Adding value to woodlot products — maritime maple

by John C. Lees

Introduction

New uses for presently underutilized species is an important component of Canada's Forestry Sector Strategy. Natural Resources Canada, in cooperation with the University of New Brunswick Wood Science and Technology Centre, and with the support of the Canada/New Brunswick Forestry Development Agreement initiated this investigation of the suitability of red maple (*Acer rubrum* L.) for the manufacture of high quality furniture products.

The problem of underutilization of "lower quality hardwoods" was examined in detail in 1982 at a conference "Fuel or Fibre? Hardwood Utilization and Marketing Opportunities", sponsored by the Atlantic Provinces Council on the Sciences (Lees, 1982). Reports of market resistance to red maple in the furniture trade were common, although opportunities for the sale of smaller shop-cuts were identified in the expanding "do it yourself" market. As a silviculturist I was challenged by the favourable growth attributes of the species, its abundance, and its availability in the hands of small woodlot owners who were enthusiastic about mixedwood management.

The concept of selling this familiar species under a new name, Maritime Maple, properly packaged and displayed, was, appealing to me. Ten years later test cutting began on Vern Fraser's woodlot at Pokiok, NB.

The text of this article was extracted from the report, "Utilization opportunities for Maritime maple (*Acer rubrum* L.) to produce value-added products," prepared by John White, Graham Savage, Bob West, Ernie Strickland, and Jock Lees.

Description of the study

The study comprised a series of eight sequential phases designed to describe the occurrence, growth, harvesting, sawing, drying, machining, product design and final wood product manufacturing of Maritime maple. In general, the output of the one phase was required to undertake the next phase, although there was some overlap.

Each of the participants was involved in one (or more) phase(s) of the study, ensuring that the phase was executed correctly and that a report of the activities was produced. The written record also incorporated any pertinent background information gleaned from published and unpublished sources.

The Phases of the study are outlined below:

Phase 1 — Resource Definition: Description of the occurrence, quantity, quality, silvics and general forestry baseline information about Maritime maple.

Phase 2 — Evaluation of the Wood and Its Properties: Collection of information on the mechanical properties of the wood, lumber and veneer.

Phase 3 — Product Specification: The information package developed in Phase 2 was provided to the product designers who on a competitive basis specified products to be fabricated locally.

Phase 4 — Product Selection: Design proposals were evaluated by an independent panel of judges with appropriate products selected for manufacture.

Phase 4 — Acquisition of Sawlogs: Approximately 6 000 board feet (fbm) of Maritime maple, in 8' lengths, with a minimum top diameter of 6" were acquired from a local woodlot.

Phase 5 — Sawing the Logs into Lumber and Drying the Lumber: The logs were sawn at the Maritime Forest Ranger School Training Sawmill, and subsequently dried in the MFRS kiln.

Phase 6 — Manufacturing the Specified Products: The products selected by the judges were produced by New Brunswick manufacturers.

Phase 7 — Presentation of the Products: The products of the study were introduced to the forestry community at SYLVI-CON '93 in Fredericton, N.B.

Phase 8 — Display of the Products: Products will be on permanent display at the Hugh John Flemming Forestry Complex in Fredericton. The display will incorporate the products of the study, signage and a promotional brochure.

Characteristics of Maritime Maple Silvics

"Maritime maple" (*Acer rubrum* L.) is the most abundant hardwood tree species in New Brunswick and Nova Scotia (Lees 1978). It is commonly called red maple, soft maple, white maple or scarlet maple. A table summarizing the New Brunswick inventory for Maritime maple on all ownerships and as a percentage of total hardwood volume is included in Appendix 1. Maritime maple comprises 8 per cent of the province's total merchantable volume and 25 per cent of total hardwood volume.

The characteristics of Maritime maple are explained in detail in Silvics of Forest Trees of the United States (Fowells 1965), Trees of the Eastern and Central United States and Canada (Harlow 1957), Native Trees of Canada (Hosie 1979), Manual of the Trees of North America (Sargent 1965), Hardwood Thinning Manual (Robertson *et al.* 1991), and others.

Appearance

A medium-sized forest tree 15 to 20 m. high with diameter occasionally as great as 60 cm. It has a fairly long trunk, irregularly shaped crown, and a shallow root system. Red shoots, flowers, and leaf buds in spring and in fall bright red leaves enhance its amenity value.

Site Preference

Borders of streams, wet swamps and upland forests. Rarely found on dry rocky hillsides or sand dunes.

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Reaction to Competition

Usually considered a pioneer or subclimax species, it often grows with other pioneer species such as pin cherry, aspen and white birch. However, it is longer-lived and more shade tolerant, and often functions as an intermediate in many forest stands.

Regeneration

The species regenerates from seed, stump sprouts and root suckering. With proper management all three regeneration systems will produce trees of log quality. At least three successive generations of stump sprouts can thrive on the same regenerating root system (Lees 1981). Fruit ripens in late spring and seeds usually germinate the same year although a small percentage will not germinate until the following year.

Appropriate Silviculture

The species is windfirm except on wet sites. It is responsive to thinning while young (up to 40 years) however, epicormic branches may persist. Shelterwood and coppice are the preferred silvicultural systems.

Maritime maple will develop the best quality when established in stands dense enough to train good stem form. They should remain crowded for at least twenty years or until the lower stem is clear of branches. Good stems can then be favored for diameter growth by thinning competing trees. (Richards 1993).

Wood Properties

The wood of Maritime maple has a basic relative density of about 0.54 which is approximately 85% of that of sugar maple (*Acer saccharum* Marsh.). Since the arrangement and sizes of woody cells are similar in the maples, the mechanical properties of maples are dependent largely upon the amount of wood substance per unit volume of wood. Thus the mechanical properties of Maritime maple should be approximately 15% less than those of sugar maple. Testing of maple wood from Ontario (red maple) and New Brunswick, Quebec and Ontario (sugar maple) showed between 15 and 20% lower mechanical property values for red maple (Kennedy, 1965). The higher grades are, nonetheless, substituted for sugar maple in furniture (U.S. Dept. of Agriculture, 1987).

A study of machining properties of various woods in Canada showed sugar maple and red (Maritime) maple to be similar in planing and shaping, but with Maritime maple inferior in turning, boring and mortising (Cantin, 1965). It dries well and has superior steam bending qualities to sugar maple.

The woods of sugar and Maritime maple are similar in appearance. Besides the lower density, red maple sapwood often has a slightly overall greyish cast or grey steaks compared to the cream to light brown of sugar maple (Hoadley, 1990).

The Dry Kiln Operators' Manual (U.S. Dept. of Agriculture, 1988) has a moisture-content based schedule for red maple. The expected drying time for one inch maple from green to six per cent is seven to thirteen days, while it is eleven to fifteen days for sugar maple. Woods which dry similarly to Maritime maple and can use the same kiln schedule include silver maple (*Acer saccharinum* L.), ash (*Fraxinus* L.) and yellow birch (*Betula alleghaniensis* Britton). Sugar maple is grouped with dense wood species such as beech (*Fagus* spp. L.).

Two red maple sawlog trees.

Procedures

Log Acquisition

The York-Sunbury-Charlotte Forest Products Marketing Board & Wood Co-Op was invited to identify members with suitable woodlots who would be interested in participating in the program. Staff from the Hardwoods Research Group of Natural Resources Canada reviewed several candidate sites before selecting Mr. Vernon Fraser's woodlot at Pokiok Settlement, York County. Arrangements were made to harvest and deliver the logs under contract.

To ensure minimal mechanical damage to residual stems the contract stipulated that harvesting could not be started before August 15. Hardwoods in this region have stopped active growth by this time and the risk of mechanical injury is significantly reduced.

Sawing and Drying

Logs were sawn at the MFRS Training Sawmill, Fredericton, New Brunswick. Logs were debarked using a rosser-head debarker prior to measurement. Then the butt diameter, top diameter and length of each log were measured to the nearest 3 mm (1/8"). Using this data, the log scale was calculated. Because the lumber needs of the designers were not known at the time of sawing, it was decided that all lumber would be sawn to the same thickness, 28.5 mm (1 1/8") and random width. Logs were sawn on a double cut band headrig with a kerf of approximately 0.145". The logs were turned to obtain the maximum grade and

volume yields. All pieces were produced at the headrig and those requiring edging were sent to the board edger. The kerf of the edger saws is 0.170". The lumber was not trimmed, piled random-width, on stick (19 mm), and set out in the yard for partial air-drying for approximately 24 days.

After partial air-drying, the moisture content of the sapwood was approximately 60% and the heartwood 30%. It was then dried in a dehumidification (Nyle 6 Mfbm capacity) kiln located at the Training Sawmill (Table 1).

Table 1. Drying.

Time	Moisture content (%)	Dry bulb (°F)	Wet bulb (°F)	Equilibrium moisture content (%)
4 days	61-20	130	123	14.3
9 hours	20-18	140	120	7.8
9 hours	18-16	150	120	5.3
4 days	18-6	133	100	4.8
6 hours	Conditioning	142	128	11

Drying time was seven days with three days of conditioning.

The drying schedule used resulted in good drying of the sapwood; however, the sapwood the heartwood was not dried adequately. To dry both together would have required a slower schedule. There was sticker stain throughout all piles of lumber. It is believed that this sticker stain was the result of leaving the wood to air-dry for the 24 days prior to kiln-drying, and perhaps to some degree attributable to the quality of stickers used. With the high relative humidity that is usually experienced in August, this staining problem should have been predicted. The lumber was graded after drying; the grade yield is shown in Table 2.

Table 2. Grade yield of lumber after drying.

Grade	Volume (fbm)	Percent
FAS	90	2.4
Sel	506	13.7
1 com.	861	23.3
2 com.	1077	29.1
cull	1155	31.5

Design of Demonstration Pieces

One of the main objectives of this project was to present innovative and thought-provoking pieces of furniture or accessories designed and manufactured in New Brunswick using Maritime maple. This was met through the efforts of the Association of Interior Designers of New Brunswick. They developed a design challenge within their organization.

The Association developed a guideline for designs deemed appropriate for the demonstration of the qualities of Maritime maple and distributed it to its twenty-one members. The categories suggested included: residential, office/commercial, education/institutional, restaurant/hospitality, and interior finishes, along with suggestions within each category. Once a design was selected, working drawings were prepared by the original designer for the manufacture of that piece.

Judging of Design Submissions

A panel of judges was appointed by the project coordinators to evaluate the design submissions and select those that were to be manufactured. The judges included the President, Interior Designers of Canada, the President, Architects' Association of New Brunswick, and the general manager of the Maritime Forestry Complex Corporation.

Consol table, clear finish.

The judging criteria included the following:

- Appropriate use of wood
- Innovation
- Overall design
- Durability for intended use
- Appearance
- Functionality
- Uniqueness
- Reproducibility
- Marketability

The designs with the highest ranking were selected for manufacturing. These included the following:

Spinal cord chair — This chair was considered to be a signature piece. The back consists of two panels of laminated veneer moulded to fit the contours of the human torso. The panels are attached by leather lacing. The seat is a round contoured plate covered in a burgundy leather. The color was a mix of clear finish (on the back) and burgundy on the seat, front legs and lacing.

Conference table — The design of this pedestal table is very flexible in that the top consists of three separate sections, i.e. the center, the working surface and the border. The manufacturer could use many combinations of wood and non-wood products to customize the table for different commercial or residential environments. For this project it was decided that the working surface would be covered with a forest green leather, with the wood components (Center, border and pedestal) finished with a mahogany stain.

Children's furniture — This series of designs consisted of roll-top toy box and a table and chair. All pieces were designed to be very sturdy for a high impact environment. The designs incorporated transparent color stains and demonstrated the wood's potential to be veneered, bent and machined.

Console table — This table consisted of a plywood top with a solid border and glued and turned sections for legs. It is the only piece that had a clear finish, which thus demonstrated the natural character of select pieces of wood. The design also included black lacquered accents which could lend itself to customizing for different tastes and applications.

Door skins — These door designs incorporate wood and non-wood solids laminated to natural finished Maritime maple doors. Such door skins are easily incorporated into a standard manufacturing process and provide a unique opportunity to liven interiors.

Conclusions and Recommendations

Each of the manufacturers were contacted and asked to comment on their experience using Maritime maple to manufacture high value components. One manufacturer with extensive experience ranging from the stump through to finished furniture stated that like all northern hardwoods, Maritime maple is an excellent wood for the manufacture of furniture. With proper training in all aspects of the process starting with woodlot management he felt that there is no reason why this species could not be developed into an important commercial species. The problems that were experienced in this project are no different than those that would be expected in working with

any new species of wood. Other manufacturers stated that the wide range in natural colour was an undesirable trait for clear finished applications. However because of the close grain structure the wood accepts coatings well and is considered an ideal species for painted or deep colored applications such as kitchen cabinets. There tends to be a lot of defects such as soft knots which again restrict the natural applications to those consisting of short components, such as children's furniture.

The project has demonstrated that Maritime maple can be managed as a saw timber species. The wood is suitable for use in many types of furniture and trim applications. Sawlogs less than 10 inches in diameter are difficult to get acceptable recovery from due to the large heart. It would be difficult for any sawmill to manufacture lumber economically from small diameter Maritime maple sawlogs.

In the process of demonstrating the suitability of Maritime maple for use in high value wood products several operational and management areas were identified where further development or education is necessary.

Research and Development Opportunities

The provincial inventory presented as Appendix 1 provides an estimate of total timber volume by diameter class. However, it is of no value in determining the amount or distribution of log quality trees in the province. There is a need to develop a system to assess the sawlog potential of standing timber, which will allow its volume to be quantified by conventional inventory procedures. This assessment would provide an estimate of the proportion of sapwood and heartwood in the individual stems in a coartype. This need is not unique to Maritime maple but would be of great value for the management and utilization of all hardwood species.

The conventional wisdom is that the proportion of heartwood in a Maritime maple stem is inversely proportional to the quality of the site and the growth rate of the stem. This needs to be verified. Silvicultural prescriptions to minimize heartwood in individual stems need to be developed and tested.

Since heartwood can be a significant portion of a Maritime maple stem there is an R&D opportunity to develop high value uses for it. This research should also address procedures for sawing and drying heartwood lumber or lumber with a high percentage of heartwood.

Education

Some of the areas where education is needed to help maximize the yield from the Maritime maple resource include:

- (1) Felling and skidding techniques to minimize mechanical damage.
- (2) Bucking for maximum yield and profit.
- (3) Assessing nature and extent of quality defects in standing trees and felled timber.
- (4) Silvicultural practices necessary to ensure a sustainable or enhanced yield of quality logs.

In the woodlot, Maritime maple can fulfill the role of nurse crop for more shade tolerant hardwoods and softwoods. At the end of its rotation Maritime maple may be removed to release a second crop of perhaps more valuable stems, and to produce an interim yield. Remember to thin early and often, removing no more than 25% of the basal area. More trees can be cut later as necessary, but overthinning creates empty gaps which encourages weed species and epicormic branching on poten-

tial crop trees. Groups should be cut large enough and strips wide enough to stimulate height growth of this intermediate to shade intolerant species (Lees 1978). Appropriate silvicultural treatments should be demonstrated.

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Appendix 1. Summary of New Brunswick red maple growing stock (1986 inventory)

Ownership	Gross merch. hardwood vol. 1000,000 m ³	Gross merch. red maple vol. 1000,000 m ³	Red maple as % of merch. hardwood vol.	Red maple as % of total merch. volume
Private woodlots	57.4	14.1	25	10
Large freehold	45.7	10.4	23	8
Crown land	83.8	23.1	28	7
Total for province	186.9	47.6	25	8

Appendix 2. List of participants

- Natural Resources Canada*
Ken Runyon — Scientific Authority
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Pierre Leroux
Graham Savage — Project Coordinator
- Maritime Forest Ranger School*
Michael Boucher
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Robert Whitney
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Don Clark
- Association of Registered Interior Designers*
Colleen O'Donnell
Sara Dunton
Louise Duguay
Betty Atkinson
- Wood Science and Technology Centre*
Marc Schneider
Jonathon Phillips
Dean McCarthy
John White — Contractor
- Y-S-C Forest Products Marketing Board*
Mohamed El-Bayoumi
David Palmer
Vernon Fraser — woodlot owner
- Hugh John Flemming Forestry Centre*
Cecil Freeman
- Architects' Association of NB*
Ed Koch
- Interior Designers of Canada*
Lynda Tetrault
- Economic Development and Tourism*
Keith Steeves
- Industry, Science and Technology Canada*
Charles MacArthur
- Manufacturers*
Queenstown Industries
Universal Outdoor Products
Les Ateliers Arpin Ltee.
Seaside Woodworks
A.A. Beaulieu Ltee.
- Others*
George Bennett — MTC — UNB
Gordon Smith — Procraft
Roelof Kiers — Kiers Productions
- Reynaking Woods Ltd.
York Tek Precision
E.L. Pine Manufacturing Ltd.
Colonial Manufacturing Ltd.