NOTE

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ABSTRACT

The study presents the outlook for the forest and forest products sector in North America to 2015 with scenarios for the forest resource and raw material supply, demand and prices for roundwood and forest products and for "offshore" trade (i.e. with other regions).

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NORTH AMERICAN TIMBER TRENDS STUDY

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PREFACE BY THE SECRETARIAT

The European timber trends studies have reviewed the outlook for the forest and forest products sector in Europe at approximately 10 year intervals since the early 1950s. The fifth study, European Timber Trends and Prospects into the 21st Century (ETTS V), will be published in spring 1996. Canada and the United States of America, although members of ECE and FAO, were treated as outside suppliers, because of the very different nature of their markets and resources.

In 1990, however, a companion study to ETTS IV was issued under the title "Timber Trends and Prospects for North America" (ECE/TIM/53). This study was welcomed as a concise, authoritative contribution to the network of information and analysis on the outlook for the world's forest sector. Forestry Canada and the USDA Forest Service, which prepared the first study, known as NATTS, have now prepared a successor (NATTS II), which brings its predecessor up to date for the mid 1990s and benefits from the progress in information collection and analysis that have taken place in recent years. The principal authors of both NATTS studies have been David Boulter of Forestry Canada and David Darr of the USDA Forest Service. The secretariat wishes to express its profound appreciation of the contribution made by both the above experts, their colleagues and their organisations, to the increasingly important task of analysing the outlook for the forest and forest products sector, which is an indispensable step towards achieving sustainable forest management all over the world.

EXECUTIVE SUMMARY

This study was jointly undertaken by the United States Forest Service and the Canadian Forest Service (the national forestry agencies in the two countries) and assesses the prospects for timber supply and demand in North America to the year 2015. We begin with an overview of future prospects from two studies which also include assessments of North American prospects for timber supply and demand.

The forests of North America are an important, diverse and dynamic resource. Forests are found in every state and every province and territory of the United States and Canada respectively. Total forest land covers some 7.1 million square kilometers or about 40% of the total land area. This is approximately five times the size of the European forest area. These forests support substantial employment and income in forest industries and provide the vast majority of the wood products required by the population of North America and considerable surpluses for the international market. In addition, they represent a unique and important recreational, aesthetic and environmental resource.

There are distinct differences between the United States and Canada in the pattern of forest land ownership (table 5). For the United States as a whole, 73% (145 million hectares) of productive and available forest land is owned by private individuals or companies. National forest lands (administered by the United States Forest Service) account for about 17% of the total, while state, county, municipal and other Federal government agencies (such as the Bureau of Land Management) administer the balance. In Canada, the majority of forest land is owned by the public sector and primarily the provincial governments. Fully 88% of the stocked, productive and available forest land in Canada is under provincial or territorial ownership and jurisdiction. Less than 1% is under Federal government administration. Finally, about 10% of stocked, productive and available forest land in Canada is privately owned.

Over the last three decades, North American timber harvests have increased quite dramatically. The extent to which this trend continues will depend in part upon the markets for forest products and timber. In the United States, there are significant non-market constraints on timber supplies from public lands. As a result, most future increases in supply must come from private lands. Growth removal balances indicate considerable further harvest potential in the north and southeast particularly for hardwoods. The situation is more constrained for softwoods. The future outlook for softwoods in the South and the Pacific Northwest depends on the ingrowth of plantations planted over the past two decades. State and local regulation of forest management on private lands may further constrain timber supplies from these lands.

In Canada, there are still substantial physical stocks of mature and over-mature timber available for harvest. However, there is considerable variation in the quality and condition of this timber, and the rate of harvest is to a greater or lesser extent constrained by public sustainable forest management policies and growing demands for other values on the forest land base. Even with these constraints there appear to be some further surpluses available to facilitate further expansion of the Canadian harvest. As in the United States the most significant surpluses appear to be hardwood. Geographically, harvests are likely to continue expanding on the prairies although at a slower pace. In other parts of the country some additional potential exists but harvest growth is likely to be well below historical levels. The rate of growth will be largely determined by demand and market trends over the period, as well as the growing demands for non-timber values on the forest land base that will constrain the harvest level.

The specific demand levels that have been projected are problematic and depend on the realization of many assumptions. There can be little doubt, however, that demands will increase significantly by 2015. Increased population by itself will dictate increased demands for all forest products.

The projected price increases initiate many market mechanisms. Available technology and market acceptance of fiber-based construction materials will tend to moderate price increases for roundwood. The effect of these materials on prices is reflected in past trends and in the demand projections which have been made. We cannot be certain, of course, that the demand projections adequately reflect the effect of technology in moderating price increases. For example, the nonconiferous timber resource in both Canada and the United states is under-utilized. Further development of this resource would moderate the price increases projected for coniferous species.

There are arguments to be made that we underestimate the price increases for roundwood. In the 1990's through 2015, North America will be going through a time when timber demands are increasing and

there is not a reserve of high-quality coniferous roundwood available for development. This situation is unprecedented in the twentieth century and may lead to market behavior not reflected in past trends.

CHAPTER 1

INTRODUCTION

Given the long planning horizons involved in forestry and the strategic importance of timber resources, over the years in many areas of the world there has been continuing concern over the adequacy of forest resources to meet anticipated future demands. In Europe, this concern has been reflected in a series of studies jointly undertaken by the United Nations Economic Commission for Europe (ECE) and the Food and Agricultural Organization of the United Nations (FAO). Since World War II, four reports on European Timber Trends and Prospects (ETTS) have been released, the most recent in 1986.[1] The fifth report on European Timber Trends and Prospects will soon be in Draft Review status, While this most recent report provides in- depth analysis of the internal European supply and demand situation to the year 2000 and beyond, considerable uncertainty exists with respect to external suppliers. In particular, North America is a large scale exporter to the European market. Trends and prospects for timber supply in North America could have a major influence on the European situation. For this reason, the secretariat of the ECE Timber Committee and the FAO European Forestry Commission requested that Canada and the United States undertake and provide a study compatible with the ETTS framework. This report updates an earlier study done for similar reasons.[2] Results of the study will also be used in a binational consultive process between Canada and the United States regarding North American timber demand and supply.

This study was jointly undertaken by the United States Forest Service and the Canadian Forest Service (the national forestry agencies in the two countries) and assesses the prospects for timber supply and demand in North America to the year 2015. We begin with an overview of future prospects from two studies which also include assessments of North American prospects for timber supply and demand.[3] The report then proceeds with a discussion of the North American forest resource in terms of its size, location and ownership distribution in both area and volume terms. In the following sections, the trends and prospects for raw material supply and forest product demand are discussed. This encompasses both a retrospective look at past history and a forward look at the potential future. The implications of the forecast forest product demand for timber requirements is then investigated. This involves an analysis of technological trends and other trends in recycling and by-product usage which may substantially influence product yields per unit of timber input.

Previous Studies of North American Timber Supply and Demand

By way of history, it should be emphasized that studies regarding the adequacy of timber supplies in North America are not new. Early studies dating back to the mid 19th century were generally done because of concern over the depletion of a specific product. For example, in eastern Canada there was concern that ship-mast quality white pine was becoming depleted. After analysis of this situation, a series of acts were implemented reserving individual white pine trees for use by the Royal Navy and providing for the establishment of forest preserves for the production of this strategic product. In general, the late 19th century in North America was a period of rapid change in forest cover, timber products were an important part of daily life and timber harvesting practices were largely exploitative. Over time, various laws were passed that encouraged forest management on private lands and implemented management on public lands. Also, other public lands were designated as National parks or other preserves that banned or restricted commercial

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[1]United Nations Economic Commission for European and Food and Agriculture Organization of the United Nations 1986. European timber trends and prospects to the year 2000 and beyond. United Nations, New York.

[2]United Nations Economic Commission for Europe and Food and Agriculture Organization of the United Nations. 1990. Timber Trends and Prospects for North America. ECE/TIM/53. ISBN 92-1-116468-0. 68 p.

[3]Jaakko Pöyry Consulting. 1994. Solid wood products competitiveness study report. Prepared for: American Forest and Paper Association. Tarrytown, New York. Apsey, Mike and Les Reed. 1994. World timber resources outlook--Current perceptions: A discussion paper. Council of Forest Industries, Vancouver, British Columbia.

exploitation.

In the United States, following World War II, management of private lands for forestry became more common, especially on lands owned by the forest industry. Public lands were increasingly in demand for purposes other than just timber products. Interest groups vied with one another for management of public lands according to their individual preferences. The United States (US) political system responded to this with a landmark piece of legislation: the Renewable Resources Planning Act of 1974 (RPA). The RPA established a process for assessing the demand and supply outlook, over a fifty year planning horizon, for all renewable resources on all forest and range lands in the nation. These assessments were intended to provide a factual basis for a national program designed to maximize the net public benefits from these resources. In keeping with the requirements of the act, a first assessment of timber supply and demand was produced in 1975 and a second in 1979.[4] A third such assessment[5] was completed in 1989. An Update[6] of the 1989 report provides the basic material for the U.S. portion of this report.

In Canada, similar national studies have been performed but on a more irregular basis. A pioneer study[7] was produced in 1957 under the auspices of the Royal Commission on Canada's Economic Prospects (The Gordon Commission). This study projected future consumption of forest products to 1980 and examined the adequacy of Canada's timber supplies to meet this demand. Other studies[8] followed in 1966 (in conjunction with the Montebello National Forest Conference) and in 1971 (by the Canadian Forestry Service the precursor of the Canadian Forest Service). Both of these later studies attempted a similar exercise as the Gordon Commission with a forecast horizon to the year 2000. Since that time, and most significantly over the last few years, considerable work has investigated either the supply potential of Canadian forests or future market potential. However, an integrated analysis of both the future supply and demand for timber has not been completed. In the previous Canadian studies and the earliest RPA assessment work, a relatively basic analytical framework was used. Anticipated consumption was derived from the projected values of a series of exogenous variables generally related to the level of anticipated economic activity. The future supply of timber was independently estimated largely on the basis of apparent physical availability as limited by policy constraints. Any "gap" identified between anticipated consumption and production was considered a problem requiring a policy response.

In more recent RPA assessment work, considerably more sophisticated planning and analytical techniques have been used. One major advance has been the development of timber inventory models which permit analysts to track through time the management assumptions made as stands are regenerated and grow

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[4]USDA Forest Service. 1982. An analysis of the timber situation in the United States, 1952-2030. Forest Resource Report No. 23. Washington, D.C.

[5]Haynes, R.W. 1990. An analysis of the timber situation in the United States: 1989-2040. A technical document supporting the 1989 RPA Assessment. General Technical Report RM__. USDA Forest Service. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. (In progress).

[6]Haynes, Richard W.; Adams, Darius M.; Mills, John R. 1995. The 1993 RPA timber assessment update. General Technical Report RM-259. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 66 p.

[7]Davis, J. et.al. 1957. The outlook for Canadian Forest Industries. Prepared by the Forestry Study Group, Royal Commission on Canada's Economic Prospects. W.L. Gordon, Chairman. Government of Canada. Queen's Printer, Ottawa, Canada.

[8]Government of Canada. 1966. National forestry conference: Background papers and general information. February 21-24. Montebello, Quebec.

to maturity. In addition, mathematical market models have been developed which facilitate simulation of market equilibrium rather than a gap between demand and supply.[9]

General Approach to Methodology

This study uses an amalgamation of earlier and more recent techniques.[10] Information from the most recent RPA assessment has been excerpted and used throughout the US section of the analysis. The US analytical system provides for a balancing of supply and demand within the US market incorporating assumed trade flows both within North America and to offshore markets. This level of sophistication cannot be duplicated in Canada and the Canadian analysis relies on more traditional techniques. Both Canadian domestic consumption and off-shore trade flows are forecast on the basis of multiple regression analysis.[11] Consideration of timber supply largely relies on provincial analyses as reflected in allowable annual cut calculations. No quantitative balancing of markets is attempted although this will certainly occur. Instead, a more qualitative discussion of potential trends in market prices and other factors is relied upon.

Timber demand in the U.S. analytical system is largely driven by population, housing starts, and gross domestic product--the same variables that are important in the analysis for Canada. Thus, although the methods differ, they should give results that are similar if not identical. There are no parallels for the analyses of supplies. Increasingly in the United States, timber supply will be coming mainly from private lands and be market driven. Less than 10 percent of US timber supplies originate on public lands where supplies are determined through various institutional arrangements. Some 90 percent of Canadian timber supply originates on public lands.

Context of Other Recent Studies

Jaako Pöyry Study

This study's primary objectives were designed to:

- assess the US solid wood product industry's current and future competitive position in overseas markets
- develop promotional strategies to strengthen the industry's position in key targeted markets
- assess the best export market opportunities and best potential export markets, market segments and specific product opportunities on a global basis for the US solid wood products industry, and to
- identify the countries in which generic promotion efforts will or will not have a significant impact on exports of US solid wood products, including an assessment on where to focus promotional activities.

Assessments of the global fiber situation and the North American forest resource situation were necessary to fulfill study objectives. Projections were made to 2004. Continued population growth, increasing per capita fiber consumption, and the mounting pressures for alternative values globally will lead to fiber supply and demand discontinuities. These discontinuities will apply, despite an increasing role for plantation wood and recovered fiber. Consequently, during the time frame of the study, the world is facing some fiber supply shortages. Prices and competitive positions will be affected across the entire time frame specified for this study.

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[9]The most complete documentation of the Timber Assessment Market Model is found in: Adams, D.M. and Haynes, R.W. 1980. The 1980 softwood timber assessment market model: Structure, projections, and policy simulations. Forest Science Monograph 22. Supplement to Forest Science, Vol. 26, No. 3. Society of American Foresters, Washington, D.C.

[10]Projections of offshore trade and U.S. domestic consumption are taken from the U.S. 1989 RPA Timber Assessment. Projections of offshore trade and Canadian domestic consumption were computed by procedures shown in Appendix A. Thus, the approach computes apparent production by product area.

[11]See Appendix A.

For North America, the study concluded that reduced access to timber supplies would occur across North America, especially for softwood in the Pacific Coast Region. Furthermore, real prices are expected to advance because of the limited ability of the Non-industrial Private lands to mitigate losses of resources from public forest lands. The net effect is one of tight long-term timber supplies, with likely impacts on both domestic demand levels of end products and more difficult environments for solid wood products exporters.

Apsey/Reed Study

The principal objective of this study is to describe the direction and pace of recent changes in output of roundwood volumes globally, and to project the scene as it may look in the years 2010 and 2020. The projections in this report are based largely on intuition and judgmental extrapolation.

The study notes that every region in the world is undergoing a fundamental shift in wood fiber supply and demand balances. Much of this change reflects new societal perceptions and priorities about the use and management of forest resources in a shrinking world.

For Canada, the study projects that softwood industrial wood (wood used to make products except for fuelwood) production would be 135 million cubic meters in 2010 and 150 million in 2020, down from a record high of 175 million cubic meters in 1987. Production of hardwood industrial wood is expected to increase from 17 million cubic meters in 1992 to 30 million in 2010 and 36 million cubic meters in 2020. All provinces are expected to lower their Annual Allowable Cuts (AACs) for a variety of reasons.

For the United States, production of softwood industrial wood is expected to decline from 286.5 million cubic meters in 1992 to 228 million in 2010 and 248 million in 2020. Output of hardwood industrial wood is projected to decline from 197.4 million cubic meters in 1991 to 187 million in 2010 and 196 million cubic meters in 2020. As with the Jaako Pöyry study, the main reasons for the projected decline in output in the United States are the decreased availability of timber from public lands and the inability of private lands to replace the timber no longer available from public lands.

The study concludes that a series of factors will interact to produce the projected output levels. Prices for standing timber, logs, and pulpwood will rise, forest product prices will rise, and non-wood substitutes for forest products will become more attractive to industrial users and final consumers.

Implications of Other Study Findings for Bilateral Trade in Softwood Lumber

The general findings of the two studies are for rising prices stimulated in part by decreased harvest on public lands in both countries. Demand for softwood lumber is expected to continue to increase because of increased population and growing economies. This will lead to high prices which will be a strong market signal for maintenance or maybe even increased levels of softwood lumber imports into the United States. There is some potential for increased U.S. imports from around the Pacific Rim, but most imports will be from Canada.

CHAPTER 2

THE NORTH AMERICAN FOREST RESOURCE

The forests of North America are an important, diverse and dynamic resource. Forests are found in every state and every province and territory of the United States and Canada respectively. Total forest land covers some 7.1 million square kilometers or about 40% of the total land area. This is approximately five times the size of the European forest area. These forests support substantial employment and income in forest industries and provide the vast majority of the wood products required by the population of North America and considerable surpluses for the international market. In addition, they represent a unique and important recreational, aesthetic and environmental resource. The purpose of this chapter is to summarize the characteristics of this vast and varied resource and to discuss the major current trends in the inventory. For this analysis, North America is divided into four major regions (Canada and the United States East and West) and a further division into nine sub regions when appropriate (fig.1).

Forest Land Areas

Of North America's 714 million hectares of forest land area, about 443 million hectares (60%) are considered commercially productive in the sense that they are capable of producing a merchantable stand of timber within a reasonable time frame (tables 1 and 2).[12] This productive forest land base is relatively evenly divided between Canada and the United States. Although Canada's total forest land base is considerably larger than that of the United States, due to its northern climate, and the resulting slower growth rates and shorter growing season, the Canadian productive proportion is considerably smaller.

Table 1
Land and Water Area of North America
(Million Hectares)

TYPE OF AREA	CANADA	UNITED STATES	TOTAL AREA
Forest Land	416.2	298.1	714.3
Other land	505.4	617.8	1123.2
Water	75.5	65.0	140.5
Total Area	997.1	980.9	1978.0

[12]The definition of "productive" forest land differs between the United States and Canada. In the United States, productive forests are, by definition, capable of producing at least 1.4 cubic meter per hectare per annum in fully stocked natural stands. In Canada, definitions vary widely from region to region and generally reflect the judgement of local forest management authorities. In both countries, volumes are under bark.

Table 2
Forest Land in North America by Type
(Million Hectares)

TYPE OF AREA	CANADA	UNITED STATES	TOTAL AREA
Productive	245.4	198.1	443.5
Unproductive	167.5	100.0	267.5
Unspecified	3.3	---	3.3
Total Area	416.2	298.1	714.3

A proportion of this productive forest land is currently reserved for non-commercial forest uses in wildlife, wilderness and other forest preserves such as parks. Approximately 14 million hectares fall into this category in the United States and 8.7 million hectares in Canada (table 3).

Table 3
Area of Productive Forest Land By Status
(Million Hectares)

STATUS	CANADA	UNITED STATES	TOTAL
Reserved	8.7	14.4	22.7
Unclassified	2.2	**	2.2
Available	234.5	198.1	432.6
Stocked	217.6	198.1	415.7
Non-stocked	16.9	**	16.9

** Unavailable

Significant areas of productive forest land are found in every region of North America (table 4).

Table 4
Stocked, Productive and Available Forest Land by Region
(Million Hectares)

REGION	AREA	SUB-REGION	AREA
United States East	153.9	North	68.2
		South	85.7
United States West	53.6	Rocky Mountains	25.3
		Pacific Coast	28.3
Canada East	106.2	Atlantic Provinces	18.8
		Quebec/Ontario	87.4
Canada West	111.4	Prairie provinces	46.1
		British Columbia	45.0
		Northern Territories	20.2

In Canada, this forest land is almost equally divided between east and west. Over 100 million hectares of productive and available forest land are located between the Atlantic Ocean and the Ontario/Manitoba border in the center of Canada. An additional 90 million hectares is almost equally divided between the prairie provinces and the province of British Columbia in the west. A further 20 million hectares are located in Canada's northern territories. In the United States, in excess of 153 million hectares or 74% of the productive and available forest land is concentrated in the eastern part of the country. Most of this area was heavily forested before European

settlement, and although much of this has been converted to non-forest use, forests remain a dominant feature of the landscape. In contrast, much of the western United States was not predominantly forested upon first habitation including vast plains, interior basins and the tundra of interior Alaska.

Forest Land Ownership

There are distinct differences between the United States and Canada in the pattern of forest land ownership (table 5). For the United States as a whole, 73% (145 million hectares) of productive and available forest land is owned by private individuals or companies. National forest lands (administered by the United States Forest Service) account for about 17% of the total, while state, county, municipal and other Federal government agencies (such as the Bureau of Land Management) administer the balance. In Canada, the majority of forest land is owned by the public sector and primarily the provincial governments. Fully 89% of the stocked, productive and available forest land in Canada is under provincial or territorial ownership and jurisdiction. Less than 1% is under Federal government administration. Finally, about 10% of stocked, productive and available forest land in Canada is privately owned.

Table 5
Ownership of Stocked, Productive and Available Forest Land by Region
(Million Hectares)

Ownership Category	United States East	United States West	United States Total	Canada East	Canada West	Canada Total
US National Forest and Canada Federal Lands	8.6	25.7	34.3	0.6	2.3	2.9
US other public and Canada Provincial Lands	12.0	6.9	18.9	88.0	104.3	192.3
Total Public	20.6	32.6	53.2	88.6	106.6	195.2
Private Industrial	22.3	6.2	28.5	3.5	--	3.5
Other Private	101.6	14.8	116.4	14.0	4.8	18.8
Total Private	123.9	21.0	144.9	17.5	4.8	22.3

These national aggregates do mask significant regional differences in both countries. For example, on much of Canada's east coast, private ownership is relatively high while public ownership is highest in western Canada accounting for about 95% of the forest land base in this region. Similarly, in the United States private ownership tends to predominate in the east representing about 86% of the total productive and available forest land area. In contrast, in the Rocky Mountain region of the western US, public ownership amounts to 61% of the productive and available forest land base.

Timber Volumes

It is estimated that the productive and available forest lands in North America contain about 48.3 billion cubic meters of timber (table 6).

Table 6
Volume of the Growing Stock by Species Group
(Billion Cubic Meters)

SPECIES GROUP	CANADA	UNITED STATES	TOTAL
Softwood	19.3	12.7	32.0

Hardwood	5.4	9.5	14.9
Total	24.7	22.2	46.9

This inventory is almost equally divided between the United States (22.2 billion m) and Canada (24.7 billion m). On an aggregate basis, coniferous species predominate in North America, representing just over two thirds of the total volumes. Coniferous species are somewhat more predominant in Canada representing about 73% of the total volume in contrast to only 57% in the United States. There are also significant regional differences within each country. Deciduous forests predominate in the eastern US (representing almost two thirds of the total volumes here) while coniferous forests predominate throughout the west. In eastern Canada deciduous species represent about one third of total volumes while in western and northern Canada they represent about one sixth of total volumes.

Productivity of Natural Forests

One measure of the natural productivity of forest land is the amount of wood per unit area that can be produced in a given time period in fully stocked natural stands. There are substantial differences between the United States and Canada in terms of natural productivity (tables 7 and 8). This is due to both climatic differences between the two countries and differences in soil fertility. A large proportion of Canada's forests are located on the thin soils of the Canadian shield.

Fully 34% of US productive forest land (67.5 million hectares) is rated as high productivity land in the sense that a fully stocked natural stand will support growth rates in excess of 6 cubic meters per hectare per annum. The balance (130.5 million hectares) will support growth rates between 1.4 and 6.0 cubic meters per annum. Over half of this high productivity forest land is located in the US Southeast.

Table 7
United States Productive Forest Land by Productivity Class and Region, 1992
(Million Hectares)

REGION AND SUB-REGION	Productivity Class * HIGH (>6.0)	MEDIUM (1.4-6.0)	TOTAL
North	12.8	51.1	63.9
South	36.4	44.2	80.6
EAST	49.2	95.3	144.5
Rocky Mountains	4.5	20.8	25.3
Pacific Coast	13.8	14.4	28.2
WEST	18.3	35.2	53.5
Total	67.5	130.5	198.0

*Mean annual growth attainable in cubic meters per hectare in fully stocked natural stands.

Although equivalent information is not available for Canada, it is revealing that the estimated average annual increment on productive and available forest land in Canada is only 1.8 cubic meters per hectare. While this refers to natural stands with actual rather than full stocking, this average is only slightly above the US definition of unproductive forest land. However, it should be noted that there are substantial regional variations within Canada.The average for western Canada as a whole is 1.8 cubic meters per annum and it is 1.9 cubic meters per annum in British Columbia. There are many sites on the west coast which meet the US definition of high productivity. The average for eastern Canada as a whole is 2.1 cubic meters per annum but again there are areas of high productivity on the east coast. Due to the very extreme climate, productivity in northern Canada is very low averaging only 0.5 cubic meters per annum.

Table 8
Estimated Mean Annual Increment to Rotation Age on
Canadian Productive and Available Forest Land*
(Cubic Meters per Hectare)

REGION AND SUB REGION	AVERAGE GROWTH
Atlantic Provinces	1.7
Quebec/Ontario	1.7
CANADA EAST	1.7
Prairie Provinces	1.8
British Columbia	1.9
Northern Territories	0.6
CANADA WEST	1.8
CANADA	1.8

*Mean annual growth attainable on natural stands of average stocking.

Timber Growth

Timber growth is an often used measure of productivity and performance of timber resources. Net annual growth is annual growth, less the volume lost through mortality. In other words, it is the net effect of natural gains and losses to timber volumes. Although net growth is sometimes used as an indication of timber available for harvest, in the specific context of North American resources, this can often be misleading. In instances where there is a heavy preponderance of old growth timber, growth rates may be low although there are significant volumes of timber available for harvest. As the old growth inventory is depleted, growth rates can be expected to increase as a younger more vigorous forest replaces the present mature and over-mature stands.

In Canada, mature and over-mature stocks of timber still predominate. Regeneration forests (less than one meter in height) account for 11% of the stocked, productive and nonreserved forest area. Another 38% of this area is classified as immature forest which does not currently contain sufficient wood volume to be harvested. In contrast, mature and over-mature forest covers approximately 100 million hectares or 46% of the total area. (Unclassified areas make up the remaining 5% balance). This mature and over-mature area contains an estimated timber volume of 17 billion cubic meters all of which is technically available for harvest at the present time. The rate of harvest of this timber is constrained by policy considerations, not the current growth rate on the land base.

A more appropriate estimate of growth for Canadian forests is provided by Honer and Bickerstaff (1985). Based on estimated mean annual increments to rotation age and the current level of silvicultural effort and treatment in Canada, these two authors estimate potential gross volume accruals to the growing stock at approximately 338 million cubic meters per annum (table 9).

Table 9
Estimated Potential Annual Growth on Canadian
Productive and Available Forest Land
(Million Cubic Meters)

REGION AND SUB REGION	SOFTWOOD	HARDWOOD	TOTAL
Atlantic Provinces	20.1	6.8	26.9
Quebec/Ontario	94.9	39.5	134.4
CANADA EAST	115.0	46.3	161.3
Prairie Provinces	37.6	21.0	58.6
British Columbia	102.6	5.6	108.2
Northern Territories	7.4	2.5	9.9
CANADA WEST	147.6	29.1	176.7
CANADA	262.6	75.4	338.0

Estimated current losses (net of salvage harvesting) due to fire, insects and disease are 144 million cubic meters per annum (table 10). This implies a net long run sustainable harvest level of 194 million cubic meters per annum.

According to more recent estimates (for the period 1977-91, State of Canada's Forests 1994), gross volume accruals to the growing stock are approximately 363 million cubic meters per annum. Estimated current losses due to fire, insects and disease are 139 million cubic meters per annum. This implies a net long run potential sustainable harvest level of 224 million cubic meters per annum. While this is a useful first approximation, a number of qualifications should be borne in mind. This estimate is based on both the current age class distribution of the forest and the current level of forest management in Canada. As harvesting proceeds and the older forest is replaced by younger and more vigorous stands, non-harvest losses can be expected to decline. Also, increased protection and silvicultural expenditures may reduce non-harvest losses while increasing growth rates. For these reasons, this may represent a relatively conservative estimate of the long run resource potential once the current older inventory has been harvested, at least from the biological point of view. However, as will be discussed later, policy constraints are changing both the availability of land for timber harvesting as well as the obtainable yields from those lands.

Table 10

Estimated Annual Non Harvest Losses on Canadian
Productive and Available Forest Land*
(Million Cubic Meters)

REGION AND SUB REGION	SOFTWOOD	HARDWOOD	TOTAL	FIRE	PESTS
Atlantic Provinces	7.8	0.2	8.0	0.3	7.7
Quebec/Ontario	42.1	15.9	58.0	10.5	47.5
CANADA EAST	49.9	16.1	66.0	10.8	55.2
Prairie Provinces	37.8	25.9	63.7	60.6	3.1
British Columbia	10.4	0.3	10.7	5.1	5.6
Northern Territories	2.8	0.7	3.5	3.5	---
CANADA WEST	51.0	26.9	77.9	69.2	8.7
CANADA	100.9	43.0	143.9	80.2	63.9

*Estimated losses are net of salvage harvesting

In the United States, estimated net annual timber growth for the year 1991 is 612 million cubic meters (table 11). Mortality due to insects, disease, fire and windthrow is about 155 million cubic meters. About 55% of this represents softwood growth. This timber growth is distributed among all sections and regions of the country. More than 70% of the net growth occurred in the eastern US and the largest proportion of this in the south east. The east accounted for more than 90% of the hardwood growth. Softwood net growth was more evenly divided with the west accounting for 47% of the total. About 76% of the net growth (463 million cubic meters) was on private lands and only about 15% (93.2 million cubic meters) was on national forest lands. As with Canadian forests, many US national forests have lands of poorer productivity and a preponderance of relatively slow growing old growth. As a result, a far greater proportion of total growth on these lands is lost to insects, disease, fire and other non-harvest drains.

Inventory Trends

Comparison of net growth and removals provides an inference on the direction of change in the inventory volumes for the year of comparison. However, considerable care should be exercised in the interpretation of this data. While net annual growth for a specific year gives a good indication of what growth might be expected over the next few years, market demand strongly influences total removals. Removals can substantially differ from one year to the next. As a result, only qualified inferences should be drawn on the long term effects on the inventory.

For the United States as a whole, 1991 net growth exceeded removals for both softwoods and hardwoods (table 11).[13] However, this excess of growth was primarily concentrated in hardwoods. Total hardwood net growth was estimated at approximately 273 million cubic meters while total removals were about 151 million cubic meters. In effect, growth exceeded removals by about 81% for hardwoods.

Table 11
Estimated Annual Growth of US Forests, 1991
(Million Cubic Meters)

OWNERSHIP	MORTALITY	NET ANNUAL GROWTH		
		TOTAL	SOFTWOOD	HARDWOOD
National Forest	34.0	93.2	77.8	15.4
Other Public	16.1	55.6	32.0	23.6
Forest Industry	21.7	121.4	90.3	31.1
Other Private	83.3	341.9	138.8	203.1
All Ownership	155.1	612.0	338.9	273.2

In contrast, total softwood net growth was estimated at about 339 million cubic meters versus total removals of 310 million cubic meters. Softwood growth only exceeded softwood removals by 9%. In 1991, growth exceeded removals in all regions; in the North by 92%; in the South by 10%; in the Rocky Mountains by 163% and in the Pacific Coast region by 14%. In the South, softwood removals exceeded growth by 14% in 1991. This is the first time since 1952 that softwood removals exceeded growth in this region.

Estimates of current growth are not available for Canada and little can be said with respect to current changes in inventory volumes. However, a comparison of 1985 removals with Honer and Bickerstaff's[14] estimate of potential net growth on the stocked, productive and available forest land base indicates that current Canadian removals have not reached the biological potential of the resource (table 13).

There are apparent positive balances particularly for hardwoods. Estimated potential net growth of the hardwood resource exceeded 1985 removals by considerably more than 100%. In contrast, potential net growth of the softwood resource only exceeded 1985 removals by 5%. Due to the preponderance of mature and over-mature forests in Canada and age class imbalances in many regions, it should be re-emphasized that these net growth figures do not define a constraint on the Canadian harvest level in the near term. They are a very approximate indication of the long run sustainable potential of the Canadian forest resource given the current levels of non-harvest drain, forest management activity and the present size of the stocked, productive and available forest land base.

[13]Powell, Douglas S. et.al. 1992. Forest Resources of the United States, 1992. USDA Forest Service. General Technical Report RM-234. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 132 p. + map. (Revised, June 1994).

[14]Honer, T.G. and Bickerstaff. 1985. Canada's forest area and wood volume balance, 1977-1981: an appraisal of change under present levels of management. Canadian Forestry Service Pacific Forestry Centre. BC-X-272, Victoria, British Columbia.

Table 12
United States Net Annual Growth and Removal Balances by Region, 1991
(Million Cubic Meters)

REGION AND SUB REGION	SOFTWOODS	HARDWOOD	ALL SPECIES
North:			
Net growth	34.4	117.4	151.7
Removals	21.0	57.9	78.9
South:			
Net growth	144.3	134.0	278.2
Removals	164.8	88.7	253.3
US EAST:			
Net growth	178.7	251.4	429.9
Removals	185.7	146.6	332.2
Rocky Mountains:			
Net growth	56.2	5.3	61.5
Removals	22.5	0.8	23.4
Pacific Coast:			
Net growth	104.0	16.6	120.6
Removals	101.9	4.0	105.9
US WEST:			
Net growth	160.2	22.0	182.1
Removals	124.4	4.8	129.3
UNITED STATES:			
NET GROWTH	338.9	273.2	612.0
REMOVALS	310.0	151.5	461.5

Table 13
Canadian 1985 Removals by Region Compared to Potential Net Growth
(Million Cubic Meters)

REGION AND SUB REGION	SOFTWOODS	HARDWOOD	ALL SPECIES
Atlantic Provinces	12.5	1.8	14.3
Quebec/Ontario	52.7	10.9	63.6
CANADA EAST REMOVALS	65.2	12.7	77.9
POTENTIAL NET GROWTH	65.1	30.2	95.3
Prairie Provinces	12.3	1.4	13.7
British Columbia	76.9	*	76.9
Northern Territories	**	**	**
CANADA WEST REMOVALS	89.2	1.4	90.6
POTENTIAL NET GROWTH	96.6	2.2	98.8
CANADA REMOVALS	154.4	14.1	168.5
POTENTIAL NET GROWTH	161.7	32.4	194.1

*Hardwood included with softwood
**Less than 50 thousand cubic meters

Indications with respect to trends in the size of the stocked productive and available forest land base in Canada are contradictory. The 1991 Canadian forest inventory indicates that the potential industrial forest land base has increased by about nine million hectares during the preceding five years. The 1986 inventory indicated a stocked, productive and available forest land base of only 208.2 million hectares versus the 1991 estimate of 218 million hectares reported above. However, this apparent change is likely misleading reflecting differences in methodology and the extent of the forest inventory between the two years.

CHAPTER 3

TRENDS AND PROSPECTS FOR RAW MATERIAL SUPPLY

Chapter 2 gave a current snapshot of the size, extent and nature of the North American forest resource. This represents the capital stock available to support the commercial forest industry. This capital stock, in conjunction with its growth dynamics, determines its potential to provide a flow of resources over time. In this chapter, we turn to the implications of this for the timber supply to the commercial forest industry over the next two decades.

Over the past three decades, the harvest in both Canada and the United States has expanded significantly. The question is whether this trend can be expected to continue. In the first part of the chapter we deal with the United States. US forests, particularly in the east, have been harvested for a considerable time period. For this reason, US forests are closer to a fully managed condition and current growth rates play an important role in determining future production potential. In the second part of the chapter we deal with Canada. In contrast to the United States, the current growth rate on the Canadian growing stock is not a fundamental determinant of the harvest rate in the near term. In virtually all Canadian regions, there are substantial inventories of mature and over-mature timber still available for harvesting. These timber volumes are theoretically sufficient to facilitate continued expansion of the Canadian harvest over the next two decades. The extent to which this occurs will depend upon market conditions and policy constraints related to sustainable forest management.

United States Harvest Trends

For the contiguous states, the softwood harvest increased by 61% between 1962 and 1991 (table 14). The softwood harvest increased in all regions over the period.

The United States has always relied on private lands for much of its timber supply (table 15). The private landownership category includes forest industry and other private ownerships. Forest industry ownerships are generally managed with timber supply as the main objective. Other private ownerships may be managed with a variety of objectives in mind in addition to timber supply or instead of timber supply. Increasingly, management of private forest lands is subject to state and local government regulation. At least 40 states use some procedure to monitor best management practices implementation on forest lands.[15] Ten states have comprehensive regulatory programs aimed at forestry practices.[16]

A survey conducted in 1992 identified 644 individual forest regulatory laws in the United States.[17] The laws were passed for a variety of reasons, including protection of water quality, endangered species, roads, and shade trees. A survey of natural resource professionals found that they expected private timber supplies to be reduced by 1-12 percent because of regulations. In 1991, about 78% of the total softwood harvest came from forest industry and other private lands. Since 1962, the harvest coming from all ownership classes has increased. However, the share coming from forest industry lands has increased relatively while the share from national forest lands has declined.

Table 14
U.S. Removals of Growing Stock on Timberland by Region

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[15]Brown, Thomas C.; Binkley, Dan. 1994. Effect of management on water quality in North American forests. General Technical Report RM-248. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and range Experiment Station. 27 p.

[16]Ellefson, Paul V.; Cheng, Anthony S.; Moulton, Robert J. Regulation of private forestry practices: Review of programs administered by State governments. 1993. Draft. On file with USDA Forest Service, Washington, D.C.
298 p.

[17]Greene, John L.; Siegal, William C. 1994. The status and impact of state and local regulation on private timber supply. General Technical Report RM-255. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 22 p.

and Softwoods and Hardwoods, Selected Years, 1962-1991
(Million cubic meters)

REGION	1962	1970	1976	1986	1991
North					
Sofwoods	15.9	16.5	19.6	20.5	21.0
Hardwoods	32.2	48.8	51.1	56.2	57.9
South					
Softwoods	70.6	104.0	125.6	162.6	164.7
Hardwoods	49.4	66.4	63.5	83.8	88.7
Rocky Mountain					
Softwoods	18.3	25.2	23.9	23.9	22.5
Hardwoods	0.1	0.8	0.7	0.8	0.8
Pacific Coast					
Softwoods	98.9	116.4	114.1	114.9	101.9
Hardwoods	2.1	3.3	3.6	3.3	4.0
United States					
Softwoods	203.6	262.2	283.2	321.9	310.0
Hardwoods	83.7	119.2	118.8	144.0	151.5
Total	287.4	381.5	402.0	465.9	461.5

Trends in the hardwood resource are dominated by private lands in the east. The increase in hardwood harvest has been from all ownerships, however. Factors contributing to this increase include a continuing demand for fuelwood, increased pulping of hardwoods and the use of hardwoods in the manufacture of structural panels.

Inventories of softwood growing stock in the United States continued to decline between 1986 and 1991. This reflected in part harvest of existing stocks on National Forest, other public and forest industry ownerships. Hardwood inventories increased on all ownerships except forest industry where some conversion of hardwoods to softwood plantations is still occurring.

Table 15
U.S. Removals of Growing Stock on Timberland by Ownership and Softwoods and Hardwoods, Selected Years, 1962-1991
(Million cubic meters)

OWNERSHIP	1962	1970	1976	1986	1991
National Forests					
Sofwoods	49.5	61.2	56.4	58.4	50.4
Hardwoods	3.6	4.5	3.6	4.6	6.2
Other Public					
Softwoods	16.1	21.3	24.1	24.3	18.6
Hardwoods	4.4	6.0	6.4	6.2	9.2
Forest Industry					
Softwoods	65.2	88.3	102.9	119.3	116.4
Hardwoods	18.6	18.4	16.9	23.0	34.3
Other Private					
Softwoods	85.2	94.4	101.1	119.9	124.6
Hardwoods	96.3	105.0	91.6	110.1	101.7
United States					
Softwoods	203.6	262.2	283.2	321.9	310.0
Hardwoods	83.7	119.2	118.8	144.0	151.5
Total	287.4	381.5	402.0	465.9	461.5

Major Factors Affecting United States Supplies

The current growth removal balances for timber show that the hardwood forests and some eastern softwood forests can support additional harvests. However, these are only an indicator of the future harvest potential. The actual harvest over the next twenty years will depend upon ownership objectives, past investments in forest management, stumpage prices and institutional constraints.

For private lands, market forces will be a predominant factor. Stumpage prices in the United States have shown wide fluctuations in the past several decades but have generally followed an upward trend. Demand rather than supply shifts have been the predominant factor in these movements. Demand increases which cause further upward movement in stumpage prices will influence ownership behavior and facilitate further increases in timber supply where inventories are sufficient.

Especially on private lands, there has been a prolonged period of tree planting in the United States over the past two decades. In the 1980's the area planted generally exceeded one million hectares per year.[18] These plantations are generally of softwood species in the South and Pacific Northwest. As they reach maturity over the coming decades, these plantations may profoundly affect the long-run timber supply outlook in the United States.

Timber sale offerings on public lands are generally determined by institutional constraints rather than the market. In the past, these institutional constraints were generally aimed at a sustained volume of timber output. Implementation of ecosystem management on Federal lands is resulting in decreases in timber sales volume. In the 1980's, for example, sales volumes from National Forests were about 50 million cubic meters per year; recent levels have been less than 20 million cubic meters per year. In addition, the Endangered Species Act[19] requires protection of threatened or endangered species on Federal lands. The number of species listed as

[18]USDA Forest Service. 1993. Tree planting in the United States--1993. Copies available from State and Private Forestry, Cooperative Forestry, Washington, DC.

[19]Endangered Species Act of 1973. Act of December 28, 1973 (P.L. 93-205, 87 Stat. 884, as amended; 16 U.S.C. 1531-1536, 1538-1540).

threatened or endangered may increase in the future and have the effect of reducing timber sale offerings on Federal and possibly other ownerships.

Other technical factors will also influence the timber supply. For inventory purposes, logging residues are counted as part of the growing stock inventory removed in harvest operations, although by definition, they are not removed from the site. Over time, logging residues as a percentage of removals has decreased as logging and processing technologies have improved and the value of wood has increased. While the rate of change may decline in the future, there is still room for marginal improvement.

Also, some of the timber supply comes from non-growing stock sources such as tops and limbs, fence rows and forested land other than timberland. In recent years, timber output from non-growing stock sources has been increasing, mainly because of increased demand for fuelwood. In 1991, this represented 18.6% of total softwood output and 43.1% of total hardwood output. While this is not expected to be a major factor with respect to the industrial roundwood market, it could be extremely important in meeting fuelwood demand.

Future Prospects for United States Timber Supplies

Given the constraints on supplies from public lands, increased harvests to the year 2015 must almost entirely originate on private lands. During the decade beyond 2000, there appears to be an unprecedented age class situation for softwood inventories in the United States. Since European settlement, the United States has had large reserves of virgin softwood timber as timber harvesting moved from the Northeast to the Southeast and then to the West. By 2000 or thereabouts, large diameter softwood timber will have been harvested on private lands and the harvest on public lands will be constrained by non-market forces. The effects of this situation on timber availability will depend to a large degree on the size and timing of forest product demand growth over the next twenty years. There is the potential for fluctuations in roundwood prices if demands cycle as in the past.

After the year 2010, plantations initiated in the last two decades will reach merchantable size in the South and the Pacific Northwest. Given the level of planting and forest management in the last decade, there is every reason to be more optimistic about the longer run timber supply. In the interim, high demand could create opportunities for more intensive use of hardwoods. Also, it could create trade opportunities for other suppliers such as Canada.

Canadian Harvest Trends

Over the last twenty five years, the Canadian harvest has increased steadily with the exception of three recessionary periods, one in the mid 1970's, one in the early 1980's and one in the early 1990's (table 16). Total Canadian roundwood production rose from about 97 million cubic meters in 1960 to about 175 million cubic meters by 1993. This represents an average rate of increase of 1.8 percent per annum. Production increases have been general throughout the country, but have been more dramatic in western Canada. The harvest in both British Columbia and the Prairie Provinces has more than doubled over the period. The harvest in the Ontario/Quebec sub region has increased at a somewhat slower pace but has still risen by more

than 47%. The harvest in the Atlantic Provinces has shown a similar rate of increase during this period. Total removals have risen by approximately 43% between 1960 and 1993.

A breakdown of total removals between softwood and hardwood is only available since 1970 (table 17). However, it is very clear that the majority of the production increase has been in softwoods, although hardwood removals have grown at a faster rate. In 1970, softwood production amounted to about 91% of total production. By 1993, this share had dropped to 86%.

While total softwood production had increased to about 152 million cubic meters, hardwood production amounted to only 24 million cubic meters. The vast majority of production, and the production increase over the period, is industrial roundwood. Until the mid-1970's the fuelwood harvest in Canada was on a declining trend. While this has now reversed, fuelwood production in 1985 attained only the same level as in 1960 and has remained at approximately this level since then. Currently, fuelwood represents about 4% of total roundwood production and about 22% of total hardwood production.

Major Factors Affecting Future Canadian Supplies

In contrast to the US, Canadian forests still have an unbalanced age-class structure with the inventory heavily weighted towards old growth natural forest. Currently there are considerable quantities of mature and over-mature timber still available for harvest. The estimated volumes are theoretically sufficient to maintain current average harvest rates for many decades or permit continued expansion of the harvest at least in the short term. Unfortunately, this largely physical assessment gives a somewhat unrealistic perspective on timber supply potential. There is a wide variation in the quality and condition of the resource and there is limited accessibility and difficult operating terrain in many regions.

Table 16
Canadian Roundwood Production by Region
(Million cubic meters)

REGION	1960	1970	1975	1980	1985	1991	1993
Atlantic Provinces	11.97	13.13	13.06	16.00	14.26	16.10	17.21
Quebec/Ontario	40.24	45.80	42.62	53.01	63.63	53.42	59.73
CANADA EAST	52.21	58.93	55.69	69.01	77.89	69.52	76.94
Prairie Provinces	6.90	7.78	9.30	11.60	13.71	17.16	20.16
British Columbia	37.88	54.73	50.08	74.65	76.87	74.71	78.00
CANADA WEST	44.78	62.51	59.38	86.25	90.58	91.99	98.52
CANADA	96.99	121.44	118.31	155.26	168.47	161.51	175.46

In addition, other competing uses for the land base and growing stock and the environmental sensitivity of certain areas may limit harvesting operations although these areas may not be formally reserved for other uses. Thus, only a proportion of the physical resource is commercially exploitable.

Table 17
Canadian Roundwood Production by Type and Species Group
(million cubic meters)

YEAR	INDUSTRIAL ROUNDWOOD		FUELWOOD		TOTAL	
	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood
1970	8.00	109.32	2.57	1.53	10.57	110.85
1975	8.06	103.44	2.55	1.21	10.61	104.65
1980	9.36	141.29	3.45	1.28	12.81	142.57
1985	9.33	152.66	4.83	1.84	14.16	154.50
1991	15.75	138.86	5.75	1.15	21.50	140.01
1993	18.51	150.42	5.25	1.28	23.76	151.70

A second important factor is that all governments in Canada are committed to sustainable forest management principles in the harvest of the forest resource. The vast majority of forest land in Canada is under the ultimate management authority of the provincial governments and each provincial forest management agency bases its harvesting policies on an assessment of the potential of the resource to support continuous commercial harvesting, as well as to provide other values and services. These assessments attempt to incorporate the social and economic values as well as the long run physical limitations of the resource, and this has significant implications for the rate at which the current mature and over-mature inventory can be harvested.

Future Prospects for Canadian Timber Supplies

The limitations and constraints imposed by provincial government policy are reflected in Allowable Annual Cut (AAC) determinations. These AAC's can be described as the average volume of timber that "may" be harvested annually from the provincial forest land base given the available timber inventory, the growth capability of the forest and the specific objectives of the forest management authority. In effect, they reflect the judgement of each provincial government on the advisable maximum harvest in the near future given assumptions about the current and future harvestability of the forest land base and management preferences with respect to provision of other values and the sustainability of yields in the long term. In certain regions and areas where current timber values are high or production costs are low, the current AAC acts as a binding constraint on current harvest levels. However, in other regions or for a province as a whole it may be a largely notional number. It may reflect only the potential harvest from a given area under assumed future market conditions rather than current roundwood demand.

A recent estimate of the AAC for industrial roundwood is 230 million cubic meters per year or 36 percent greater than the 1993 harvest level of 169 million cubic meters. However, it should be noted that this "apparent surplus" is predominantly composed of hardwood species (approximately 60 percent). Also, a one year comparison of AACs and harvests is misleading since harvests may fluctuate in response to market forces. In a number of provinces, harvests can exceed the AAC in a one year period, as long as over a five year period the AAC is not exceeded.

The future prospects for timber supply vary considerably on a regional basis. Table 18 shows the current AAC, 1993 harvest level and "apparent surplus" of AAC over harvest by region. (Further details on timber supply are available in the Canadian Background paper on Canadian Timber Supply). Table 19 shows

the distribution of stocked and available productive forest land, as well as the proportion of that area which is currently mature or overmature and provides a different perspective on supply potential.

Table 18
Regional AACs and Harvests

		AAC	1993 Industrial Harvest	Apparent Surplus
		Millions of cubic metres		
Atlantic	Softwoods	14.03	13.39	0.64
	Hardwoods	5.57	2.06	3.51
	Total	19.6	15.46	4.14
Quebec/ Ontario*	Softwoods	60.21	45.62	14.59
	Hardwoods	32.54	9.56	22.98
	Total	92.75	55.18	37.57
Prairie Provinces**	Softwoods	23.63	14.27	9.36
	Hardwoods	15.69	5.72	9.97
	Total	39.31	19.99	19.32
British Columbia**	Softwoods	75.87	76.85	(0.98)
	Hardwoods	2.9	1.2	1.7
	Total	78.8	78.0	0.8

*Includes unofficial estimate for Ontario
**Includes estimates for unregulated lands

Table 19
Regional Supply Indicators

	Total stocked and available forest land (Million ha)	Area of mature and over-mature timber (Million ha)	Area of mature and overmature as percent of total (%)	Volume of mature and over-mature timber (million $m^{3)}$
Atlantic Provinces	18.8	4.59	24	581
Quebec/ Ontario	87.4	46.5	53	4,968
Prairie Provinces	46.1	15.6	34	2,647
British Columbia	44.99	28.77	64	8,100

In the Atlantic region, there is a relatively small apparent surplus of softwood and a relatively large apparent surplus of hardwood available. Ontario and Quebec have both been cutting softwoods well within their AACs, although local shortages have been experienced. Ontario is in the process of redetermining its AAC levels and expects its softwood AAC to decline. In Ontario, demand for softwood timber will exceed

likely supply until the middle of the next century unless forest management is intensified. Both Ontario and Quebec have substantial reserves of hardwood, and Quebec also has reserves of softwoods. In Quebec there are additional physical supplies beyond the economic margin identified by the provincial government , since a considerable proportion of the productive and available forest land base is designated as inaccessible or uneconomic and removed from consideration in supply planning. In the Prairie provinces, there are still large surpluses of both softwood and hardwood available although hardwood harvests have increased considerably in recent years, from 1.44 million m^3 in 1985 to 5.7 million m^3 in 1993.

AACs in B.C. are currently in the process of being updated, and this process will not be complete until the end of 1996. In many areas, the current harvest is higher than the long term harvest level and AACs are under downward pressure. This is in part because of the planned so-called fall-down effect, where second growth forests that replace old growth forests provide lower yields per hectare since they are harvested at younger age than the current old growth. Second, there is increasing pressure on the forest land base from urbanization, and environmental considerations. Areas are being set aside for parks, protected areas and wilderness areas, and these areas reduce the landbase that is available to the forest industry. Other factors are updated inventory information, as well as changes in forest practices that reduce the amount of wood that can be harvested from a given land area. On regulated lands, the AAC is 71.3 million cubic metres. Extrapolations of preliminary analyses indicate that timber supply for regulated lands could decline to 60 million cubic metres by 2050, and 57 million cubic metres in the longer run. Enhanced silvicultural investment could offset some of this decline in the longer term.

Summary

Over the last three decades, North American timber harvests have increased quite dramatically. The extent to which this trend continues will depend in part upon the markets for forest products and timber. In the United States, there are significant non-market constraints on timber supplies from public lands. As a result, most future increases in supply must come from private lands. Growth removal balances indicate considerable further harvest potential in the north and southeast particularly for hardwoods. The situation is more constrained for softwoods. The future outlook for softwoods in the South and the Pacific Northwest depends on the ingrowth of plantations planted over the past two decades. State and local regulation of forest management on private lands may further constrain timber supplies from these lands.

In Canada, there are still substantial physical stocks of mature and over-mature timber available for harvest. However, there is considerable variation in the quality and condition of this timber, and the rate of harvest is to a greater or lesser extent constrained by public sustainable forest management policies and growing demands for other values on the forest land base. Even with these constraints there appear to be some further surpluses available to facilitate further expansion of the Canadian harvest. As in the United States the most significant surpluses appear to be hardwood. Geographically, harvests are likely to continue expanding on the prairies although at a slower pace. In other parts of the country some additional potential exists but harvest growth is likely to be well below historical levels. The rate of growth will be largely determined by demand and market trends over the period, as well as the growing demands for non-timber values on the forest land base that will constrain the harvest level.

It should be emphasized that the above commentary is on a broad regional and national basis and represent very large aggregates of forested areas, timber types and owner classes. While there may be apparent surpluses of timber at this level, this says nothing with respect to the supply situation in individual local areas. The specific supply situation may vary widely within the region and a general situation of surplus or adequacy of timber supply can co-exist with serious local shortages. Similarly, the adequacy of the timber supply does depend upon market trends and prices. Recessions or other temporary downturns in the economy can significantly reduce the economic supply of wood. As a result, temporary shortages can co-exist with long term adequacy of timber supply.

CHAPTER 4

TRENDS AND PROSPECTS FOR FOREST PRODUCT DEMAND

The United States has long been the major market for Canadian exports of softwood lumber, newsprint, and woodpulp. Similarly, Canada is a major market for U.S. exports of softwood lumber and other products. In keeping with the North American context for this report, trends and prospects for forest product demand are presented for North America as a whole. Thus, the presentation focuses on North American domestic consumption, offshore exports, and imports from offshore destinations.

In the discussion, emphasis is given to the following products: Lumber (softwood and hardwood); panels (softwood plywood, hardwood plywood, particleboard, and OSB/waferboard); paper and paperboard (the aggregate of newsprint, printing and writing paper, tissue and sanitary paper, wrapping paper and paperboard), and logs (softwood and hardwood).

Relative Importance of Export and Domestic Markets

The United States and Canada combined have a population of some 282 million people (1992). There is a long history of the use of wood in construction and for many other purposes that affect the daily lives of everyone. The population of the two countries has been growing over the past decades, a pattern that is expected to continue. Immigration accounts for a significant part of the expected growth in population. Per capita personal income has also been growing over time with consequent increases in demands for many products/services requiring the use of wood. A growing, increasingly affluent population will mean increased demands for timber products in the future, but demands will not increase in the same proportion for all products.

North America is either self-sufficient or a net exporter of most timber products. The main exception is for nonconiferous plywood which consists mainly of panels made of tropical species and especially from Indonesia. Imports account for about one-half of North American consumption of nonconiferous plywood.

The region is a net exporter of coniferous sawnwood, paper, paperboard, woodpulp, pulpwood, and logs. Pulpwood and coniferous logs have the Pacific Rim as the major market. Sawnwood and the fiber-based products have a more diversified market which includes Europe. European and increasingly, Pacific Rim countries are the major destinations for nonconiferous logs.

Major Market Developments Since 1960

Technological changes and other market developments have had major influences on the way that wood is used in North America. Over the period, 1960-90, particleboard consumption increased by more than 15 times and coniferous plywood consumption more than tripled. OSB/waferboard was not produced in commercial quantities until the late 1970's in the United States after being started in Canada in the 1960's. Since the late 1970's, consumption has expanded to over three million cubic meters. The expanding economy led to more than doubling of paper and paperboard consumption.

Plastic overlays and particleboard have combined to substitute for expensive nonconiferous veneers and plywood. Consumption of nonconiferous plywood peaked in the early 1970's. After declining through the early 1980's, consumption has increased somewhat as the result of increased imports from Indonesia.

Development of coniferous plywood and the various fiber-based boards undoubtedly slowed consumption of sawnwood in the period, 1960-90. Despite this competition, consumption of coniferous sawnwood increased by more than 50 percent. Markets for nonconiferous sawnwood are more limited and consumption was flat during the 30-year period.

One of the most visible market developments for the North American timber industry has been the sale of coniferous logs to Pacific Rim markets. From small volumes in the early 1960's, the market expanded to over 20 million cubic meters in 1989. Volume has since declined and amounted to 10.9 million cubic meters in 1993. The origin of the logs has been primarily the States of Washington and Oregon and secondarily the Province of British Columbia and the State of Alaska. Japan and, since 1980, the People's Republic of China have been primary destinations. This market development has had major effects on roundwood markets in Washington and Oregon and has been the source of much controversy. There are no restrictions on exports of logs from private lands. There is now a ban on exports of softwood logs from public lands in the western United States (west of the 100th meridian).[20] British Columbia has an export restriction that limits the volume of exports and other Provinces have various restrictions.

In 1994, the United States imported 0.3 million cubic meters of softwood logs from Canada and exported 1.2 million cubic meters to Canada.

Factors Influencing Domestic and Export Demand

Various factors are more or less important for markets for individual products. In general, however, demands for forest products are tied to population and the economy. Markets for some products are relatively stable while others are cyclic. The construction industry--new construction and repair and remodeling of existing structures--is the primary market for solid wood products and cycles according to changes in interest rates necessary to finance mortgages. The demographics of the population also influence housing demand. For example, the "baby boom" generation in the United States had a major influence on U.S. housing demand in the 1980's.

Demands for paper and paperboard are also cyclic in the domestic North American economy. For example, demands for newsprint depend in part on advertising in newspapers which cycles with the economy and the demand for paperboard depends in part on the level of general manufacturing activity with its consequent demand for packaging materials.

Despite cycles in consumption, the overall trend in North American consumption has been upward because of growth in population and economic activity. Projections of population and economic activity underlie projected North American consumption of forest products.[21]

Demands in the export market depend on demand conditions in the importing countries, exchange rates, competing sources of supply, the demand-supply situation in North America, and tariff and nontariff factors. Export markets for North America have traditionally been the industrialized countries and this is expected to continue. For example, Japan was the destination for 74% of U.S. softwood log exports in 1994 and 44% of U.S. softwood lumber exports. These and other emerging markets are discussed at length in a recent report by Jaako Pöyry.[22] Thus, Japan and Europe are the major sources of offshore demand. Other developing markets include the Republic of Korea, Taiwan and the Peoples Republic of China. Market development activities are in place in other countries, but low per capita incomes and/or lack of tradition of use of the various forest products are formidable obstacles to overcome.

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[20]Forest Resources Conservation and Shortage Relief Act of 1990, 16 U.S.C. 620, et seq., 104 Stat. 714, Pub. L. 101-382, August 20, 1990, as amended by: Forest Resources Conservation and Shortage Relief Amendments Act of 1993, Pub. L. 103-45, July 1, 1993.

[21]Projections used for the US component of the analysis can be found in Haynes, Richard W.; Adams, Darius M.; Mills, John R. 1995. The 1993 RPA timber assessment update. General Technical Report RM-259. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 66p., and for Canada, in Appendix A.

[22]Jaako Pöyry Consulting. 1994. Solid wood products competitiveness study report. Prepared for: American Forest and Paper Association. Tarrytown, New York.

Exchange rates have been free floating since the early 1970's and have major influences on North American shipments to offshore markets. Trends in exchange rates are very difficult to project in the current world economic environment and thus any projections of trade flows are uncertain to the extent that exchange rates may change.

Japan--The main competition for North American softwood exporters in the Japanese market consists of domestic Japanese sources and coniferous logs from Russia, and secondarily coniferous logs from New Zealand and Chile. Despite the many uncertainties associated with development of the Siberian timber resource, exports of softwood logs from Russia to Japan are expected to continue in the foreseeable future. Both New Zealand and Chile will have large volumes of radiata pine reaching merchantable size over the next two decades with Japan being a market of preference for both countries. Market acceptance of radiata pine remains an uncertainty as does the specific products that may be sold. For example, it is uncertain whether the Japanese market will be for logs or processed products. The trees are in the ground in both countries to make them major factors in world softwood markets by the turn of the century.

The Japanese market for temperate hardwoods has generally been limited, in part because of lack of market familiarity with them and in part because of the availability of tropical hardwoods. Market development activities are having some effect on the market, but it is expected to remain relatively small. In part, controversy over harvest of the tropical rain forest is stimulating interest in temperate hardwoods.

There is every reason to be optimistic about exports of pulp, paper, and paperboard to Japan. Per-capita consumption of paper and paperboard is expected to increase. The domestic pulp industry has been relatively stable in terms of production and environmental concerns limit the outlook for new mills. As mills are modernized, there will be some increases in domestic capacity, however.

Unlike the situation for softwoods where North America is one of the few sources for world markets, the world market for pulp and paper has many current and potential sources of supply. Japan is also a major importer of waste paper for recycling. Brazil, South Africa, and various Pacific Rim countries are all potential sources of fiber-based products. The outlook for Japan thus is upbeat, but the expectation is that it will be a very competitive market.

Japan traditionally imported little in the way of panel products. Until log export controls took effect in the Philippines and Indonesia, Japan imported tropical hardwood logs and manufactured plywood for the domestic and some export markets. Tropical hardwood logs are still imported from Malaysia and other Southeast Asian sources, but the domestic plywood processing industry in Japan is facing strong competition from the newly developed plywood industry of Indonesia. Coniferous plywood and panels of temperate hardwoods are not used to any great extent in Japan. Market development activities are making progress, but there is little basis for expecting major increases in North American shipments of panel products to Japan.

Europe--The market outlook for Europe can be characterized as mature with growth paralleling increases in population. In a mature market, growth in market share for any one supplier must come at the expense of another supplier. Projections of North American exports to Europe are based largely on judgments about the future course of trends of the past 25 years.

North America supplies to Europe mainly coniferous and temperate hardwood lumber, wood pulp, newsprint, and linerboard. Coniferous plywood and temperate hardwood logs and veneer are also important. Currency valuations affect the competitive position of North America with respect to producers of wood products in Scandinavia.

NORTH AMERICAN VIEW OF TRADE PROSPECTS

General Overview of Trade Environment

The following points figure prominently in the general North American view of trade prospects.

* In general, the outlook for World markets is one of maturity in the industrialized countries which are the traditional markets for North American offshore shipments.

* In addition, additional sources of supply will be coming on line over the next two decades that will have the industrialized countries as the intended markets. Chile, New Zealand, and Brazil all will be able to supply major segments of world demands for imports by 2000.

* Importing regions in some instances have plantation programs of their own.

* There may be some export opportunities in smaller, industrializing countries such as the Republic of Korea, but the volumes involved are small relative to North American production.

* The People's Republic of China is an uncertain market and will be difficult to project so long as the political economy of the country remains unstable.

* The North American market is expected to continue solid growth in consumption of all timber products.

* Siberia will not be the source of increased wood products output in the foreseeable future.

Given these expectations, the following projections of North American trade are generally conservative, but North American production and consumption are expected to continue historical patterns of growth. The situation varies by product.[23]

Trade Outlook for Specific Products

Coniferous Sawnwood--North American consumption of coniferous sawnwood increased 57 percent in the period 1960-90 (or approximately 1.5% per year). Future growth in demand is expected to be somewhat slower, but will exceed 150 million cubic meters in 2015. Exports to offshore markets has been somewhat erratic because of fluctuations in currency exchange rates and emergence of technical barriers to trade, but they are projected to exceed 16 million cubic meters by 2015. Imports from offshore sources are expected to remain small in volume. By 2015, offshore exports amount to about 10 percent of production compared with 7 percent in 1960.

[23]The projections are done such that production is considered apparent production--consumption, offshore exports, and imports from offshore sources re. projected independently with production being a computed value.

Table 22
sawnwood (coniferous)
Offshore

	Production	Imports	Exports	Consumption
	(million cubic meters)			
1960	82.7	0.1	5.1	77.7
1970	92.9	0.1	9.0	84.0
1980	110.4	0.1	14.6	95.9
1985	128.0	0.2	10.6	117.6
1990	138.0	0.3	16.1	122.2
1994	140.8	0.7	12.2	129.3
2000	145.3	0.7	14.9	131.1
2005	152.0	0.8	15.5	137.3
2010	157.9	0.9	15.8	143.0
2015	169.0	0.9	16.4	153.5

Nonconiferous Sawnwood--North American consumption of nonconiferous sawnwood was relatively stable in the 30 years, 1960-90. Strong growth in consumption is projected for the future, mainly because of growth in demand for pallets. There is the expectation that exports will increase from current levels, but then level off at 1.8 million cubic meters. Imports are projected to be about one-half of the levels of the mid-1980's.

Table 23
sawnwood (nonconiferous)
Offshore

	Production	Imports	Exports	Consumption
	(million cubic meters)			
1960	14.9	.4	.1	16.1
1970	16.8	.5	.2	18.2
1980	16.8	.6	.7	18.1
1985	15.6	.6	.7	15.5
1990	26.3	.2	1.4	25.1
1994	31.7	.3	1.8	30.2
2000	30.53	.3	1.8	29.0
2005	1.2	.3	1.8	29.7
2010	32.3	.3	1.8	30.8
2015	33.2	.3	1.9	31.6

Coniferous Plywood--Wide-spread use of coniferous plywood is limited to North America where it has markets in construction and specialty products such as concrete forms. Consumption more than doubled between 1960 and 1990 and markets are expected to continue to grow despite strong competition from OSB/waferboard. Market promotion efforts in Europe and Japan are beginning to pay off for North American

producers and some growth in export volume is expected. By 2015, however, exports are still less than 12 percent of production. Concerns over deforestation of tropical hardwoods may stimulate demands for coniferous plywood, especially in applications where the wood is not exposed to view. North America may share in any increased demands, but New Zealand would like to supply Japanese demands that may result from substitution of coniferous species for tropical hardwood species.

Table 24
Plywood (coniferous)
Offshore

	Production	Imports	Exports	Consumption
	(million cubic meters)			
1960	7.7	neg.	.1	7.6
1970	14.1	neg.	.4	13.7
1980	15.9	neg.	.8	15.1
1985	19.2	neg.	.7	18.5
1990	20.3	neg.	1.6	18.7
1994	18.7	neg.	1.3	17.4
2000	18.1	neg.	1.7	16.4
2005	17.6	neg.	1.7	15.9
2010	17.1	neg.	1.9	15.2
2015	17.0	neg.	2.0	15.0

Note: neg.=less than 50,000 cubic meters

Nonconiferous Plywood--Consumption of nonconiferous plywood in North America fell 40 % between 1970 and 1980 but is now back up to near 3.2 million cubic meters. Imports, mainly from Southeast Asia, account for about one-half of the market. Exports have traditionally been small in volume and this is expected to continue. Production and consumption are expected to increase somewhat through 2015. Imports are projected to stay near the volume reported for 1990.

Table 25
Plywood (nonconiferous)
Offshore

	Production	Imports	Exports	Consumption
	(million cubic meters)			
1960	1.1	.6	neg.	1.8
1970	1.8	1.9	neg.	3.7
1980	1.1	1.1	neg.	2.2
1985	0.9	1.6	0.1	2.4
1990	1.7	1.5	neg.	2.4
1993	1.8	1.4	neg.	3.2
2000	2.3	1.5	neg.	3.8
2005	2.5	1.5	neg.	4.0
2010	2.6	1.5	neg.	4.1
2015	2.8	1.5	neg.	4.3

Note: neg.= less than 50,000 cubic meters

OSB/waferboard and particleboard--North America is self-contained for OSB/waferboard and particleboard. After production of OSB/waferboard was initiated in the United States in the late 1970's, output grew rapidly and reached 3.7 million cubic meters in 1985 and 9 million by 1993. The product substitutes directly for coniferous plywood as sheathing in construction. Growth in consumption is expected to continue to grow, reaching 23.7 million cubic meters by 2015.

Table 26
OSB/Waferboard
Offshore

	Production	Imports	Exports	Consumption
	(million cubic meters)			
1960	--	--	--	--
1970	--	--	--	--
1980	.7	--	--	0.7
1985	3.7	--	--	3.7
1990	6.8	--	--	6.8
1993	9.0	neg.	--	9.0
2000	12.8	neg.	--	12.8
2005	16.3	neg.	--	16.3
2010	19.7	neg.	--	19.7
2015	23.7	neg.	--	23.7

Particleboard consumption increased by a factor of 22 between 1960 and 1990. The product has found many uses in furniture and other markets. As with OSB/waferboard, very little offshore trade is expected to occur. North American consumption is projected to increase 36 percent between 1990 and 2015.

Table 27
Particleboard
Offshore

	Production	Imports	Exports	Consumption
	(1,000,000 cubic meters)			
1960	0.5	neg.	neg.	0.5
1970	3.4	neg.	neg.	3.4
1980	7.0	neg.	neg.	7.0
1985	8.3	neg.	neg.	8.3
1990	11.0	neg.	neg.	11.0
1993	12.3	neg.	neg.	12.3
2000	12.7	neg.	neg.	12.7
2005	13.4	neg.	neg.	13.4
2010	14.1	neg.	neg.	14.1
2015	15.0	neg.	neg.	15.0

Note: neg.= less than 50,000 cubic meters

Paper and Paperboard--North American paper and paperboard consumption and production doubled between 1960 and 1990. The projected increases in population and economic activity are reflected in the strong growth in projected consumption which amounts to 27 percent between 1990 and 2015. Some increase in trade--both imports and exports--is expected. By 2015, exports amount to 10 percent of production and imports 2 percent of consumption.

Table 28
Paper and paperboard
Offshore

	Production	Imports	Exports	Consumption
	(1,000,000 tonnes)			
1960	47.2	.2	1.9	45.5
1970	70.0	.3	3.8	66.5
1980	87.5	.4	6.0	81.9
1985	82.8	1.7	5.9	78.6
1990	96.0	1.6	7.2	90.4
1993	84.4	1.9	8.9	94.9
2000	106.0	2.2	9.7	98.5
2005	112.2	2.3	10.5	103.9
2010	118.4	2.4	11.8	109.0
2015	125.9	2.5	13.1	115.3

Coniferous logs--Exports of coniferous logs increased rapidly in the 1960's and tended to fluctuate in volume in the 1970's. Entry of the Peoples' Republic of China into the market in the 1980's caused volume to increase. Japan, the Peoples' Republic of China, and the Republic of Korea are the primary customers. Between 1990 and 2015, volume is expected to decline in part because the privately owned old-growth timber on the U.S. West Coast will have been harvested by the turn of the century. Export volume is still expected to be significant, however, and reach 9.8 million cubic meters in 2015.

Table 29
logs (coniferous)
Offshore

	Imports	Exports
	(1,000,000 cubic meters)	
1960	neg.	0.9
1970	neg.	11.5
1980	neg.	13.1
1985	neg.	15.8
1990	neg.	17.3
1993	1.3	11.6
2000	1.5	9.8
2005	1.5	9.8
2010	1.5	9.8
2015	1.5	9.8

Note: neg.=less than 50,000 cubic meters

Nonconiferous logs--Imports of nonconiferous logs declined from 1960 to 1990 and are not expected to be a significant factor in North American timber supply in the future. Exports increased some in the 1980's, but future growth is not expected. Offshore demand for temperate hardwoods is expected to be more for lumber, flitches, and other semi-processed material.

Table 30
logs (nonconiferous)
Offshore

	Imports	Exports
	(1,000,000 cubic meters)	
1960	0.4	0.1
1970	0.1	0.1
1980	neg.	0.4
1985	0.1	0.3
1990	neg.	0.7
1993	neg.	0.5
2000	neg.	0.5
2005	neg.	0.5
2010	neg.	0.5
2015	neg.	0.5

Note: neg.=less than 50,000 cubic meters

CHAPTER 5

IMPLICATIONS FOR RAW MATERIAL DEMAND

The roundwood raw material demands implied by the projected production of the various end products depends in part on expectations about future utilization of the resource. Factors affecting utilization vary between solid and fiber-based products.

Trends in Utilization of Solid Wood Products

For solid wood products, there has been a trend toward improvements in conversion efficiency--more veneer and lumber are being recovered from the same volume of roundwood. For example, in Canada in 1970, an average of 2.67 cubic meters of roundwood was required to produce one cubic meter of lumber and plywood. By 1984, the roundwood input requirement had declined to 2.14 cubic meters and is currently estimated to be 1.98 cubic meters. Increased recovery was facilitated by installation of computer assisted scanning devices that permitted optimization of log lengths and cutting patterns so as to maximize lumber production. There are other technologies that have the effect of extending timber supplies for manufacture of solid wood products.

There have also been changes in building practices that economize in the use of wood. For example, a shortage of skilled labor has facilitated the development of modular and prefabricated construction of building components that are assembled at the building site.

Utilization has improved at the logging site. For example, in the United States in 1962, 37 percent of the softwood growing stock volume at a logging site was left as logging residue and in 1986, it was less than 10 percent.

Trends in Utilization of Fiber-based Products

For fiber-based products, there are differences in utilization patterns between pulp-based products and the various panel products. The amount of wood required to produce a ton of paper or paperboard depends on fiber recovery in the pulping process.

The amount of wood required per ton of pulp varies from about 2.5 cubic meters for the mechanical processes to over 5 cubic meters for the chemical sulphite processes. Over time, the mix of pulps produced has changed considerably. These changes were brought on in part because of increased awareness of water pollution, changes in energy costs, and increased use of nonconiferous species in the United States. Improved mechanical pulping processes such as chemo-thermo-mechanical pulp may be substituted in the future for low yield chemical pulps. The average wood consumed per ton of pulp in North America has changed only very slowly and we do not expect major changes in average wood use through 2015. Past trends are reflected in the wood use assumed per ton of pulp output in the projections, however.

The roundwood required for paper and paperboard production depends in part on the recycling of paper and paperboard. By European and Japanese standards, recycling of paper and paperboard in North America is low, despite considerable progress in the 1990's. The recycling rate in Japan is near 50 percent; for the European Economic Community, 51 percent; for the United States, 33 percent--up from 25 percent in 1988, and for Canada, 12 percent. After a period of a glut in North American markets, the market for waste paper went through a period of rapid rises in prices in 1994.

The US paper industry as represented by the American Forest and Paper Association announced a goal of 40 % recovery of paper and paperboard by 1995 and this goal has been met. Billions of dollars have been invested in recycling capacity in the past few years and as this capacity comes on line, the recycling rate should increase. The effect of increased recycling on roundwood markets is not clear at this time.[24] One rationale is that increased recycling reduces the need for wood fiber in pulp manufacture. Thus, fewer trees are needed to manufacture pulp and these trees will go on to grow into sizes suitable for the production of lumber and other products.

Roundwood demand for the production of wood pulp is also affected by the extent of use of the by-products from the manufacture of solid wood products. Increased production of coniferous lumber and plywood in North America since 1960 led to a corresponding increase in output of sawdust, slabs, edgings and other usable by-products. In the United States and for most of Canada, these by-products are almost completely used for pulp, energy, or reconstituted panel manufacture. In Canada, consumption of wood residues surpassed consumption of roundwood in pulp manufacture for the first time in 1983--43 million cubic meters of wood residues and 40 million cubic meters of roundwood were used in the production of 20 million tonnes of wood pulp.

The importance of roundwood in pulp manufacture varies around the United States. The pulp industry of Washington and Oregon is almost completely dependent on mill by-products while the pulp industry in the South uses roundwood as a major component of the fiber mix.

Utilization of wood brought to mills is complete to the point that increased efficiency of recovery of lumber and veneer increases the demand for roundwood for fuel, pulp, and other uses. The increases in lumber production forecast for North America imply increased output of by-products which will end up primarily in the fiber mix for pulp manufacture.

Production of OSB is based almost entirely on roundwood because of the need for quality control in the production of the fiber for panel manufacture. These boards were initially based on the use of low-density species such as aspen found around the Great Lakes. These species are still the preferred ones, but the OSB panels can be produced from any species. Initially based in the Great Lakes region, the industry has branched out into other parts of the continent. Roundwood used in the production of the panels is almost completely used with little by-product volume. Technology and wood utilization in this industry is straight forward and few changes are expected by 2015.

North American Roundwood Demand

After taking into account utilization trends, the projected increases in production of the various end products imply substantial increases in the demand for roundwood, especially for coniferous species. By 2015, the demand for roundwood in total is expected to be some 24 percent higher than for 1991.

Through 2010, the increased output is expected to come from existing inventories. In the decades immediately after 2010, there will be substantial volumes of Southern pine coming from plantations in the Southern part of the United States. The increased demands projected through the turn of the century imply higher prices for roundwood when considered in relation to supplies. In the United States, for example, the price (net of inflation and deflation) for coniferous species in the U.S. South is projected to more than double between 1991 and 2010. These price increases are expected to be the basis for increased output from private lands in the United States and from the publicly owned lands of Canada.[25] The price increases will also reinforce the incentives to forest industry to maintain plantation programs that will be the basis for supply expansion after 2015.

Table 31

	Coniferous	Nonconiferous	Total

[24]Ince, Peter J. 1994. Recycling and long-range timber outlook. General Technical Report RM-242. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 23 p.

[25]See Jaakko Pöyry Consulting. 1993. For a presentation of the cost of factors of production other than wood.

	(million cubic meters) (Industrial roundwood)		
1960	293	57	350
1970	365	70	435
1980	418	80	498
1986	314	113	427
1991	300	127	427
2000	295	156	451
2005	295	167	462
2010	297	176	473
2015	312	184	496

Note: Nonconiferous included in coniferous column for Canada

In Canada, prices are one of the determinates of the economic accessibility of timber in Provincial forest plans. There are substantial acreages of timber currently considered economically inaccessible that would go into the timber base under the terms of these price increases. Precise volume estimates for Canada are not possible at this time. It is the judgment of the Canadian cooperators for this report that there exists in Canada enough uncommitted timber inventory to meet the projected demands for the Canadian resource.

Especially for pulp manufacture, there exists vast potential for adoption of wood-saving technology that would extend the Canadian timber supply. Replacement of chemical pulping processes with thermo-mechanical processes would effectively halve the wood fiber needed by the pulp industry in Quebec and Ontario. Indeed, the installation of such capacity is well underway.

Possible Equilibrating Mechanisms

North America has gone through many cycles in rising real prices for roundwood. In Washington and Oregon and the U.S. South, recent ones occurred in the late 1960's and late 1970's. During these times, there was a response of increased harvest from private lands in the United States and a huge response from British Columbia in the 1970's. Just as important as increased supply of roundwood, however, was the response of technology--the substitution of coniferous plywood for coniferous lumber and the substitution of fiber-based structural panels for coniferous plywood.

The specific demand levels that have been projected are problematic and depend on the realization of many assumptions. There can be little doubt, however, that demands will increase significantly by 2015. Increased population by itself will dictate increased demands for all forest products.

The projected price increases initiate many market mechanisms. Available technology and market acceptance of fiber-based construction materials will tend to moderate price increases for roundwood. The effect of these materials on prices is reflected in past trends and in the demand projections which have been made. We cannot be certain, of course, that the demand projections adequately reflect the effect of technology in moderating price increases. For example, the nonconiferous timber resource in both Canada and the United states is under-utilized. Further development of this resource would moderate the price increases projected for coniferous species.

There are arguments to be made that we underestimate the price increases for roundwood. In the 1990's through 2015, North America will be going through a time when timber demands are increasing and there is not a reserve of high-quality coniferous roundwood available for development. This situation is unprecedented in the twentieth century and may lead to market behavior not reflected in past trends.

Implications for Offshore Trade

In the market economy of North America, supplies of timber products will meet demands. The question is at what price. The West Coast of North America has had a comparative advantage over the rest of the world in being blessed with a high-quality indigenous coniferous timber resource. This situation is changing on private lands in the United States, but the resource will still be a major factor in world trade in the forecast period, and will still have the effect of a comparative advantage because of the unique qualities of the resource.

The temperate hardwoods of the United States also have unique properties that would maintain their presence in World markets despite upward pressure on prices.

Wood accounts for less than 25 percent of the cost of a ton of paper and paperboard--price increases for roundwood used in pulp manufacture would have some effect on the North American competitive position, but a significant increase in roundwood cost would be necessary.

Market development activities in Japan and Europe for sale of coniferous products mainly involve the promotion of platform-frame housing. The cost of wood in a platform-frame house is a small fraction of the cost of the final structure and land combined. Price increases for roundwood in the United States would have some effect on the success of promotion efforts, but would not be devastating.

Exchange rates are probably the most important determinate in the price of North American wood delivered to offshore markets. Exchange rates in the 1990's will be affected by strong forces, as they have in the past and the net effect is impossible to predict.

The projections of North American trade and consumption of timber products that have been presented still show North America to be relatively self-contained for timber supply. They show some expansion of offshore trade, but markets are dominated by domestic demand. It is this strong domestic market and not offshore trade that will determine the course of North American demand and supply in the 1990's through 2015. North America has the supply capability to support increased harvests. If the growth is to offshore markets, domestic supply will still equal demand in North America. Technology, substitutes for wood, and currently economically inaccessible resources are all strong and plausible responses to increased demands for timber products.

APPENDIX A

Projection Methodology for Canada[26]

The final projection methodology for each product or product group is as follows:

Softwood Lumber

The softwood lumber domestic consumption was projected using the following equation:

SL = 960.471 + 480.091 RGDP - 394.222 RGDP Lag + 0.33551 SL Lag
(0.83) (3.09) (-2.54) (1.98)

The equation was estimated for the period 1962-1992.

R-Square adjusted = 0.81

SL = the apparent domestic consumption of softwood lumber.

RGDP = the real Gross Domestic Product.

RGDP Lag = the real Gross Domestic Product lagged one year.

SL Lag = the apparent domestic consumption of softwood lumber lagged one year.

Total Canadian forecast imports of softwood lumber were projected using the equation presented in an earlier north american timber trends study (NATTS) entitled *Timber Trends and Prospects for North America (1990)*. Total Canadian imports were assumed to be of American origin.

Exports to the U.S. were calculated as a residual between total U.S. imports as presented in *The 1993 PPA Timber Assessment Update* (1995) and U.S. offshore imports for the purpose of the present document. A five-year average ratio (1990-1994) was subsequently applied to our U.S. exports to calculate our offshore exports.

Using the forecasted consumption, total imports and exports, an apparent domestic production was derived.

Hardwood Lumber

The hardwood lumber consumption and total imports were projected using the equations presented in NATTS. The total imports were assumed to be of American origin.

Exports to the U.S. were calculated as a residual between total U.S. imports as presented in the RPA Update and U.S. offshore imports for the purpose of the present document. Canadian offshore exports were projected using a time trend.

Using the forecasted consumption, total imports and exports, an apparent domestic production was derived.

Other solid wood products

For each product group, consumption and total imports were projected using the equations presented in NATTS. Offshore imports were assumed to be negligible.

Total exports and offshore exports were projected using the trend (1985-2005) of the forecast values obtained from the equations presented in NATTS. These trends were then applied to the 1990 base year.

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[26]Unless otherwise specified, the historical data used in this report are official data from Statistics Canada.

An apparent domestic production was subsequently derived.

Paper and Paperboard

In the original NATTS, the individual products contained in the paper and paperboard category were estimated separately. However, for the purpose of this study, the paper and paperboard category was dealt treated as a single aggregate.

Production and total exports were projected using the trend for the period 1961-1992. Offshore exports were then adjusted at the average 1990-1993 ratio. Offshore imports were assumed constant at .2 million tonnes.

Apparent domestic consumption was subsequently derived.

SOME FACTS ABOUT THE TIMBER COMMITTEE

The Timber Committee is a principal subsidiary body of the ECE (UN Economic Commission for Europe) based in Geneva. It constitutes a forum for cooperation and consultation between member countries on forestry, forest industry and forest product matters. All countries of Europe; the former USSR; United States of America, Canada and Israel are members of the ECE and participate in its work.

The ECE Timber Committee shall, within the context of sustainable development, provide member countries with the information and services needed for policy- and decision-making regarding their forest and forest industry sector ("the sector"), including the trade and use of forest products and, when appropriate, formulate recommendations addressed to member Governments and interested organizations. To this end, it shall:

1. With the active participation of member countries, undertake short-, medium- and long-term analyses of developments in, and having an impact on, the sector, including those offering possibilities for the facilitation of international trade and for enhancing the protection of the environment;

2. In support of these analyses, collect, store and disseminate statistics relating to the sector, and carry out activities to improve their quality and comparability;

3. Provide the framework for cooperation e.g. by organizing seminars, workshops and *ad hoc* meetings and setting up time-limited *ad hoc* groups, for the exchange of economic, environmental and technical information between governments and other institutions of member countries that is needed for the development and implementation of policies leading to the sustainable development of the sector and to the protection of the environment in their respective countries;

4. Carry out tasks identified by the UN-ECE or the Timber Committee as being of priority, including the facilitation of subregional cooperation and activities in support of the economies in transition of central and eastern Europe and of the countries of the region that are developing from an economic point of view;

5. It should also keep under review its structure and priorities and cooperate with other international and intergovernmental organizations active in the sector, and in particular with the FAO (Food and Agriculture Organization of the United Nations) and its European Forestry Commission and with the ILO (International Labour Office), in order to ensure complimentarily and to avoid duplication, thereby optimizing the use of resources.

More information about the Committee's work may be obtained by writing to:

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