upon the Forintek saw-log classification system, what average grade of factory grade lumber should our economic analysis assume. (Appendix III)

The analysis prepared by A.E. Richmond, R.P.F., (Appendix II), suggests that two operators could be sustained from the birch resource in the 1100 sq. km. area that was considered. Our reconnaisance and inventory map analysis were directed primarily at birch since it is most plentiful in that area and the viability of a lumber manufacturing facility would be primarily dependent on that species. Elm/ash would constitute supplemental products that could enhance the economic viability.

An unintended outcome of our emphasis on identifying the best birch resource was that we did not do an inventory analysis of the 7 or 8 townships with the best elm/ash resource (see map sheet). Gross volumes reported by Richmond are therefore much lower than those reported by Little in 1976. Both Begrand and Little covered 15 townships (approximately 8,100 sq. miles.). Richmond's analysis is based on only 11 map sheets (425 sq. miles.) thus accounting for the lower reported volumes.

Our calculations below are therefore based on the assumption that the elm/ash resource will sustain 2 or 3 sawmills if it makes up an average of 10% of the processed log volumes and birch makes up the balance.

4.1.1 Log Classification Results

Following rules set out by Petro and Calvert in How to Grade Logs for Factory Lumber (1978), the study team classified logs in the standing inventory of the plots tallied. The results are shown in Table 4.1

Table 4.1 Birch sawlog classification averages from four plots and elm sawlog classification averages from two plots. In the latter group only logs over 1Ø.6 inches dbh were included.

Species	Log Class	Percent
Birch	F.1	22.Ø
	F.2	32.Ø
	F.3	46.Ø
Elm	F.1	13.Ø
	F.2	15.Ø
	F.3	72.Ø

The study team found no green ash of sufficient size to classify. However, it should be noted that the reconnaisance did not cover areas considered to have the best elm/ash stands.

4.2 PRODUCTION COSTS

4.2.1 Mill Conversion

The two softwood sawmills in the Carrot River area that we have been using for cost analysis purposes are very similar. Both have a 48" circular headsaw with 9/32" inserted teeth and a manual setting/dogging carriage. Both have a two saw edger (circular) adjustable at 1" increments. Both have Canadian type, two saw trimmers which are set up to cut to a minimum of 8 feet. One mill has 150 hp at the headsaw, the other approximately 175 hp.

Both mills are set true and have sawn hardwood lumber to construction specifications. The quality of their softwood lumber product has been high. These mills would be capable of converting to hardwood product processing as they now sit. However the recovery ratios we have used in this analysis might not be attained without some modest modifications.

Such modifications to equipment would include those noted in the document Circular Sawmills and Their Efficient Operation (Lunstrum, 1977) . These involve reducing the headsaw rim speed, reducing feed speed and increasing the number of teeth.

In addition Forintek staff (19) recommend:

- carbide tipped teeth on the trim saws
- an extra set of chains to the trimmer to accommodate stops down to 4 feet at 1 foot intervals
- a stickering jig
- shelters for sawn lumber to reduce downgrading as a result of exposure

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19. Bill Love, Personal Communication

- modifications to setworks on the edger to allow 1/4" increments down to 1 inch

- laser guides at the headsaw which would cost about $2000 installed but which would enhance grade recovery

- shifting laser light lines for the trimmer which would cost about $5000 but which would improve grade recovery sufficiently to pay back capital costs in 4 to 5 months.

Total cost of all of these additions and modifications is in the $10,000 - $12,000.00 range.

4.2.2 Log Costs

Based on selective cutting in hilly terrain in an area where white spruce is being or has recently been logged out leaving some roads, skid trails and landings (typical of much of the area under consideration), experienced loggers (20) estimate log costs at approximately $107/Mbf. This estimate can be broken down as follows:

Falling, bucking and loading - $ 35/cord

This estimate is about 1.75 times softwood log costs. The higher cost is attributed to:

- increased weight which affects skidding and transport
- tree length (40 ft hardwood as opposed to 70 ft softwood)
- additional handling and bucking for grade recovery
- increased travelling time due to a scattered resource

20. Bob Sauder, Henry Wiens, Personal Communications

Stumpage

At present no stumpage fee is charged for birch, elm or ash in the study area. Therefore no stumpage cost has been included in the production cost calculations.

Should a stumpage fee be introduced, it is probable that it would be somewhat similar to that recently introduced for aspen, where $0.50 is levied as a royalty and $0.80 is added to cover forest renewal. However it could be argued that the forest renewal portion should not be applied to birch, elm and ash.

If both levies were applied, stumpage would add $7.00 /Mbf to the cost of hardwood product. (21) However if only the royalty portion were applied, the increased cost would be about $2.70/Mbf.

Transport to the mill gate

The estimated cost, $12.50 per cord, assumes $3.50 per loaded mile for an average 25 mile, 7 cord log haul. This estimate is based on the actual costs of an operator in the area who harvested birch to produce construction grade lumber. (22)

As with the falling, bucking and loading estimates above, the transportation estimate assumes the harvest to be part of an integrated hardwood operation and therefore contains no profit margin since profits/losses are accumulated in the end product.

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21. ($1.30 x 2.407 cu. m/cord x 16 cords) ÷ 7.111 Mbf/shift

22. R. Sauder, Personal Communication

Wasteage Conversion

For the primary calculations in this section we have chosen to use a conversion factor of 2.25 cords processed for each 1000 bd ft of hardwood product output. The effect of other conversion factors is discussed in Section 4.5.2.

Total Log Costs

With logs landed at the mills site for $47.50 a cord, and using the above conversion factor, 2.25 cords/Mbf, to account for an assumed greater hardwood waste factor, the cost of landed logs is approximately $107.00/Mbf ($106.88).

4.2.3 Conversion Costs

Sawing and Stickering

Using slightly modified (under $5000) existing sawmilling equipment with a capacity of 8000 bf per shift, and calculating on the basis of actual costs including depreciation, maintenance, etc., but no profit margin, experienced sawyers in the area estimate sawing and stickering costs at $132.00/Mbf. (23,24)

Grading

In many eastern mills a certified hardwood lumber grader is employed as part of the milling operation. Indications are that this expense may be reduced if the grader is employed at the marketing point.

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23 R. Sauder, Personal Communication

24. H. Wiens, Personal Communication

For this analysis we have assumed this cost to be a variable ranging from $5/Mbf if the trim saw operator doubled as the person responsible for maximizing grades, to $25/Mbf if a full time, certified grader were employed to do nothing but sort output by grade ($180.00 including expenses per shift).

4.2.4 Costs Related to Marketing and Carrying Inventory

The cost of marketing wood products for which there is currently a good demand will vary with time and the methods employed. Current thinking is that the 2 or 3 producers will market jointly from the dry kiln location. However since marketing success will be a significant factor in the feasibility of a processing operation we have added $5/Mbf or approximately $4800.00/year for marketing costs.

Carrying charges on inventory have been one of the factors inhibiting development of the industry to date. It is anticipated that log harvest will occur during the winter months with sawing and drying taking place in summer and fall. Our study anticipates that 300 days may elapse between the date the first logs are cut and the day that cash flow is established. In our analysis we have accumulated those carrying costs, including those associated with logging, at the mill/kiln.

Assuming that the mill will operate for an average of 120 days per year, operating costs which will accumulate before cash flow range from $228,000.00 (per shift cost x 120) for green birch lumber to $290,000.00 for kiln dried elm/ash/birch product. Accumulating interest (compounded) will range from $16000.00 to $17,500.00 per season depending upon the degree of processing. Based on an annual production of 960 Mbf, interest on operating expenses will add approximately $18/M to the cost of production.

4.2.5 Total Logging, Conversion and Marketing Costs

Total log processing costs for rough sawn, stickered, graded to factory grade, green lumber at the mill site, including estimated marketing and carrying charges is

$267.00/Mbf or if a dedicated grader is employed, $287.00/Mbf. These costs are summarized in Fig. 4.1.

4.2.6 Production Costs in Other Regions

Extensive research on eastern Canadian mills (25) indicates that green hardwood lumber input costs are as follows:

Logging Costs - Approximately $220.00/Mbf

This estimate is double the log costs that we have applied to the study area. However there are a number of reasons for this difference. First, the $220.00 figure is based upon a contracted log supply and it therefore includes the contractor's profit margin. As indicated earlier, our assessment assumes an integrated operation and therefore we have accumulated all costs/losses in the manufactured product.

Second, the eastern Canadian figure includes a stumpage fee which in 1983/84 ranged from $22.27/Mbf for Class 1 logs to $2.22 for Class 3 logs. Reforestation agreements which vary from region to region add additional costs. (26)

Third, eastern operators are now generally faced with smaller logs and much longer hauls. Haul distances of 100 miles are not unusual. Using transportation cost estimates from the study area, the greater distances alone could add nearly $40.00/cord to log costs at the eastern Canadian mill gate.

Finally, it should be noted again that our transportation costs are based upon those actually incurred by an operator in the study area who was harvesting birch to be used in the production of construction-grade hardwood lumber.

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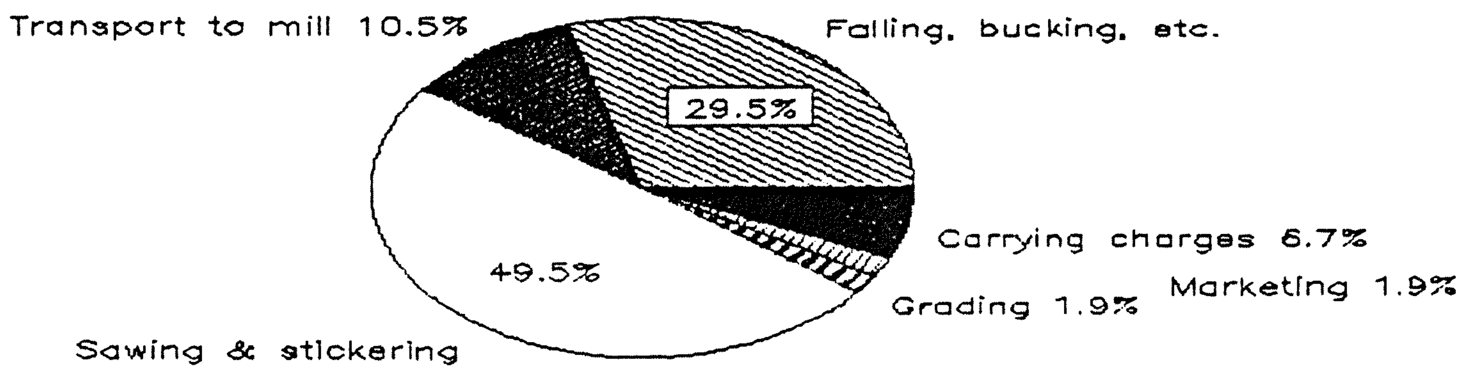
25. Bill Love, Personal Communication

26. Jim Johnson, Personal Communication

Fig 4.1 Summary of production costs for rough, green lumber.



Sawing Costs - Approximately $140.00/Mbf

The above figure taken from Forintek (1985) is very close to our sawing and stickering estimate of $132.00/Mbf. If we included grading costs our estimate would increase to $137.00/Mbf.

Forintek's figure is based on the production of cants and ties and assumes a nine hour shift with 10 percent down time and 10 percent delays. This is similar to the operating histories of the two mills under consideration in this study area.

4.3 GREEN PRODUCT VALUE AT THE MILL

Assuming an average distribution of log classes consistent with Table 4.1 and that average grade recovery from Saskatchewan white birch will equate to "lumber grade yields for yellow birch logs" found by Petro and Calvert, then the value of birch lumber 1C and better should be as shown in Table 4.2.

TABLE 4.2 Volume and value of #1C and better lumber recovered from Saskatchewan white birch, based upon an input of 16 cords per shift.

INPUT	
Volume handled per shift	16.0 cords
Conversion (16 cords @ 2.25 cords/Mbf)	7111.0 bf
OUTPUT	
Total volume of F1 logs	22.0% (27)
Recovery of 1C or better from F1 logs	74.3% (28)
Per shift volume 1C+ lumber	1162.4 bf (29)
Value per shift @ $540/Mbf	$627.70
Total volume of F2 logs	32.0%
Recovery of 1C or better from F2 logs	50.7%
Per shift volume 1C+ lumber	1153.7 bf
Value per shift @ $540/Mbf	$623.00
Total volume of F3 logs	46.0%
Recovery of 1C or better from F3 logs	22.6%
Per shift volume 1C+ lumber	739.2 bf
Value per shift @ $540/Mbf	$399.20
TOTAL VALUE OF LUMBER	$1649.90

27. From Table 4.1

28. See Appendix II.

29. 7111.0 bf x 22.0% x 74.3%

Volumes of wood remaining after #1 Common and better lumber is extracted are shown in Table 4.3. These are calculated from the figures used in Table 4.2. For example, since the recovery of #1 common and better lumber from F1 logs is 74.3%, then 25.7% remains as a residual for processing into other products.

TABLE 4.3 Residual volumes of wood by log class after 1C and better lumber is extracted

Log Class	% Residual	Board feet
F1	25.7	402.1
F2	49.3	1121.8
F3	77.4	2531.8
Total		4055.7

A summary of expected income from the sale of #1 Common and better lumber as well as the residual products, rail ties and firewood, is given in Table 4.4. We have assumed for these calculations that 60% of the residual would be useful only for firewood while 40% could be used for the production of rail ties. All costs are indicated as well as an estimated before tax profit.

TABLE 4.4 Summary of anticipated lumber/residual recovery volumes and values from Pasqua Hills birch based upon an input of 16 cords per shift and grade recoveries as per Petro and Calvert (1976).

INPUT	
Volume per shift	16.0 cords
Conversion (2.25 cords/Mbf)	7111.0 bf
OUTPUT	
#1 Common & better lumber	3055.3 bf
Value @ $540.00/M	$1649.86
Residuals	4055.7 bf
Rail ties at 40% of residuals	1622.3 bf
Value @ $290/M ($305/M less $15/M for loading) (30)	$470.47
Firewood at 60% of residuals	2433.4 bf
Value @ $50/M at mill site (31)	$121.67
Gross value/shift of green, rough wood products	$2242.00
Gross value per Mbf of green, rough wood products (gross/7.111 Mbf)	$315.29
VALUE vs PRODUCTION EXPENSES	
Total log and processing costs/m (from 4.3.3)	$244.00/M
Marketing and carrying charges	$23.00/M
BEFORE TAX PROFITS	$48.29/M

30. V. Petinger, Personal Communication

31. C. Coleman, Birch Firewood Wholesaler, Pers. Comm.

4.4 FACTORS AFFECTING PROFITABILITY

4.4.1 Grade Recovery

The proportion of round wood which can be converted to the higher value lumber grades will significantly affect profitability. The addition of processing equipment designed to enhance grade recovery (ie. short bolt mills, band headsaws and edgers, etc.) would no doubt have a positive impact. Whether or not the impact on profitability would be sufficient to justify the expenditure of the required $30,000.00 to $50,000.00 is beyond the scope of this study.

However based upon our preliminary assessment of the resource quality, the Red Earth study (Petro, 1977) and the experience of sawmill operators in the region (32), the study team has concluded that existing equipment will achieve a recovery ratio of about 43%. In our primary feasibility calculation we used a recovery rate of 42.9% for #1 common and better birch lumber (Table 4.4).

To demonstrate the effect of different recovery rates on mill profitability we prepared Table 4.5 which shows similar calculations where the recovery rates vary from 31% to 50%. The low end figure, 31%, represents the value found in Forintek's Red Earth sawing demonstration. In that study it was pointed out that the sawlogs provided were of poor quality and not representative of the area. The resulting recovery rate would appear to be a worst case scenario for the area. However, it still produces a small positive balance. Details of the Red Earth calculation are shown in Table 4.6.

The upper value of 50% is similar to rates achieved in some of the better operations in eastern Canada. (33)

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32. Based upon sawing birch for construction grade lumber.

33. Bill Love, Personal Communication

Table 4.5 Effect of recovery rates on before tax profits per shift if conversion factor is constant

PRODUCTION COSTS	CONVERSION FACTOR	INPUT MBF	LUMBER RECOVERY	LUMBER MBF	LUMBER VALUE	TIES MBF	TIES VALUE	FIREWOOD MBF	FIREWOOD VALUE	TOTAL VALUE	NET PROFIT
$1,897.78	2.25	7.1111	0.31	2.2044	$1,190.40	1.9627	$569.17	2.9440	$147.20	$1,906.77	$9.00
$1,897.78	2.25	7.1111	0.32	2.2756	$1,228.80	1.9342	$560.92	2.9013	$145.07	$1,934.79	$37.01
$1,897.78	2.25	7.1111	0.33	2.3467	$1,267.20	1.9058	$552.68	2.8587	$142.93	$1,962.81	$65.03
$1,897.78	2.25	7.1111	0.34	2.4178	$1,305.60	1.8773	$544.43	2.8160	$140.80	$1,990.83	$93.05
$1,897.78	2.25	7.1111	0.35	2.4889	$1,344.00	1.8489	$536.18	2.7733	$138.67	$2,018.84	$121.07
$1,897.78	2.25	7.1111	0.36	2.5600	$1,382.40	1.8204	$527.93	2.7307	$136.53	$2,046.86	$149.08
$1,897.78	2.25	7.1111	0.37	2.6311	$1,420.80	1.7920	$519.68	2.6880	$134.40	$2,074.88	$177.10
$1,897.78	2.25	7.1111	0.38	2.7022	$1,459.20	1.7636	$511.43	2.6453	$132.27	$2,102.90	$205.12
$1,897.78	2.25	7.1111	0.39	2.7733	$1,497.60	1.7351	$503.18	2.6027	$130.13	$2,130.92	$233.14
$1,897.78	2.25	7.1111	0.40	2.8444	$1,536.00	1.7067	$494.93	2.5600	$128.00	$2,158.93	$261.16
$1,897.78	2.25	7.1111	0.41	2.9156	$1,574.40	1.6782	$486.68	2.5173	$125.87	$2,186.95	$289.17
$1,897.78	2.25	7.1111	0.42	2.9867	$1,612.80	1.6498	$478.44	2.4747	$123.73	$2,214.97	$317.19
$1,897.78	2.25	7.1111	0.43	3.0578	$1,651.20	1.6213	$470.19	2.4320	$121.60	$2,242.99	$345.21
$1,897.78	2.25	7.1111	0.44	3.1289	$1,689.60	1.5929	$461.94	2.3893	$119.47	$2,271.00	$373.23
$1,897.78	2.25	7.1111	0.45	3.2000	$1,728.00	1.5644	$453.69	2.3467	$117.33	$2,299.02	$401.24
$1,897.78	2.25	7.1111	0.46	3.2711	$1,766.40	1.5360	$445.44	2.3040	$115.20	$2,327.04	$429.26
$1,897.78	2.25	7.1111	0.47	3.3422	$1,804.80	1.5076	$437.19	2.2613	$113.07	$2,355.06	$457.28
$1,897.78	2.25	7.1111	0.48	3.4133	$1,843.20	1.4791	$428.94	2.2187	$110.93	$2,383.08	$485.30
$1,897.78	2.25	7.1111	0.49	3.4844	$1,881.60	1.4507	$420.69	2.1760	$108.80	$2,411.09	$513.32
$1,897.78	2.25	7.1111	0.5	3.5556	$1,920.00	1.4222	$412.44	2.1333	$106.67	$2,439.11	$541.33

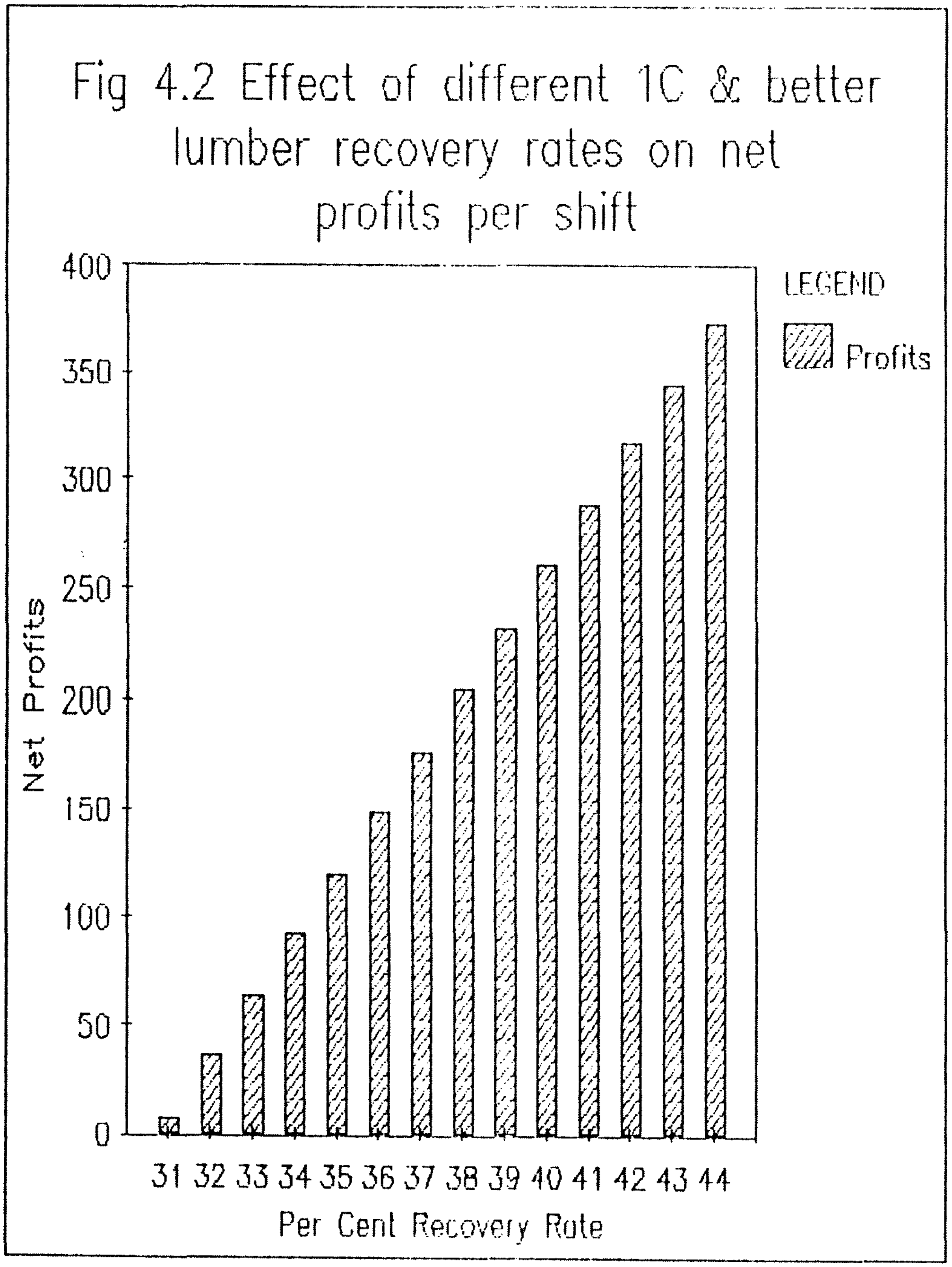
Fig 4.2 Effect of different 1C & better
lumber recovery rates on net
profits per shift
400
350
300
250
200
150
100
50
0
Net Profits
LEGEND
Profits
31 32 33 34 35 36 37 38 39 40 41 42 43 44
Per Cent Recovery Rate

TABLE 4.6 Summary of anticipated lumber/residual recovery volumes and values for white birch at Red Earth, Saskatchewan based upon Forintek Canada Corporation, 1982 recovery rates (31%) and an input of 16 cords per shift.

INPUT	
Volume per shift	16.0 cords
Conversion (2.25 cords/Mbf)	7111.0 bf
OUTPUT	
#1 Common & better lumber	2204.4 bf
Value @ $540.00/M	$1190.38
Residuals	4907.0 bf
Rail ties at 40% of residuals	1962.8 bf
Value @ $290/M ($305/M less $15/M for loading)	$569.21
Firewood at 60% of residuals	2944.2 bf
Value @ $50/M at mill site	$147.21
Gross value/shift of green, rough wood products	$1906.80
Gross value per mbf of green, rough wood products (gross/7.111 Mbf)	$268.15
VALUE vs PRODUCTION EXPENSES	
Total log and processing costs/m (from 4.3.3)	$244.00/M
Marketing and carrying charges	$23.00/M
BEFORE TAX PROFITS	$1.15/M

4.4.2 Wasteage Conversion Factor

Our study has assumed a significant waste factor. We have used a roundwood to lumber conversion factor of 2.25 cords/Mbf for our primary calculations, as opposed to the usual 1.78 cords of softwood per Mbf experienced by independent operators in the area. (34)

However, since this conversion factor represents a significant assumption we have prepared Table 4.7 and Fig. 4.3 to illustrate the effect that different conversion factors would have on net profit per shift, assuming other factors remained constant. The 2.5 fold increase in profits that results when the conversion factor ranges from 1.75 to 2.4 amply demonstrates the sensitivity of this factor. However, the study team as well as one of the independent operators is confident that the 2.25 factor is the most representative of the the likely range that will be encountered. (35)

4.4.3 Other Factors

In addition to the grade recovery factor and the wasteage conversion factor, we have included nine other variables in the calculation of mill profit/loss. The relationship of all variables is shown on the following page.

Using this equation, the effect of altering one variable while keeping the others constant can be examined (essentially the process used in 4.4.1 and 4.4.2 above for the wasteage and conversion factors). For example, such an exercise highlights that, because of their value differential, altering the proportion of the residual wood (the wood remaining after #1 common lumber is removed) that is used for rail ties vs. firewood dramatically affects profits. If rail ties comprise only 10% of the residual wood per shift rather than our assumed 40%, profits are virtually reduced to zero. Conversly, by either increasing that proportion

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34. Bob Sauder, Personal Communication

35. Bob Sauder, Personal Communication

Fig. 4.7 Effect of different conversion factors on per shift before tax profits assuming a constant recovery rate.

PRODUCTION COSTS	CONVERSION FACTOR	INPUT MBF	RECOVERY RATE	LUMBER MBF	LUMBER VALUE	TIES MBF	TIES VALUE	FIREWOOD MBF	FIREWOOD VALUE	TOTAL VALUE	NET PROFIT
$2,222.86	1.75	9.1429	0.429	3.9223	$2,118.03	2.0882	$605.59	3.1323	$156.62	$2,880.24	$657.38
$2,182.22	1.80	8.8889	0.429	3.8133	$2,059.20	2.0302	$588.76	3.0453	$152.27	$2,800.23	$618.01
$2,143.78	1.85	8.6486	0.429	3.7103	$2,003.55	1.9754	$572.85	2.9630	$148.15	$2,724.55	$580.77
$2,107.37	1.90	8.4211	0.429	3.6126	$1,950.82	1.9234	$557.78	2.8851	$144.25	$2,652.85	$545.48
$2,072.82	1.95	8.2051	0.429	3.5200	$1,900.80	1.8741	$543.47	2.8111	$140.55	$2,584.83	$512.01
$2,040.00	2.00	8.0000	0.429	3.4320	$1,853.28	1.8272	$529.89	2.7408	$137.04	$2,520.21	$480.21
$2,008.78	2.05	7.8049	0.429	3.3483	$1,808.08	1.7826	$516.96	2.6740	$133.70	$2,458.74	$449.96
$1,979.05	2.10	7.6190	0.429	3.2686	$1,765.03	1.7402	$504.66	2.6103	$130.51	$2,400.20	$421.15
$1,950.70	2.15	7.4419	0.429	3.1926	$1,723.98	1.6997	$492.92	2.5496	$127.48	$2,344.38	$393.68
$1,923.64	2.20	7.2727	0.429	3.1200	$1,684.80	1.6611	$481.72	2.4916	$124.58	$2,291.10	$367.46
$1,897.78	2.25	7.1111	0.429	3.0507	$1,647.36	1.6242	$471.01	2.4363	$121.81	$2,240.18	$342.41
$1,873.04	2.30	6.9565	0.429	2.9843	$1,611.55	1.5889	$460.77	2.3833	$119.17	$2,191.49	$318.44
$1,849.36	2.35	6.8085	0.429	2.9209	$1,577.26	1.5551	$450.97	2.3326	$116.63	$2,144.86	$295.50
$1,826.67	2.40	6.6667	0.429	2.8600	$1,544.40	1.5227	$441.57	2.2840	$114.20	$2,100.17	$273.51

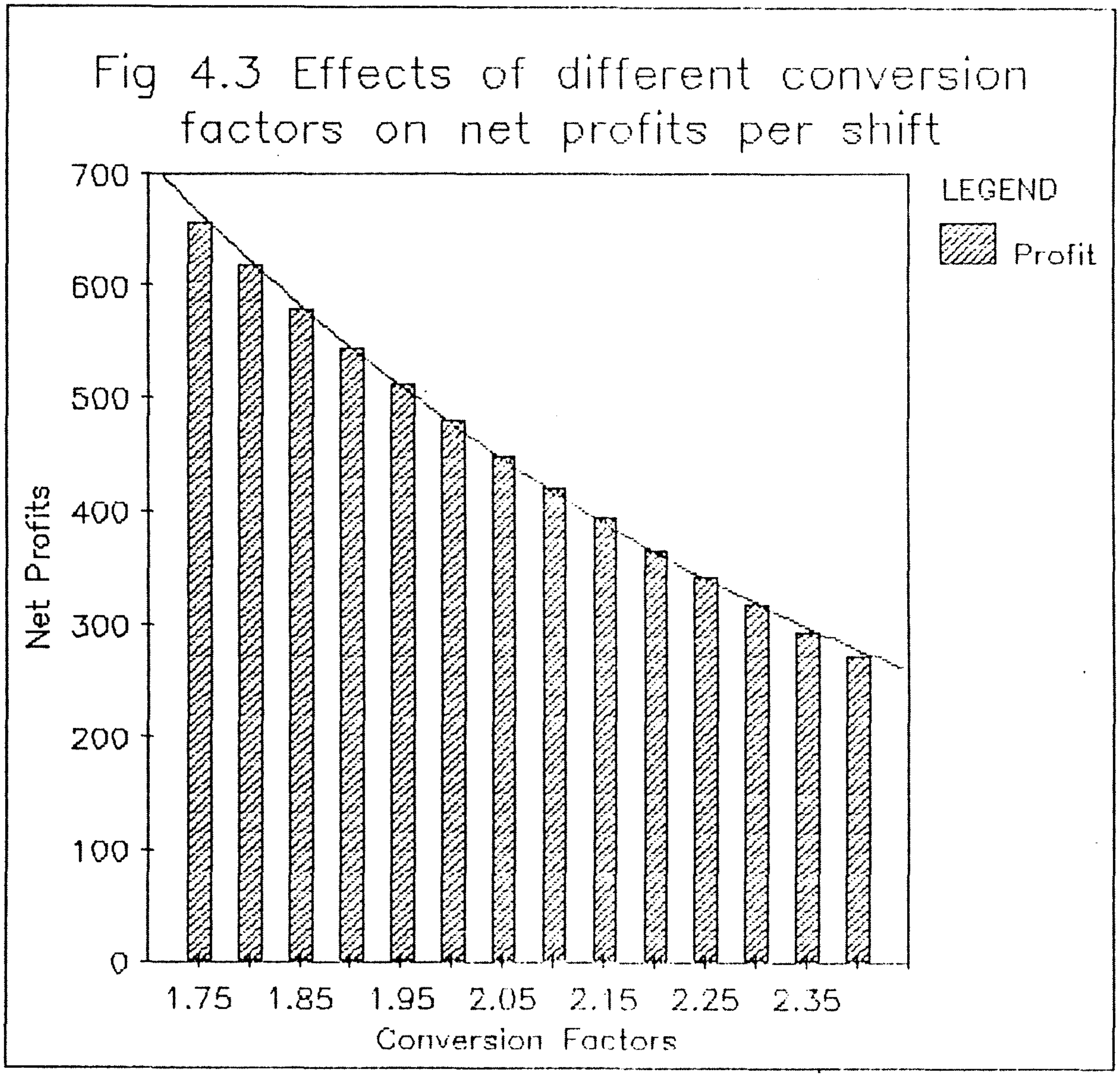
Fig 4.3 Effects of different conversion factors on net profits per shift
LEGEND
Profit
Net Profits
700
600
500
400
300
200
100
0
1.75
1.85
1.95
2.05
2.15
2.25
2.35
Conversion Factors

or substituting a higher value product in the place of rail ties or firewood, profitability can be significantly enhanced.

$$\text{Profit} = \frac{X * \{[Y*L + (1-Y)P*T + (1-Y)Q*F] - (C+M+B)\}}{Z}$$

where:

X = input in cords	C = conversion costs/Mbf
Z = conversion factor	M = Marketing & carrying costs/Mbf
Y = grade recovery	B = log costs/Mbf
L = lumber value/Mbf	P = proportion ties
T = tie value/Mbf	Q = proportion firewood
F = firewood value/Mbf	

The relationship could also be used to generate a "worst case" scenario using the lowest probable value for each of the variables. However the usefulness of such an exercise is questionable given the minute probability that each of the variables would be at its most negative position concurrently.

4.5 ADDITIONAL "VALUE ADDED" PROCESSING

4.5.1 Dry Kiln

Our market survey indicates that the value of factory grade lumber increases by $250 to $300/Mbf if it is kiln dried to 10 to 12% M.C. This sharp increase in value seems to have more to do with supply/demand influences than with added processing costs.

Fin Mac Ltd. of Winnipeg estimates the total cost of amortizing and operating their dehumidification kiln at between $80 and $100/Mbf.

A solar powered hardwood lumber dry kiln will be constructed and tested in the Carrot River area in 1986-87. Assuming it is available to local processors for commercial use, the viability of a sawmilling operation would be significantly enhanced. Table 4.8 provides a summary of the impact of kiln drying on before tax profits.

4.5.2 Grade Selection

As experience is gained and specific markets are identified, profitability may be further enhanced by pulling out the "select and better" grades which are estimated to make up approximately 18% of total lumber production (Petro and Calvert, 1978) and marketing them separately for at least $1500.00/Mbf.

In addition the spread in value between rough selects and milled (S2S, S4S) selects would seem to justify the additional handling and processing, even for these small volumes. Milling equipment would require some upgrading in order to meet the quality specifications demanded in the marketplace. However, it is relatively inexpensive (for example, approximately $8000.00 for a low volume, high quality planer). An increase in value of the product in the range of $600.00/M, even at annual volumes of 65 Mbf would indicate a short pay-back period.

Table 4.8 Summary of production costs and product values when the #1 Common and better lumber is kiln dried.

COSTS OF PRODUCTION PER SHIFT	
Logging, transportation, etc. $47.50/cord x 16 cords	$760.00
Sawing and stickering $132/Mbf x 7.111	$938.65
Grading $180/shift	$180.00
Transportation to kiln $25/M x 3.055	$76.38
Kiln Drying $100/M x 3.055	$305.50
Marketing $23/M x 7.111	$163.55
TOTAL	$2424.08
VALUE OF PRODUCTS PER SHIFT	
Lumber, kiln dried, graded $840/M x 3.055	$2566.45
Ties $290/M x 1.622	$470.38
Firewood $50/M x 2.433	$121.65
TOTAL VALUE	$3158.48
NET PROFIT PER SHIFT	$734.40
NET PROFIT PER MBF OF PRODUCT	$103.27

Studies of eastern Canadian hardwood industries conducted by Forintek strongly indicate that investment in processing equipment has a very positive impact on profitability. (36) A 1% improvement in grade recovery results in a 10.7% improvement on margin of profit.

4.5.3 Addition of the Elm/Ash Component

Our preliminary analysis indicates that elm/ash will make up an average of only 10% of the round wood accessible to a sawmill in the area. While there are significant amounts of elm/ash in the inventory, achieving a higher volume would result in substantially higher log costs.

Elm/ash occurs in elongated groves near existing and vestigial stream beds, many of which are subject to annual flooding. While elm/ash is also found scattered among birch/black poplar stands in the upper reaches of streams and creeks, it is generally smaller and more decadent than that found in the lowlands. Unfortunately it is the elm/ash in the uplands, where the quality is poorest, that could be most efficiently harvested in combination with birch, although it might be supplemented by some winter harvest in lowlands along existing roads and trails. Harvest of the better quality lowland elm/ash might be further hampered due to environmental concerns associated with river bank and flood plain erosion.

As a result of the higher log costs and the fact that the flood plain trees have embedded grit which would result in higher costs for chain saw and sawmill maintenance, we have added a 20% increase in log and processing costs. Table 4.9 summarizes the calculations.

It should be noted that this analysis attributes no value to the elm/ash residuals which amount to 60% of log volumes or more than 1800 bf of potentially saleable hardwood fibre per shift.

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36. Bill Love, Personal Communication

Table 4.9 A summary of product costs and values if elm/ash constitutes 10% of the kiln dried output.

COSTS OF PRODUCTION	
Kiln dried birch at 90% $2424.08 x 0.9 (37)	$2181.67
Kiln dried elm/ash at 10% $2424.08 x .10	$242.41
Additional processing cost for elm/ash $242.42 x .2	$48.48
Total processing	$2472.56
REVENUE	
Birch products $3158.48 x .9 (38)	$2842.63
Elm/ash at 10% of output (7.111bf) 7.111 x .1 x $900 (39)	$639.99
Total product value	$3482.62
BEFORE TAX PROFITS PER SHIFT	$1010.06
BEFORE TAX PROFITS PER MBF	$142.04

37. Birch lumber production cost from Table 4.8

38. Birch lumber value taken from Table 4.8

39. Rick Dawson, Personal Communication

PART V. CONCLUSIONS

Both conventional wisdom and this study point out that the existing equipment dedicated by small operators to softwood processing is under-utilized and that, given the current state of the softwood industry in Western Canada, it is likely to remain so. It is therefore essential that some of that investment be re-deployed. Converting a portion of the equipment to hardwood processing appears to be one viable option.

5.1 THE RESOURCE

The study team has concluded that a birch/elm/ash resource base exists in sufficient quantities to support at least two mills with capacities of one million board feet per year in the 1100 sq. km. study area. This may be a conservative estimate since there is limited current information available on hardwood inventories. However some caution is warranted since it is generally recognized that much of the resource is mature and over-mature. This raises both recovery rate and quality concerns.

The study team is confident that at least one more mill could be established in the Carrot River region based on hardwood outside the study area.

5.2 THE MARKET POTENTIAL

Preliminary market surveys have indicated that the proposed products of the mill, #1 common and better lumber, rail ties and firewood can be readily absorbed by the marketplace. The surveys, of course, assume that the products are produced in both quantities and qualities that are acceptable to buyers. Annual production calculations for all of the above products suggest that quantities will be acceptable. However few buyers are prepared to offer firm purchase commitments until they have an actual product to assess. Thus the question of quality will be unanswered until an actual conversion is undertaken.

It should be noted that the viability of the mill will depend upon getting as high a price as possible for the residuals after the #1 Common and better lumber is extracted. For example, if the mill produced only rough, green lumber and firewood it would not meet expenses. The production of rail ties from a portion of the residual changes the profit picture dramatically.

Our review indicated that of the several products which could be recovered from this portion, rail ties provide a reasonable return for a relatively modest capital investment. We feel that at this point it was essential to keep conversion and production costs as small as possible given the "experimental" nature of the conversion.

However following the initial conversion, a more detailed analysis of an operating mill might point toward a product such as interior grade, tongue and groove wall panelling because of its larger "value-added" content. Similarly, "landscape ties" which retail for approximately $635.00 per Mbf (40) may offer an attractive alternative.

5.3 THE MILL OPERATION

There is no major obstacle to converting existing mill equipment that is in good condition from softwood to hardwood production. The cost of such a conversion is estimated to be $10 - 12,000.00

Additional investment to enhance grade recovery would be significantly larger, $30 - 50,000.00. Experience elsewhere suggests that such expenditures have a positive impact on profitability and hence a short payback. However we suggest that such investment be considered only after the mill has been in operation

40. Beaver Lumber advertising supplement to the Saskatoon Star Phoenix, May 6, 1985

for some months and there is better information on the quality of the log supply.

Some "skill upgrading" for operators as well as those involved in the harvesting operations will be required. Grade recovery rate variations have a significant effect upon mill profitability and this in turn is at least partly dependent on the skill of the loggers. Because of their past involvement in the area, staff of Forintek Canada Corporation, Eastern Laboratory, are in a good position to meet this requirement.

5.4 THE PROFIT MARGIN

Our study team has concluded that, assuming a conversion factor of 2.25 cords per 1000 bf of product, and a recovery rate of 43%, (ie., 43% of product is #1 common and better lumber), an operator could expect a before tax profit of about $48.00/M from an integrated operation if his products were rough, green lumber, rail ties and firewood. It should again be noted that in comparison to mills in eastern Canada, this study has identified that logs could be delivered at the mill site in the study area at a significantly lower cost, but conversion costs would be similar.

Our "worst case" scenario based upon the admittedly low recovery rates from the Red Earth study, 0.31, but using all of the other assumptions from above generated a very modest before tax profit of slightly more than $1.00/M.

The addition of kiln drying substantially increases estimated before tax profit to about $103.00/M. Since a solar powered dry kiln is planned for the area, provision should be made so that it can accommodate the lumber output of the hardwood mills. As the rail tie market develops, the feasibility of kiln drying that product should be considered.

Utilizing the elm/ash resource at the same ratio it is likely to be encountered in the area (10% of mill input) further increases before tax profits to approximately $142.00/M notwithstanding the greater processing costs associated with that product.

5.5 A DEMONSTRATION MILL

As with all technical and economic feasibility studies, not all factors important to the success of the mill conversion considered in this study can be accurately estimated. From a practical perspective, these include the day to day quality of the saw logs, the ease with which the skills associated with a hardwood operation can be transferred, and the degree to which the various product markets can be penetrated by a small independent operator. The cumulative effect of any inaccuracies in these estimates could be significant.

It is probable that given the size of the investment required, these uncertainties will discourage any independent operator from undertaking a mill conversion on his own. Although the cost of the conversion itself is not large, ($10-12,000.00), the operator would have to invest a very substantial amount of money and time in harvesting and processing the hardwood while foregoing any other income generating activities. As a result an operators "risk" investment would be in excess of $250,000.00. Few independent operators could afford such an expenditure, and financial institutions would be unlikely to provide financing.

At the same time, many of the independent operators face a gloomy future if they do not change some aspect of their operation. Therefore a mill conversion demonstration project, <u>subsidized by the public sector to reduce the operators risk</u>, should be initiated as soon as possible. Limited public sector involvement could be justified both on the basis of broadening the resource base of an industry faced with a diminishing resource supply, as well as promoting the balanced use of a valuable public resource.

The demonstration project would serve two primary purposes. First it would permit an assessment of those factors affecting mill profitability that cannot be tested in any other way. Second, it could serve as a focus for technology transfer for other operators in the area interested in a similar conversion.

PART VI. RECOMMENDATIONS

Based upon the preceding review and analysis, the study team makes the following recommendations:

1. A "demonstration" mill conversion should be undertaken in cooperation with a current operator of a softwood mill in the area. If necessary some public funds should be used to subsidize the conversion in order to reduce the owner's risk.

2. A training program for the mill operator should be developed.

3. The use of public funds for both the conversion and training programs should be dependent upon a formal agreement with the operator that the mill may subsequently be used as a "demonstration" to acquaint other mill operators with hardwood procedures.

4. As a preliminary step, a two year log supply for the mill should be identified in detail and a three year supply should be outlined in principle.

5. The .#1 Common and better hardwood lumber should be kiln dried if the solar powered kiln is built in the area.

6. Where possible the elm/ash content of the product mix should be maximized.

APPENDIX I

MARKET SURVEY
FOLLOW-UP
1986

TELEPHONE SURVEY OF LARGE VOLUME BUYERS OF HARDWOOD LUMBER IDENTIFIED IN 1983 MARKET SURVEY

NORPLAN CONSULTING
February, 1986

TELEPHONE FOLLOW-UP - LARGE VOLUME BUYERS IDENTIFIED IN 1983 MARKET SURVEY

1. The 1983 market survey was aimed at end users of hardwood dimension stock, but also included some brokers, retailers, wholesalers, secondary processors, etc. It's purpose was to determine volumes of dimension stock that are currently consumed in Western Canada and an approximate end market value.

   Respondents did not clearly identify the degree to which the material they used was processed before they bought it.

   In this brief survey, we attempted to accomplish two objectives:

   1.1 Determine any significant changes in prices, supply or demand for birch, elm or ash since the 1983 survey.

   1.2 Get a better appreciation for the "value-added" as hardwood lumber goes through each processing phase.

2. Methodology

   The writer selected twelve of the larger volume buyers of furniture grade birch, elm and ash identified in the 1983 survey. This was refined to the extent of selecting "headquarter" operations and eliminating some "branch plants". Also, in those cases where the respondent had indicated that he purchased these species through a specified supplier, we called the supplier rather than the manufacturer.

   Eight companies were contacted. On all calls we asked to speak to the same contact person (by name) with whom we had spoken in 1983. We succeeded in only two cases, indicating the dynamic nature of the business. The others had been promoted, or left the company, or the company itself had been restructured.

Two significant users are no longer in business.

A simple questionnaire format was followed, which introduced the caller, explained the purpose of the exercise, and requested volume, grade, degree of processing and pricing information on the species under study.

The information obtained is summarized below.

3. Summary data - Telephone Survey

3.1 Reynaldo's Supply - Arlee, Saskatchewan - 237-9585

Contacted Rick Dawson - Owner/Manager
Reynaldo's Supply is a broker/wholesaler of dimension hardwood lumber and specialty wood products, including exotic species, distributing across Western Canada and into the northwestern United States.

-hardwood prices are generally up due to the American dollar. The American market sets the price.

-demand for species change year by year. No definite trend in demand is evident. There would be "lots of room" in the market for a Saskatchewan product if it was of consistently good quality.

Birch - is able to buy mill-run, construction grade, rough, green birch from within Saskatchewan/Manitoba for $300 to $450/M, delivered.

-is buying 10 to 20,000 fbm per year, factory grade selects, kiln dried 8%, 8/4" and 4/4", rough, random lengths and widths for $1200/M. #1 Common and better at $875/M.

-processed in the United States.

Elm/Ash - buys about 10-15 Mfbm/year, rough, furniture grade, kiln dried, random lengths and widths in full 8/4" or 4/4" thickness. Selects $1800/M. #1 Common and better $1300/M.

-presented Pine as an example of "value-added".

Can buy mill-run, green, ungraded construction lumber, delivered for $250 to $300/M.

Buying Ponderosa Pine (Jack Pine could be interchanged) graded to #1 Common and better, kiln dried to 12% to 16%, smooth two sides (S2S) or Smooth four sides (S4S), in full inch dimension (4/4" and 8/4"), in random lengths and widths (wider are more valuable), for prices as follows:

Selects - Clear -	$1300/M.
#1 Common - Clear -	$1000/M.
1"x4" Clear -	$ 950/M.
Sound Knots -	$ 570/M.

3.2 Atco Components Division - ATCO Industries - Calgary

Contacted a receptionist at ATCO Industries. The components division, which in 1983 was manufacturing all wood components for the company, (except structural), and was also producing furniture frames for upholsterers, has been discontinued. All work is now subcontracted to a number of smaller firms.

Mr. Peter Houserman, whom we had contacted in 1983, now had his own firm - Cambrian Woodworks. His phone number was provided.

3.3 Cambrian Woodworks - Calgary - 403-249-2025
Peter Houserman. Does custom millwork. Mainly Oak, Cherry, Walnut. Purchases through Elswood - Calgary.

-no Elm/Ash to speak of. Very little Pine.

Birch - buys select grade only, rough, kiln dried to 8 - 11%. 8/4", 6/4", 4/4" random lengths and widths originates in United States. Annual use about 2000 fbm.

-prices up slightly from 1983. About $1500/M.

3.4 Finn Woodworks Ltd. - Winnipeg - 204-774-1606
Mr. H. Maki - Buyer

-manufactures hotel and motel furniture and furniture frames.

-did not discuss pine.

Birch - buying carload/day. About 50/50 United States supply and Manitoba/Saskatchewan supply.

-purchased from Finn Mac who have own sawmilling contractors who ship to Winnipeg for kiln dry and other treatment.

-prices generally up since 1983. Demand still high for good quality material.

-buys mostly S2S, kiln dried to 12 - 18% in 15/16" thickness, random widths and lengths. Most #2 and #3 grade Selects.

-average price on birch is $750/M.

Elm/Ash - not using much Ash. About 100M Elm/year. Mostly from United States.

-#1 Factory grade Elm, rough, kiln dried 8%, random widths and lengths.

-$700 to $1000 mfbm.

3.5 Palliser Furniture - Winnipeg - 204-668-5600 Helmut Epp. No longer buying. Buyer not available to answer questions. Spoke to warehouse clerk.

-company manufactures all types of furniture. They have branch manufacturing plants at Airdrie, Alberta and Fargo, North Dakota. Each buys its own materials, although ordered through Winnipeg purchasing agent.

-respondent not aware of volumes utilized in other plants.

-prices are up a bit from 1983, although respondent could give no specific pricing information.

-purchase all "factory grade" lumber, random widths and lengths in 4/4", 6/4", 8/4" thickness. They kiln dry, plane and resaw to own specifications. Sell some furniture frames to other upholstering plants.

Volumes -	Birch	112 Mfbm
	Elm	825 Mfbm

-no prices available this time, but 1983 prices for Birch approximately $700/M and Elm $1100/M.

3.6 Saskatoon Custom Millwork - Telephone # disconnected

-no longer in business. In 1983, the firm was manufacturing some furniture frames for resale to upholsterers.

3.7 Creative Millworks - Saskatoon - 242-1494

-called Creative Millwork (242-1494) to see if their operation would compare to the former Saskatoon Custom Millwork. It does not.

-use no elm. Use about 1000 fbm solid birch per year which they rip for edging. Paying about $2200/M since buying in small quantities from Elswood.

3.8 Elswood Distributors - Saskatoon - 931-3066 Ken

-Elswood is a division of Sauder Industries Ltd. acting as wholesale, retail distributor of hardwood lumber and other specialty wood products. Have outlets in all major Western Canadian cities.

-buy only "select and better" grades. Pointed out that an immediate problem for producers would be to dispose of what he described as the "fall down grade" material. Claimed that in the United States and Eastern Canada, most of the "fall down" is sold to furniture manufacturers rough and green, to be dried and resawn to furniture components.

-also noted that a dry kiln operator ranks pretty high in the "pecking order" in a hardwood lumber manufacturing operation, because of the critical nature of his job, and the potential for some very costly errors.

Birch - the Saskatoon outlet moves approximately 25 M/yr of "select and better" grades only, in random lengths and widths, kiln dried to about 10% at an average price of $1400 Mfbm.

Elm - the company does not keep Elm in stock because of its tendency to twist and deteriorate when unstrapped.

-will special order from Vancouver warehouse as required. There is a demand for Elm veneer plywoods.

Ash - stock and sell only "select and better" grades. Saskatoon handles about 25

Mfbm/year. Average price for all grades - select and better - $3200 Mfbm.

-should find that prices are up over 1983 due to United States exchange rate, as well as the tight supply for some species (notably Oak, which is causing coincidental increase in price of Elm, Ash and Birch). Supply of birch is "fairly good".

APPENDIX II

"RECONNAISSANCE" SURVEY OF STUDY AREA

R.E. RICHMOND
SILVIBA SERVICES

March, 1986

I. METHODOLOGY:

For white birch, reconnaissance volume estimates were calculated from four (4) BAF 2M prism plots using the 'rule of thumb' formula: Vol/ha = 1/3 (BA)H, where H was estimated in meters to the 4 inch top d.i.b. point and an average obtained in each plot. To obtain estimates of factory grades, the trees were subdivided into log lengths by grade, according to the C.F.S. Publication - HOW TO GRADE HARDWOOD LOGS FOR FACTORY GRADE LUMBER - Petro, Calvert - 1976. A taper factor of 1.02 cm/m of log length was used, after conversion, to read off the board foot values from the volume tallies included with the publication. In the absence of white birch tables, those for yellow birch were used. It should be noted that no reasonable association between the ratio of fbm and square meters per plot was identified, thus the 'rule of thumb' equation was used instead. Also, no cull factor was used at this stage in the calculation of net volume/ha. Lastly, the same procedure was used for the calculation of white elm grade percentages, together with a volume/ha estimate, all based on just one plot considered to be representative.

The volume/ha values for the birch plots were then transformed into a weighted average value of 5110 fbm/acre, considered to be representative of the area sampled. A further estimate of 2000 fbm/acre was provided by Bob Sauder to cover the remaining, less attractive commercial areas within the tract. Assuming that half the tract cruises out at 5110 fbm/acre, and the other half could be assumed to contain 2000 fbm/acre, the average value becomes 3555 fbm/acre. This was the figure used in conjunction with the Saskatchewan Parks and Renewable Resources inventory to derive a potentially commercial area of 9000 acres.

II. RECONNAISSANCE PRISM PLOTS: ECONOMICS OF UTILIZATION OF SASKATCHEWAN HARDWOODS - March 5/86

(All Plots: BAF 2M)

Plot 1: Lowland

Tree No.	Dbh (Inches)	Length/Gade (feet) All Birch		
1	12		35/2	
2	8		20/2	20/3
3	7			35/3
4	8			35/3
5	14	10/1	10/2	20/3
6	12	12/1		30/3(est)

532 fbm

No. 1 17%
2 21%
3 62%

Vol/ha = 1/3 BA x Ht
= 1/3(12) x 13m
= 52 m3/ha (8.7 cds/ac)

Plot 2: Midslope

Tree No.	Dbh (Inches)	Length/Grade (feet) All Birch		
1	14	10/1		50/3
2	12			25/3
3	10			15/3
4	14		12/2	18/3
5	10			40/3
6		Dead		
7		Dead		

654 fbm

No. 1 15.7%
2 25.4%
3 58.8%

Vol = 1/3(10) 14.1m
= 47 m3/ha
(7.8 cds/ac)

Plot 3: Upper Gully

Tree No.	Dbh (cm)	Length/Grade (feet) All Birch		
1	46.8cm	16/1		20/3
2	16		20/2	20/3
3	18	8/1	20/1	10/3
4	12			30/3
5	14		20/2	10/3
6	8			20/3
7	10			30/3
8	32.3cm*			40/3

*8" used in calculations

1385 fbm

No. 1 25.9%
2 32.6%
3 41.5%

Vol = 1/3(16) 16.1m
= 85.3 m3/ha
(14.4 cds/ac)

Plot 4: Midslope Bench

Tree No.	Dbh (cm)	Length/Grade (feet) All Birch		
1	36.5 cm	8/1	4/2	30/3
2	40.0 cm	16/1		20/3
3	55.0 cm	10/1		25/3
4	35.2 cm		6/2	25/3
5	39.0 cm		25/2	
6	44.0 cm		22/2	
7	36.8 cm	16/1		16/3
8	31.0 cm		16/2	20/3

1588 fbm

No. 1 27.7%
2 49.4%
3 22.9%

Vol = 1/3(16) 15.1m
= 80m3/ha
(13.5 cds/ac)

Elm Plot

Tree No.	Dbh (cm)	Length/Grade Feet		
1	25.5			40/3
2	20.6			25/3
3	38.8			30/3
4	30.6	20/1		10/3
5	47.0	8/1	20/2	10/3
6	47.7	8/1	20/2	10/3
7	19.8			25/3
8	36.0			25/3
9	22.5			20/3

No. 1 13%
2 15%
3 72%

Using Maple Grades as a Substitute.

III. NET MERCHANTABLE VOLUMES AVAILABLE FOR WHITE BIRCH, WHITE ELM AND GREEN ASH ALONG THE KELSEY TRAIL REGION EAST OF CARROT RIVER

1. WHITE BIRCH

Reconnaissance Plots:

1. Lowland	: 52m3/ha Residual	8.75	cords/ac
2. Midslope	= 57m3/ha Residual	7.8	cords/ac
3. Upper Slope Gully	: 85.3m3/ha Residual	14.4	cords/ac
4. Midslope Bench	= 80m3/ha Residual	13.5	cords/ac

Given Area Classification, From Observations, as follows:

Lowland	35% of Terrain
Midslope	30% of Terrain
Midslope Bench	25% of Terrain
Upper Slope	10% of Terrain

Then Weighted Average NMV/ac Becomes:

10.22 cords/ac --60.7m3/ha --5,110 FBM/ACRE

From Plot Data: No. 1 Grade = 22% or 1125 FBM/acre
No. 2 Grade = 32% or 1635 FBM/acre
No. 3 Grade = 46% or 2350 FBM/acre

COMPARISON WITH PROVINCIAL INVENTORY, 1984 SUMMARY:

GIVEN 11 map sheets (see key map) : 110,000 ha gross.

AND 55,624 ha productive forest area.

AND GIVEN 704,818m3 Gross Merchantable Volume Minus
27% cull - 514,517 m3 NMV White Birch

THEREFORE NMV = 9.2 m3/ha = 1.5 cords/ac net.

BUT ASSUME that 30% of NMV is Economically Accessible

THEREFORE 32 million FBM White Birch available.

GIVEN that Best area produces 5110 FBM/acre (plots measured on best sites)

Worst Average/Area Produces 2000 fbm/acre:

Comments and Conclusions from Bob Sauder

AND inventory provides 32 million FBM

THEN 32 MMBM/5110 + 2000 = 9000 acres available

$$\frac{5110 + 2000}{2}$$

THIS COULD MEAN 1 operator for 32 years
or
2 operators for 16 years

THEREFORE RECOMMEND: 2 Operators until further inventory analysis proves otherwise : at 3555 FBM/acre

RE: GREEN ASH...............95% is 7.9 inches dbh
THEREFORE none of sufficient size to be attractive.

RE: WHITE ELM 10.6 inches dbh

We know it is found in pockets along the Sipanok Channel: 73,600 m3 net OR 15 MMBA. This should be reduced to 10 MMBM for planning purposes.

From one plot grades are estimated at: 13% No. 1
15% No. 2
72% No. 3

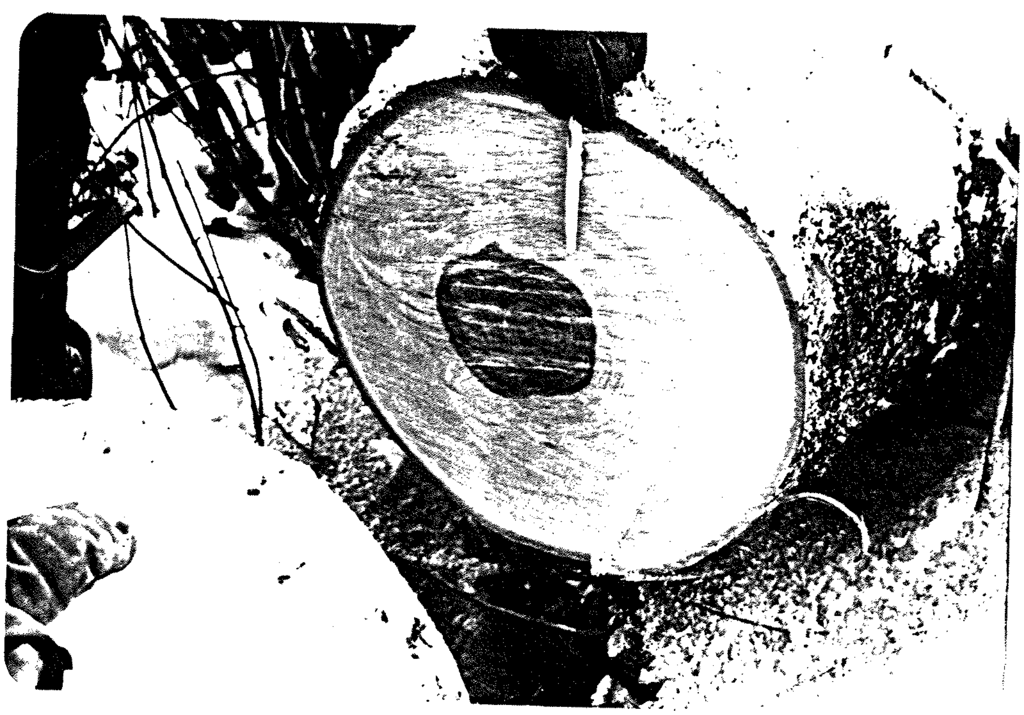
However no white elm grading specs were applicable. There should be pockets where more No. 1 may be found.

Logging of White Elm and Birch should be premised on appropriate forest renewal obligations.

A budget of $20,000. for update photography and an operational cruise should be provided for before a white birch operation commences. One needs two years planned in detail with a further three years identified in principle.

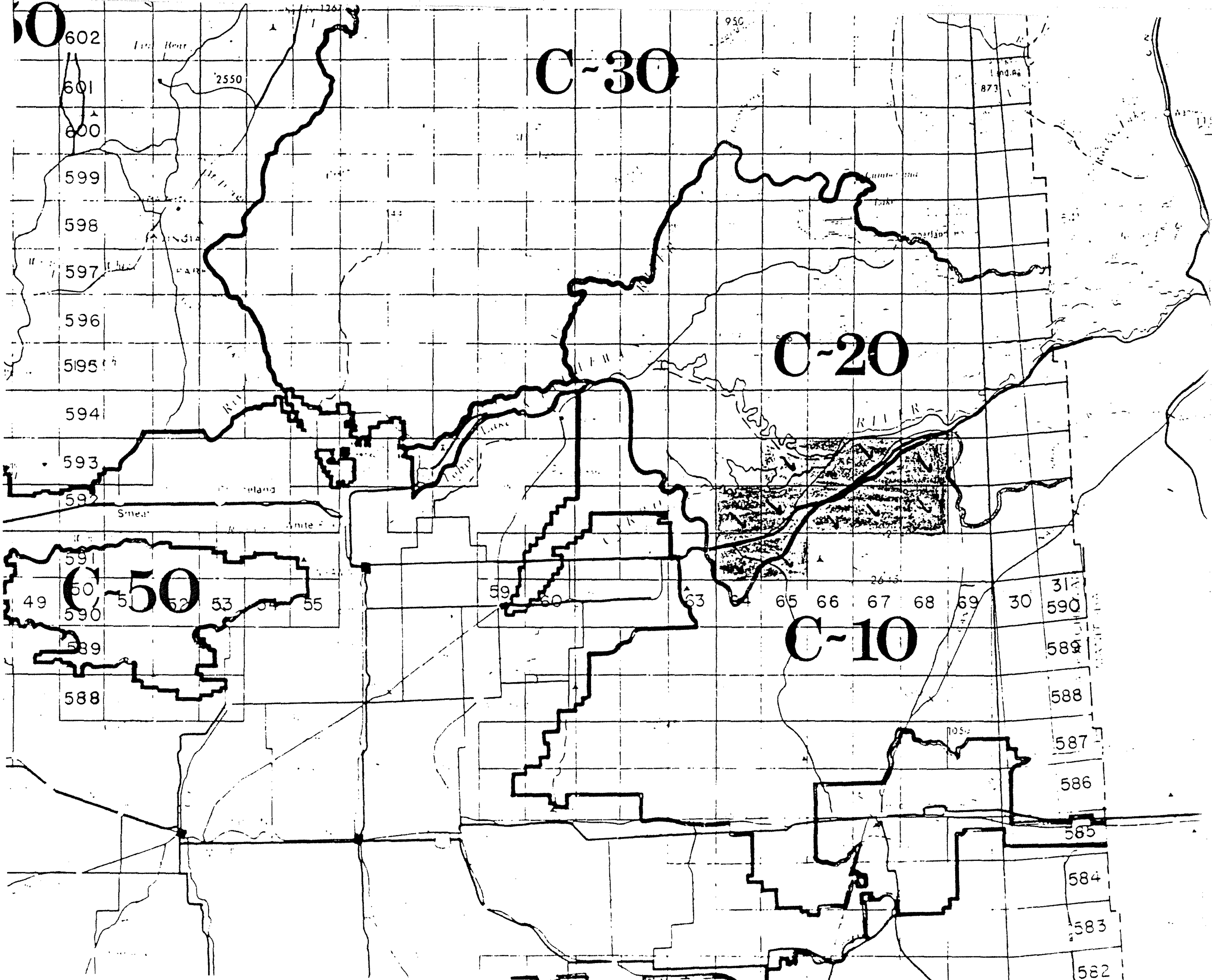
Birch stump - Poorest sample bucked.

Birch butt log. Best sample bucked.



A stand of elm/ash along power line at the Sipanok Channel.
Note high water line.

Typical pure birch stand. White spruce logged out.
Upper slopes - Pasqua Hills.



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APPENDIX III

PETRO AND CALVERT

HOW TO GRADE HARDWOOD LOGS FOR FACTORY LUMBER

1976 - C.F.S.

FACTORY GRADE LUMBER YIELDS
by Log Class

Lumber grade yields for yellow birch logs

Diam class	Number of logs	Total recovery (board feet)	Lumber grade recovery (%)						
			FAS	SEL	1C	2C	3A	3B	1C & Better
			Log grade F–1						
13	13	1,169	15.7	25.4	25.3	15.4	11.8	6.4	
14	12	1,232	18.9	30.9	15.1	7.7	11.8	15.6	
15	11	1,250	28.0	28.2	15.7	8.5	12.1	7.5	
16	14	1,646	22.3	16.6	29.0	13.8	7.6	10.7	
17	10	1,380	36.2	19.4	20.7	10.3	9.5	3.9	
18	6	1,024	13.3	20.0	33.9	15.5	7.2	10.1	
19	6	1,030	29.4	20.4	32.5	8.9	7.9	0.9	
20	13	2,283	34.0	23.7	18.1	11.0	7.0	6.2	
21	1	234	52.3	8.7	14.2	9.0	1.9	13.9	
22	4	989	59.2	11.3	14.2	7.3	6.6	1.4	
23	1	312	75.0	10.6	9.9	4.5	—	—	
26	1	217	22.8	46.4	13.7	14.6	—	2.5	
27	1	370	72.4	16.9	6.5	1.4	1.4	1.4	
All	93	13,136	31.3	21.7	21.3	10.6	8.2	6.9	74.3
			Log grade F–2						
10	29	1,193	3.4	18.6	22.0	20.9	24.3	10.8	
11	71	3,819	4.8	18.0	19.3	20.2	24.9	12.8	
12	53	2,976	6.3	20.4	20.2	17.5	20.5	15.1	
13	46	3,200	5.7	14.1	22.5	17.4	22.4	17.9	
14	30	2,242	4.8	14.2	19.5	17.2	23.3	21.0	
15	30	2,773	9.1	16.3	24.6	18.2	14.8	17.0	
16	32	3,258	11.0	16.5	22.4	16.7	16.5	16.9	
17	23	2,983	20.2	21.5	18.9	15.2	13.6	10.6	
18	25	3,254	22.1	18.8	23.2	11.3	14.4	10.2	
19	10	1,215	25.3	24.0	13.5	11.4	14.5	11.3	
20	11	1,807	14.1	20.8	19.0	13.8	13.2	19.1	
21	7	874	13.9	25.7	22.7	10.8	8.2	18.7	
22	5	809	19.5	24.1	14.3	16.8	14.7	10.6	
24	1	227	16.8	13.3	20.1	32.7	11.9	5.2	
All	373	30,630	11.5	18.4	20.8	16.5	18.1	14.7	50.7

Lumber grade yields for yellow birch logs *(continued)*

Diam class	Number of logs	Total recovery (board feet)	Lumber grade recovery (%)						
			FAS	SEL	1C	2C	3A	3B	1C & Better
			Log grade F–3						
8	64	1,550	0.6	4.6	9.4	13.3	41.1	31.0	
9	127	3,740	0.3	3.6	11.7	21.5	34.0	28.9	
10	102	3,383	0.6	4.7	14.5	23.1	33.7	23.4	
11	75	3,286	1.3	4.4	12.8	21.5	30.7	29.3	
12	67	3,266	2.4	6.0	15.6	18.1	32.6	25.3	
13	36	2,006	0.7	3.5	13.3	23.3	34.8	24.4	
14	25	1,519	2.1	3.9	18.9	24.7	22.6	27.8	
15	22	1,495	1.9	5.3	22.1	26.4	20.5	23.8	
16	19	1,686	4.7	5.1	22.6	19.3	25.7	22.6	
17	2	86	—	—	24.9	28.8	36.4	9.9	
18	6	433	2.9	10.4	24.5	19.3	16.4	26.5	
19	1	74	28.3	5.4	—	35.5	24.1	6.7	
20	2	246	10.2	7.4	13.2	16.7	34.4	18.1	
22	1	256	43.9	20.7	18.8	7.3	5.1	4.2	
24	1	206	52.8	31.7	6.2	3.5	1.6	4.2	
All	550	23,232	2.5	5.1	15.0	20.9	30.7	25.8	22.6

Lumber grade yields for hard maple logs

Diam class	Number of logs	Total recovery (board feet)	Lumber grade recovery (%)						
			FAS	SEL	1C	2C	3A	3B	1C & Better
			Log grade F–1						
13	21	1,713	16.0	18.5	21.4	12.8	11.6	19.7	
14	15	1,446	26.6	22.4	21.4	11.6	4.6	13.4	
15	14	1,380	20.1	28.4	23.3	11.5	5.3	11.4	
16	10	1,230	19.5	27.4	20.1	8.8	12.2	12.0	
17	6	788	34.9	17.6	21.8	10.3	2.6	12.8	
18	2	308	41.5	31.0	16.6	6.4	4.5	—	
19	3	329	24.9	36.6	25.1	10.9	2.5	—	
20	1	79	15.2	57.8	11.7	8.9	—	6.4	
21	3	556	40.0	23.9	17.3	9.0	2.7	7.1	
22	2	419	25.4	23.4	26.9	12.0	10.9	1.4	
25	1	347	27.3	41.4	12.8	5.8	5.8	6.9	
All	78	8,595	24.4	24.9	21.1	10.7	7.1	11.8	70.4

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ABBREVIATIONS USED IN REPORT

D.N.S.	Department of Northern Saskatchewan
M.C.	Moisture Content
K.D.	Kiln Dried
M	Thousand
MM	Million
fbm	foot board measure
b.f.	board feet
AAC	Annual allowable cut
F.A.S.	Free all sides
S2S	Smooth two sides
S4S	Smooth four sides
CFS	Canadian Forestry Service