

C I N T R A F O R

Working Paper

46

**THE RUSSIAN FORESTRY SECTOR OUTLOOK AND
EXPORT POTENTIAL FOR UNPROCESSED LOGS AND
PRIMARY FOREST PRODUCTS THROUGH 2000**

March 1994

Charles A. Backman

**Thomas R. Waggener
College of Forest Resources**



**CENTER FOR INTERNATIONAL TRADE IN FOREST PRODUCTS
UNIVERSITY OF WASHINGTON
COLLEGE OF FOREST RESOURCES AR-10
SEATTLE, WASHINGTON 98195**

CINTRAFOR Working Paper 46

**THE RUSSIAN FORESTRY SECTOR OUTLOOK AND
EXPORT POTENTIAL FOR UNPROCESSED LOGS AND
PRIMARY FOREST PRODUCTS THROUGH 2000**

March 1994

Charles A. Backman

**Thomas R. Waggener
College of Forest Resources**

This material is based upon work supported by the Cooperative State Research Service, US Department of Agriculture, and the State of Washington Department of Trade and Economic Development. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the funding agency.

PREFACE

Global interest in the forests of Russia (and the NIS) has grown significantly in recent years, both reflecting the opening of the country to greater outside investigation and the general tightening of global timber supplies which has stimulated speculation regarding the potential for greater production and trade from the great forests of Siberia. CINTRAFOR has sought to contribute to the growing information base available to Western scholars regarding the Russian forests through the ongoing research program on Country & Market Studies, including competitor-supply regions outside of North America.

CINTRAFOR has previously published two major Working Papers dealing with the Russian Forests. In their initial work, Backman and Waggener (Soviet Forests at the Crossroads: Emerging Trends at a Time of Economic and Political Reform, CINTRAFOR Working Paper 28, 1990) provided an extensive examination of the Soviet forestry sector at the beginning of the period of remarkable economic and political reform. In a companion volume (Soviet Timber Resources and Utilization: An Interpretation of the 1988 National Inventory, CINTRAFOR Working Paper 35, 1991), they present a detailed compilation of the official Soviet forest inventory data based on the most recently completed national forestry assessment.

The studies noted above provide the necessary background for a structured analysis of the near-term outlook for the Russian forests in light of the current economic and political turmoil confronting the country. Although CINTRAFOR has previously presented preliminary projections of timber harvest and export potential (Cardellichio et al, Potential Expansion of Soviet Far East Log Exports to the Pacific Rim, CINTRAFOR Working Paper 21, 1989), the analysis was limited, and based primarily on the potential for sustainable allowable harvest.

A substantially more detailed analysis of the Russian forest sector and the near-term potential for output and trade has been completed by Mr. Charles Backman and is included in his doctoral dissertation "Prospects for Wood Raw Material Exports from Russia to Pacific Rim and European Markets up until the Year 2000" (University of Washington, 1993). In this work, Mr. Backman formulated the "Russian Forest Sector Model" (RFSM), an analytical computer model capable of estimating production and trade under a variety of economic and political possibilities. A baseline estimate reflecting "most likely" trends was formulated, together with optimistic and pessimistic projections bracketing the possible outcomes under alternative assumptions about the future course of political and economic reform. It is anticipated that this work will be published in book form during 1994.

The present working paper provides a summary of the significant features of the forest sector analysis developed in greater detail in the Backman dissertation. Interested readers are referred to

that document for greater detail on both the background to the present situation in the Russian forest sector and the analysis of the various scenarios for future direction.

This research is the result of a broad cooperative research initiative undertaken through CINTRAFOR. The basic analysis of the Russian (former Soviet Union) forestry sector, forest industry and international trade was supported by CINTRAFOR, University of Washington with funding from the Cooperative State Research Service (CSRS), U.S. Department of Agriculture and the State of Washington, Department of Trade and Economic Development (DTED). Other cooperators include the Center for International Business and Economic Research (CIBER) of the Graduate School of Business Administration, University of Washington who supported investigation of the Russian-Japan trade relationship, and the Forest Economics and Policy Analysis project (FEPA) at the University of British Columbia for the detailed examination of the most recent forest inventory information reported in Working Paper #35. Private industry support was provided by the Boise Cascade Corporation and ITT-Rayonier, Inc. The Foreign Agricultural Service (FAS) market development program (Forest Products Division) provided assistance for a linked analysis of the Russia-Eastern Europe timber market relationships through the National Forest Products Association (NFPA).

Academic-scholarly support was provided to Mr. Backman by the Canadian Government through the Association of Universities and Colleges of Canada, and by the Kennan Institute for Advanced Russian Studies, Washington, D.C. The International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria also provided valuable assistance through the IIASA Forest Study of the former Soviet Union. Critical assistance within Russia was provided by VNIPIEllesprom (Moscow), the Economics Institute, Far East Branch of the Russian Academy of Sciences, the Far Eastern Institute of Forestry, and the Institute of Market Reform, all located in Khabarovsk. The Ural Forest Technical Institute assisted with information regarding the forestry sector under the present conditions of economic reform and transition to a market economy.

The findings, opinions, conclusions and recommendations expressed in this publication are those of the authors, and do not reflect the views of any of the supporting organizations.

Charles A. Backman
Thomas R. Waggener

Seattle, March 1994

TABLE OF CONTENTS

PREFACE	i
EXECUTIVE SUMMARY	iv
INTRODUCTION	1
RUSSIAN ROUNDWOOD AND FIBER SUPPLY	9
Solid Roundwood Supply	9
Principal Harvest and Allowable Annual Cut (AAC)	11
Intermediate Harvesting	19
Other Harvesting	21
Secondary Timber Resources	23
Imported Timber	26
FUTURE TIMBER OUTLOOK: BASIC DETERMINANTS	27
The Russian Forest Sector Model (RFSM)	27
Major Factors Shaping Development of the Forest Sector	27
Scenarios for the Near and Medium Term	32
Baseline Scenario	36
Pessimistic and Optimistic Scenarios	38
ECONOMIC WOOD SUPPLY	40
"Available Supply"	40
Projected Near Term and Medium Term Roundwood Supply	44
Estimated Total Delivered Commercial Wood and Fiber Supply	48
Long term Economic Supply and Real Prices	51
ROUNDWOOD TIMBER AND FIBER ALLOCATION	55
Domestic Production of Forest Products	58
Lumber	58
Panel Products	60
Pulp and Paper	60
Export of Roundwood and Forest Products	62
Export of Roundwood and Chips	62
Exports to the Former Republics	62
Exports to European and Pacific Rim Markets	63
Exports of Manufactured Wood Products	66
CONCLUSIONS	72
REFERENCES	76
APPENDIX	78

EXECUTIVE SUMMARY

While the Russian Republic represents one of the largest single holdings of forests and forest inventory, the potential of this resource is far from fully realized. In part, this is due to the huge size of the Republic, and the overall pressures that have taken priority over the development of the forestry and forest products sector historically.

In more recent years, the ongoing political and economic disruptions associated with political and economic reforms have resulted in actual declines in output and production in the face of breakdowns in the routine processes of economic activity generally.

The findings of this analysis clearly indicate, however, that there remains a number of fundamental problems of a long term nature that will inhibit and slow the realization of the potential for the forestry and forest products sector beyond the immediate short run chaos.

Timber Resources

The economic availability of timber resources, in contrast to the physical presence of forests, brings into question the real potential for near term development. Primary harvest, from designated (Category III) forests under the administration of the forest administrative authorities, has been stated as approaching 833 million cubic meters annually as a sustainable yield (Annual Allowable Cut). However, only a fraction of that potential is considered by the Russian authorities as either currently available or potentially available over the next twenty years through significant investments in infrastructure for accessibility. In the present analysis, it is suggested that of the 545 million cubic meters of current and potentially accessible AAC, that the near term harvest will be restricted to the currently accessible forests. These forests have an AAC "realistic" AAC of only 426 million cubic meters, or about 51 percent of the aggregate physical total. Of the currently accessible AAC, some 248 million cubic meters are from conifer forests, and 178 million cubic meters from deciduous forests. Further, this analysis finds that some 88 million cubic meters of the "currently accessible" AAC is in fact not realistically accessible due to access, reservation for alternative uses, environmental restrictions etc.

Timber supplies from other sources include intermediate harvests (primarily from silvicultural operations), harvests from "other" forests not administered by forestry organizations, and secondary resources from waste and recycling. While important, these sources do

not constitute more than 125 million cubic meters in the aggregate, and at present is mainly derived from secondary sources (primarily sawmill waste).

ECONOMIC REFORMS AND FORESTRY

The future outlook for the forestry and forest products sector is highly uncertain in today's political climate. As Russia struggles to install "market economy" mechanisms, it finds itself trapped in many economic and political issues of transition. Reforms are far from complete, particularly as it relates to the former administered cost/price system and the physical nature of decision-making for the forestry sector. Further, the overall decline in economic performance throughout the Russian economy has led to declines in almost all indicators for the sector relative to the previous "normal" levels as of 1989.

It is expected that in the near term that domestic prices and costs will continue to be distorted, and hence of limited value in guiding normal economic decision-making about the allocation of resources. Further, the forestry sector is compelled to approach reforms from the vantage point of the existing industry structure and resource conditions. This will mean that structural adjustments will come slowly. This is only part political. The lack of capital investment to modernize and restructure the sector will be a major constraint. The reinvestment of present hard currency earnings within the sector for restructuring are meager, as these earnings are diverted to other purposes. Foreign investment is likewise discouraged by the economic and political uncertainties, as well as the unknown parameters of future policies.

It can be expected that the imperfect corrections to the price/cost structure will have an immediate impact on the forestry sector, since the freedom from central control also means that enterprises must become "profitable" - measured by the covering of primary operating costs (variable costs) from their own sources of income. In the short term, the installed industrial capacity (including logging) can be further depreciated, with the appearance of avoiding the significant capital (fixed) costs of operations. Although beyond the period of analysis incorporated in this analysis, the deferral of capital investment will have serious consequences for the sector after the turn of the century.

It is also clear that Russia will be torn between two conflicting policies with respect to domestic use of available forest resources. On the one hand, the large

standing inventories of timber represent a "bank account" that can be liquidated as needed to generate desperately needed hard currency. The potential for exploiting the significantly higher valued export markets is a great temptation under the pressing needs of the country at present. However, this factor is offset by the rapidly declining levels of domestic consumption since 1990, and the potentially growing need for forest products to aid in the eventual economic recovery process and future economic development. This means restricting the export of timber in lieu of meeting current and anticipated future domestic requirements.

FUTURE TIMBER HARVESTS

In terms of harvest, the need to recover variable costs by forest enterprises means that not all "currently accessible" timber can be economically harvested under prevailing (and distorted) prices and costs. The relatively low domestic price for timber means that the ability to cover rising domestic costs is difficult, imposing a constraint on harvest.

The scenarios developed in this analysis attempt to mirror the "most likely" conditions through the end of the century, and bracket the most significant potential uncertainties. For the baseline conditions, the economic harvest rate declines to a delivered volume of industrial timber of approximately 250 million cubic meters for Period 1 (1990-1995), in contrast to a 1989 level of some 338 million cubic meters. Due to the presence of existing infrastructure for accessing the forest and the installed production capacity, the share of delivered timber increases for the European-West Siberian region, from 68 percent of the 1989 total to over 76 percent of the projected Period One timber supply. In Period 2 (1996-2000), the delivered supply is projected to decline further, to approximately 244 million cubic meters, with 178 million cubic meters (73 percent) derived from the European-West Siberia region. This slight decline in regional share is due to the continuing depletion of mature timber inventory in the Russian west. Under the Pessimistic scenario, the delivered supply would decline to only 214 million cubic meters, while the most Optimistic forecast for Period 2 would lead to a supply of 338 million cubic meters, just restoring the previous levels of 1989.

If firewood is excluded from the delivered commercial supply, but secondary sources (waste, chips and recycled fiber) are included, the total available wood/fiber supply projected from Period 1 is 230 million cubic

meters, which includes 185 million cubic meters of roundwood. By region, this supply includes 175 million cubic meters from the European-West Siberian region (76 percent roundwood) and 56 million cubic meters from the Asian-Pacific region (86 percent roundwood). For Period 2, the total wood/fiber supply is 229 million cubic meters under the baseline scenario. With the decline in capital investment, the pessimistic outlook for Period 2 is for a supply of only 203 million cubic meters. Under the Optimistic case, Period 2 supply would increase to 341 million cubic meters. The gain over the baseline case represents an increase of 112 million cubic meters, which includes 65 million cubic meters of roundwood, with 40 million cubic meters of this derived from the Asian-Pacific region as the inventories in the European-West Siberian region continue to decline. The most important gain under the Optimistic case would be for greater waste paper recovery in the European region, with the equivalent of 37 million cubic meters of waste fiber recovered.

The analysis also sought to approximate the likely supply response to long term price/cost reforms based on 1992 international levels. Although higher international prices are an incentive, the reform of domestic costs would clearly discourage production. The results were perhaps surprising, indicating that full price/cost reforms to international levels for Period 2 would result in an economic timber/fiber supply of only 216 million cubic meters, very close to the Pessimistic case outlook. However, supply would shift slightly to the Asian-Pacific region, where the more abundant timber would offset the higher costs, while the European-West Siberian region would continue to face declining competitiveness due to aging capital structure. If sufficient investment was made in infrastructure to access the "potentially accessible" forest (a factor not assured) the overall supply would increase to 265 million cubic meters, well below the 338 million cubic meters attained in the "pre-reform" period (1989).

As an illustrative example, it was further assumed that world real prices would increase by 10 percent in response to growing global timber scarcity. This assumption, with constant (1992) world real costs, lead to an estimate of Russian supply of only 350 million cubic meters, close to the realized volume of 338 million cubic meters for 1989. Conifer supply would approximate 248 million cubic meters, with deciduous supply would be 102 million cubic meters.

Full economic reform (to global competitive levels) thus does not significantly improve the comparative advantage of Russia in the absence of increased prices, and only then with substantial capital investment. Russia will continue to struggle to recover to the harvest levels and delivered wood/fiber supply of the centrally planned system (338 million cubic meters) during this century.

ALLOCATION OF AVAILABLE TIMBER/FIBER SUPPLY

The allocation of the available wood/fiber supply will reflect the dual objectives of assuring an "adequate" domestic consumption consistent with overall economic performance (GDP) and internal price/cost reforms and the opposing need for critical foreign hard currency earnings. Assuring domestic consumption (relative to the declining GDP) results in a domestic use of timber of 207 million cubic meters in Period 1, leaving some 22 million cubic meters available as "surplus" for export. In Period 2, domestic consumption (baseline) is estimated as declining to 204 million cubic meters, leaving a slight increase available for export (25 million cubic meters).

Under pessimistic assumptions for Period 2, domestic consumption would absorb the entire supply of 203 million cubic meters. However, the analysis suggests that Russian central authorities would sacrifice domestic consumption in order to maintain exports at near present levels of 13 million cubic meters, resulting in a decline in domestic consumption to 190 million cubic meters.

Optimistic conditions would lead to a Period 2 domestic consumption of 256 million cubic meters, reflecting recovery of GDP. This growth, together with increased capital investment would allow for total supply to reach 341 million cubic meters, giving an export potential of almost 85 million cubic meters.

DOMESTIC USE OF TIMBER/FIBER

Domestic processing of wood/fiber is primarily related to conifer lumber. In 1989, output was 83 million cubic meters, with two-thirds of this in the European region. Projections for Period 1 indicate a significant decline, to approximately 54 million cubic meters of lumber, with conifer lumber accounting for 44 million (mainly non-larch species or 37 million cubic meters). Under optimistic assumptions, lumber production would increase over the baseline, but only to about 68 million cubic meters, still below the 1989 level of 83 million cubic meters.

Wood panel production in 1989 was approximately 12 million cubic meters. This is estimated to drop to only 6 million cubic meters in Period 1, and to a maximum of 7.7 million cubic meters in Period 2 under the optimistic case. Pulp and paper production was some 11.4 million metric tons in 1989, with 8.6 million metric tons produced in the European region. Baseline estimates are for a decline to 5.9 million metric tons in Period 1, with 3.5 million metric tons in the European region. For Period 2, production is estimated to range from 3.8 million metric tons (pessimistic) to 7.8 million metric tons (optimistic), with the majority being produced in European region.

EXPORT OF ROUNDWOOD AND WOOD PRODUCTS

Export trade by Russia as typically involved the export of unprocessed logs to both the former Soviet Republics and China (soft trade), the Pacific Rim (Japan) and Europe for hard currency. While the Pacific Rim trade has been primarily higher quality sawlogs, the hard currency trade with Europe has been primarily lower grade sawlogs and pulpwood.

Export trade with the former Soviet Republics was approximately 20 million cubic meters in 1989. Due to economic declines in the Republics (as with Russia), domestic consumption has fallen and hence the need to import conifer logs. Period 1 estimates are that unprocessed exports will decline to 8 million cubic meters, reflecting the Russian desire to maintain the traditional trade relationship with these Republics that are the source of critically needed Russian imports of other goods. In Period 2, exports to the former Republics are estimated to range from 8 million cubic meters to an optimistic level of 17 million cubic meters, a level still below that of 1989.

Exports to hard currency markets in Europe and the Pacific Rim were about 16 million cubic meters in 1989. Period 1 estimates are for exports of 13 million cubic meters, with 7 million going to European markets and 6 million to the Pacific Rim. While only 30 percent of European exports are sawlog quality, it is expected that over two-thirds of Pacific Rim exports will be higher grade sawlogs.

In Period 2, hard currency exports are estimated to range from a low of 7 million cubic meters (pessimistic) to a high of 29 million cubic meters. The baseline projection for Period 2 is for exports of 13 million cubic meters, representing the Central Government concern for

maintaining hard currency sales in spite of the implied shortfall for domestic consumption. European exports would range from 2 to 17 million cubic meters, while Pacific Rim exports range from 5 to 12 million cubic meters.

Exports of manufactured wood products are anticipated to remain modest in contrast to unprocessed timber exports. Lumber exports are almost entirely to Europe, with the total estimated at 4.5 million cubic meters total for Period 1 (4.1 million cubic meters to Europe), and ranging from 3.3 to 5.8 million cubic meters for Period 2. Panel exports are likewise modest, estimated at only 0.4 million cubic meters in Period 1 and ranging from 0.3 to 1.9 million cubic meters in Period 2. The majority of panel exports will be to the Former Asian Republics of the Soviet Union rather than to hard currency markets.

FUTURE OUTLOOK

Although Russia seeks to utilize the forestry and forest products sector to promote regional economic development and desires to encourage value added production (both for domestic consumption and exports), the current state of industry capacity and the near term problems of gaining hard currency for capital investments will continue to constrain the achievement of these objectives. If (and when) incentives emerge for the reinvestment of hard currency export earnings and/or a favorable climate for foreign investment is created, it can be expected that the more optimistic outlook described here will be more realistic. However, it remains that even the optimistic outlook barely allows Russia to reach the levels of harvest, production and trade achieved under non-economic central planning in the last half of the 1980's. Further development will require substantial capital investments beyond the levels assumed in the optimistic scenarios in order to develop a competitive sector with an international comparative advantage.

Trade of forest products with hard currency trading regions can be expected to continue at levels evident in the late 1980's and early 1990's through 1995 (subject to short term cyclic variations).

The prospects for wood fiber exports between 1995 and 2000 depend on levels of invested capital, alacrity with which domestic costs and prices rise to world levels, and levels of domestic demand. Exports during 1995 and 2000 will fluctuate between 17 million cubic meters to European markets and 12 million cubic meters to Pacific Asian markets, and 2 million cubic meters to European

markets and 5 million cubic meters to Pacific Rim markets. Higher exports are potentially possible should the ties binding Russia to other republics of the former Soviet Union not be as strong as those existing before the break-up of the USSR.

Employing the Russian Forest Sector Model, the reasonable bounds for this important sector of the Russian economy have been estimated. The implications are that restructuring and reform have had significant negative impacts to date, but that modest recovery can be anticipated during the balance of this century. However, no major expansions of the sector, or external trade, can be anticipated in the near to medium term. In fact, recovery to the pre-reform levels of the late 1989 will be a substantial challenge as Russia struggles to put reforms in place, and to substitute more market-like resource allocation decision-making for the previous non-economic central planning approaches.

The longer-term outlook for the volume of wood raw material exports to trading regions not belonging to the former Soviet Union is clouded in uncertainty. Rising domestic consumption levels interacting with the physical limits imposed by the forest resource may effectively limit the contribution which Russia could be expected to make to consumption in regions outside of Russia.

Longer-term outlook for the volume of wood raw material exports to trading regions not belonging to the former Soviet Union is clouded in uncertainty. Rising domestic consumption levels interacting with the physical limits imposed by the forest resource may effectively limit the contribution which Russia could be expected to make to consumption in regions outside of Russia.

INTRODUCTION

Political turmoil continues unabated in Russia. The unfolding drama over the distribution of power is generating a paralysis in government which is casting a shadow over the future social and economic path which Russia will follow. Regional structures are emerging in the power vacuum, further clouding the future.¹ Against the unfolding political turmoil, Russia's economy has continued to deteriorate.² Prognosis of the Central Bank is for further erosion of output with decline on 1992 industrial output in 1993 of between 12 to 15 percent predicted.³ The forest sector has not escaped these upheavals, suffering significant declines in production and shipments. Such short term disruptions, however, are likely to cloud the realistic outlook assessment for the longer term development of the forest sector - and the potential for that development relative to the broader participation of Russia in the external timber markets of Asia and Europe.

In particular, the potential role of the forests of East Siberia and the Far East regions of Russia relative to the economies of the Pacific Rim has been of growing interest. The Pacific Ocean links the different producer and consumer countries of the Pacific Rim in an interlocking web of production and trade relationships. The region is rapidly emerging as the largest single global marketplace for both unprocessed timber and manufactured forest products. This emerging marketplace accounts for approximately one-half of the world production of roundwood, nearly 45 percent of lumber, one-

¹Stanglin, Douglas and Pope, Victoria, "Two cheers for demokratiya", *U.S. News & World Report*, 5 Apr., 1993, p. 42-52

²Gross Domestic Product by the third quarter of 1992 had plummeted to levels less than two-thirds those existing in 1989. Industrial output showed similar declines. Value of exports have declined (1991-\$38.1 billion; 1992-\$38.1 billion), while estimated external debt has increased (1991-\$54.6 billion; 1992-\$69.1 billion). Retail prices have skyrocketed with inflation estimated to be nearly 800 percent in 1992. Witt, Howard, "Economy: All bets are on privatization:", *The Seattle Times*, 28 Mar., 1993, p. A3.

³*European Market Report*, 7 Jan., 1993, p. 10

fifth of wood panel production and almost one-quarter of pulp and paper production. This region accounts for approximately 45 percent of global imports of roundwood, 40 percent of lumber and wood based panel imports, and some 40 percent of all pulp and paper trade. This region also represents one of the fastest growing economies globally, and hence is of considerable importance to all major forest producers including the US Pacific Northwest, Western Canada, Chile, and New Zealand. Russia, and the forest potential of Siberia and the Far East, is the major "unknown" in the Pacific Rim marketplace for timber and forest products.

Backman and Waggener (1990) noted that trade in forest products to the Pacific Rim has not amounted to more than 20 percent of the total former-Soviet Union forest products exports. This trade is dominated by trade in unprocessed log exports, representing more than 95 percent of Russian forest products trade with the Pacific Rim. Exports of lumber, wood panels, and pulp and paper products are relatively minor in comparison.

The transition from a centrally planned economy to a market economy has been very painful to date, not only for the country as a whole, but for the forest sector as well. The declines in forest sector output, first evident in 1990, have continued unabated, affecting both production and export volumes. By 1992, Russian production of timber had declined to 225 million cubic meters, two-thirds of the level attained in 1989.⁴ Output of lumber has also suffered steep declines, reaching 50 million cubic meters by 1992, two-thirds of production levels in 1990, and more than 35 million cubic meters below levels achieved in 1988. While data are not currently available which describe other branches of the forest sector, similar declines are expected.⁵ A recent forecast of forest sector

⁴*Timber Trades Journal*, 2-9 Jan., 1993, p. 3.

⁵*Finansovi Izvestiya*, 10-16 Dec., 1992, "Promishlennost' Rossii v 1992 godu"

output in 1993 revealed drops in commercial roundwood output of 18 percent, lumber output of 26 percent, plywood of 16 percent, and particleboard of 17 percent.⁶

The declines in domestic production have not been fully reflected in the foreign trade of forest products.⁷ While 1992 figures are not yet available, the declines evident between 1990 and 1991 are expected to have continued. In 1991, log exports amounted to 11 million cubic meters, down from 15 million in 1990. Lumber exports have dropped just as precipitously, reaching almost 5 million cubic meters, down from 7 million in 1990.⁸ Paper exports have suffered similar declines. In 1991, exports of paper products amounted to 330 thousand tons while 1990 exports were 514 thousand metric tons.⁹

While the decline in industrial output may have been arrested, the lack of historical data describing the forest sector under the current market conditions makes it very difficult to provide a forecast with any certainty the likely direction which production, consumption, and trade of forest products will follow. As noted, even though production has plummeted, the volume of timber exports has fallen less precipitously. Although desire for hard currency will undoubtedly support current export levels to hard currency trading areas, the prospect for exports to countries belonging to the former COMECON trading bloc and republics of the former USSR is

⁶*European Market Update*, 22 Apr., 1993, p. 6

⁷The data presented in this paragraph considers export statistics of products destined for countries not belonging to the former Soviet Union.

⁸*European Market Update*, 11 Mar., 1992, p. 3

⁹*Narodnoye Khozaystvo RSFSR v 1990 g.*, p. 59.

less certain.^{10,11} Furthermore, the existence of quotas to limit the volume of exports is a political decision based on the need to support acceptable minimum level of domestic consumption. Applying export tariffs to forest products also acts as a disincentive to exports since the tariffs siphon off a portion of the economic surplus which could be used to encourage greater economic activity within the forest sector. Abnormally high tariffs effectively discourage economic activity.¹²

Additionally, the rapidly changing cost and price structure, superimposed on the dissolution of the centrally planned economy makes the selection of future scenarios for demand, price, and cost vectors difficult. While the eventual outcome of the ongoing economic reforms can be agreed upon, whether Russia can successfully navigate the shoals which lie between the centrally planned economy and the market oriented one remains to be seen.

Russia can be expected to seek ways to improve the flow of hard currencies from the export of forest products. This could include any or all of the following possibilities: a) increasing the absolute volume of exported unprocessed timber in spite of stable or declining harvests and at the expense of domestic processing and consumption, b) substituting manufactured forest products for the present emphasis on the export of unprocessed timber, c) increased sustainable harvests and domestic production through capital investments in the forest sector and infrastructure supporting the

¹⁰Eronen, Jarmo and Simula, Markku, *Russia and Other Ex-Soviet Republics as Future Paper Markets*, Conference Paper, Prima Conference, Helsinki, Finland, May 12-14, 1993, p. 11

¹¹Estimates of sawn lumber exports to the unified Germany from Russia are in the range of 400 thousand to 600 thousand cubic meters. The combined total prior to unification for the two separate Germanies amounted to the range between 1.6 million and 1.8 million cubic meters. (*European Market Update*, 10 May, 1993, p. 1).

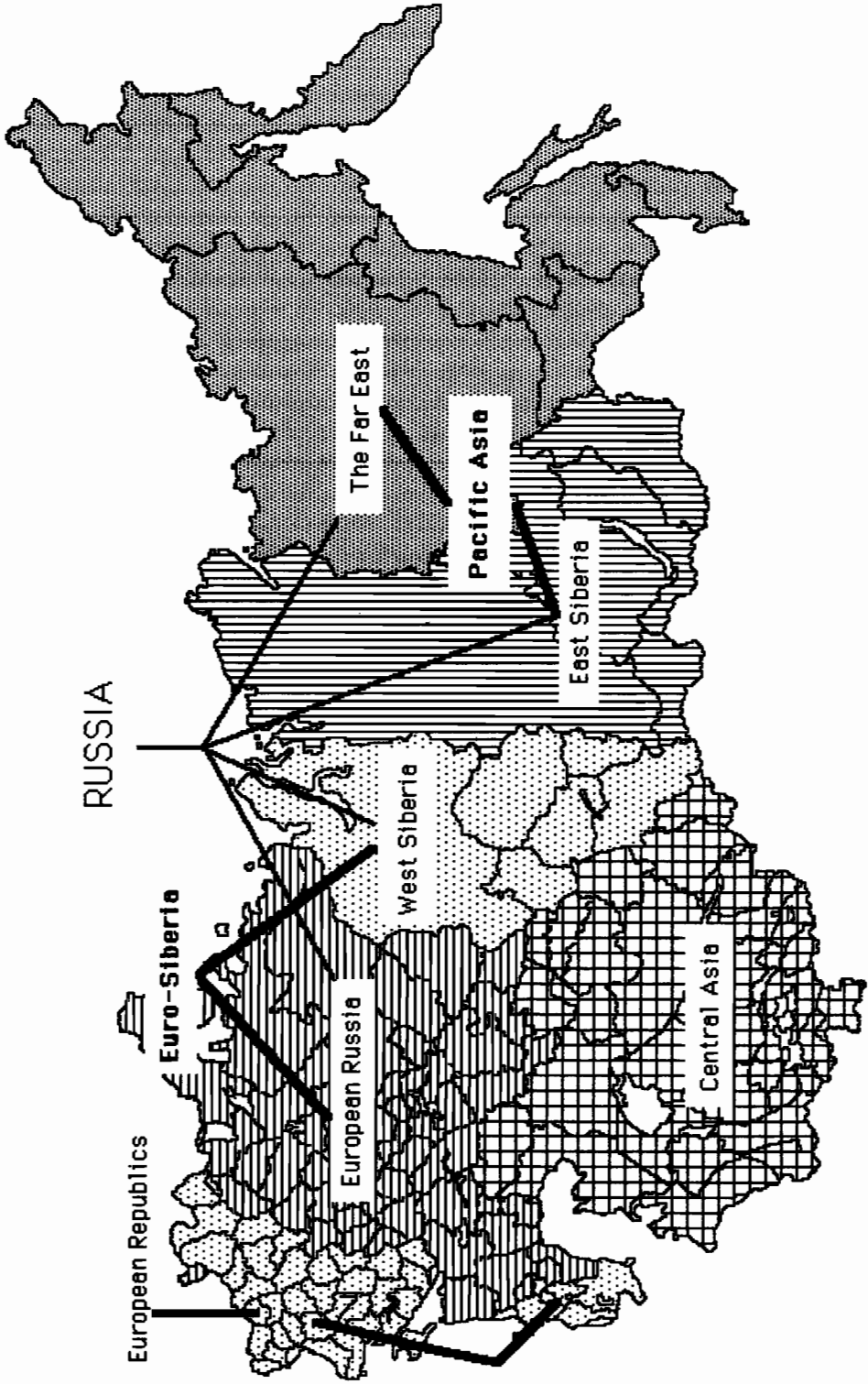
¹²*Timber Trade Journal*, 22 May, 1993.

export of both unprocessed timber and manufactured products, and d) redirection of export volumes from former non-hard currency trading areas within Russia, the former Soviet Republics, and Eastern Europe.

Despite the uncertainties painted above, the near term outlook for the forestry sector of Russia is of immense importance to greater understanding of the global trends in production and trade of forest products. The recently completed analysis (Backman, 1993) reported here illustrates some of the likely boundaries within which the production and export volume of unprocessed timber and wood products can be expected to fall during the decade ending in the year 2000.

Backman and Waggener (1991) have noted that the Russian Republic (as with the former Soviet Union) is not a homogeneous forest territory, nor a balanced nation in terms of the production and consumption of forest products. For this reason, Russia was considered at two major regions for the purposes of documenting and describing the forest resource base. European Russia and West Siberia were considered as one major region, referenced as the Euro-Siberian Russian Region. The East Siberian and Far East sub-regions were similarly aggregated as the Pacific Asian Russian Region. These distinctions, including the Russian sub-regions, are likewise utilized in the present analysis, and are shown on **Map 1**.

MAP 1: Regions of the Former Soviet Union



Source: C.A. Backman

The analysis of the Russian forest sector integrates the consideration of economic reform, the capacity of the forest resource base, domestic consumption, domestic production, and trade in both raw materials and manufactured products with former Soviet trading partners and hard currency markets of Europe and the Pacific Rim. For this purpose, the Russian Forest Sector Model (RFSM) was developed, providing for a consistent and integrated analysis of the various factors influencing the viability of the Russian forest sector and the likely dynamics in the near term.¹³

Beginning with the forest resource base, the various components of the Russian fiber supply are identified. The currently and potentially accessible allowable annual cuts (AAC) are evaluated, followed by a careful consideration of the economic accessibility of the roundwood (harvest) component of the total Russian wood-fiber supply. Next, the share of the harvested roundwood which is "consumed" within the domestic economy (as either unprocessed timber or processed into various manufactured products for domestic consumption and/or export) is estimated relative to the share which is estimated to be exported as unprocessed timber (logs).

Finally, a prognosis of the export of unprocessed timber (logs) and major wood products to European and Pacific Rim markets for the decade of the 1990's is provided, reflecting a two period analysis. The estimates of exports by stage of processing, various markets, and timber type reflect the overall equilibrium between the complex physical resource and economic relationships noted above, and probable central policy decisions reflecting domestic consumption priorities and export earning potentials given international competitiveness. A baseline scenario is developed to illustrate the most likely economic and political factors impacting the near term

¹³For a full discussion of the Russian Forest Sector Model, see Backman, Charles A. *Prospects for Wood Raw Material Exports from Russia to Pacific Rim and European Markets up until the Year 2000*, Chapter 3 and Appendix A. Unpublished doctoral dissertation, University of Washington, 1993.

future of the forestry and forest products sector, with alternative "optimistic" and "pessimistic" scenarios designed to bracket the range of uncertainty surrounding the major factors of capital investment and economic (price & cost) reforms and the pace and success of these efforts up to the end of the century. The various scenarios reflecting trade outcomes are more fully described and discussed in the following sections of this report.

RUSSIAN ROUNDWOOD AND FIBER SUPPLY

Backman (1993) identified five components to the total Russian fiber supply which are illustrated in Figure 1. The most important component consists of the "principal harvest" or the final harvest from forest lands under the administration of the forest sector organizations, and additional "non-forest sector harvest", which is the incidental harvest from forest lands under the administration of non-forest Ministries or institutions which nevertheless control and administer forests. These two categories of harvest accounted for an estimated 342 million cubic meters of roundwood, or 84 percent of the total fiber supply in 1989.

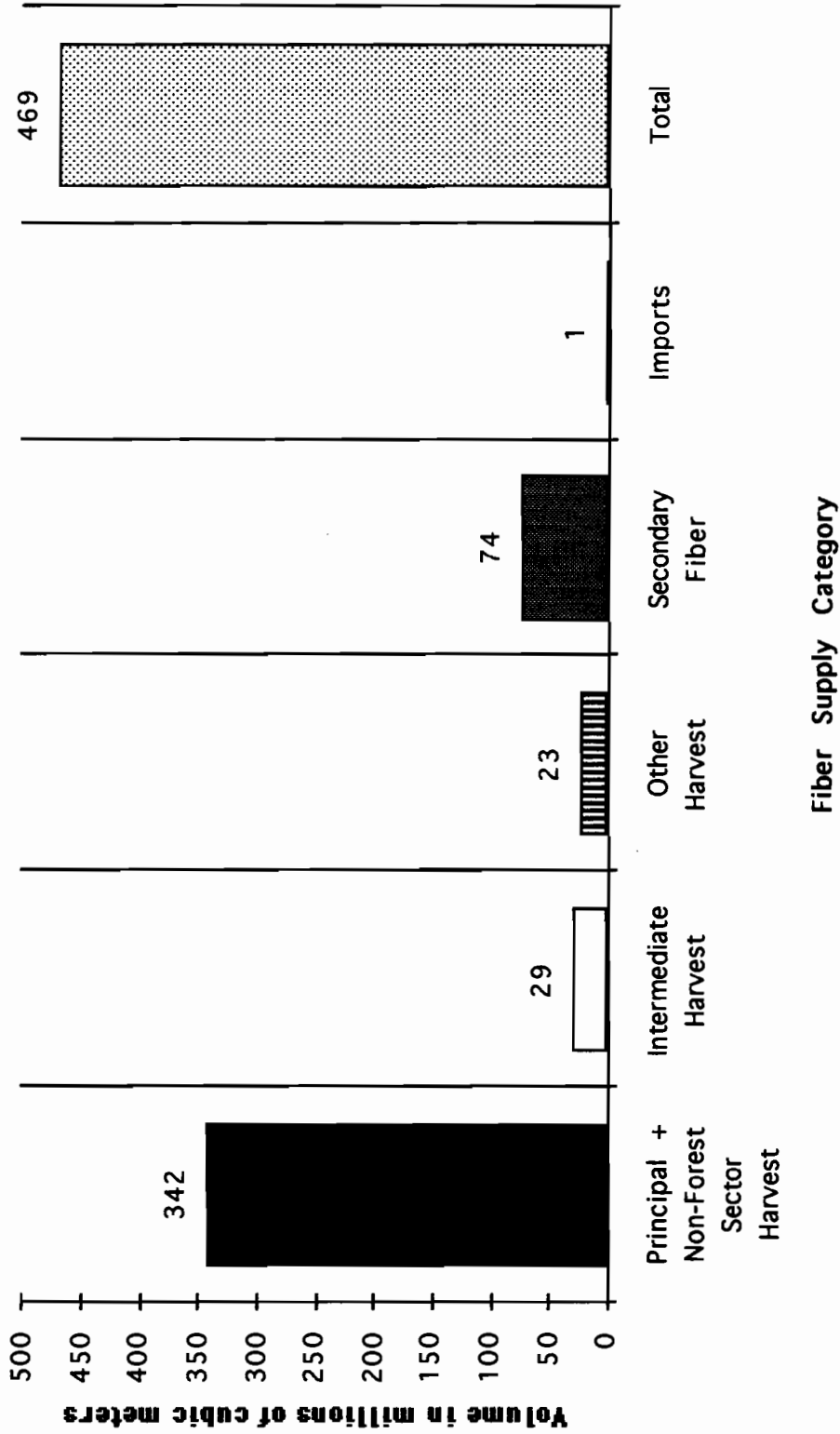
The other contributing components include "intermediate harvesting" from silvicultural operations such as thinning, "other harvesting" such as land clearing for conversion to other land uses, secondary fiber (material obtained from logging and manufacturing residues as well as recycled fiber), and imported roundwood, solid wood products, and pulp products.

Solid Roundwood Supply

The solid roundwood supply consists of the principal (final) harvests (including forest sector and non-forest sector harvests), the intermediate harvests, and the "other harvest", which together accounted for more than 394 million cubic meters (four-fifths) of the estimated total wood fiber supply of 469 million cubic meters in 1989.¹⁴

¹⁴It is this solid wood and wood fiber supply upon which the estimate of economic accessibility is based.

FIGURE 1: RUSSIA: Estimated Total Fiber Supply in Roundwood Equivalents - 1989



Source: C. A. Backman (1993)

Principal Harvest and Allowable Annual Cut (AAC)

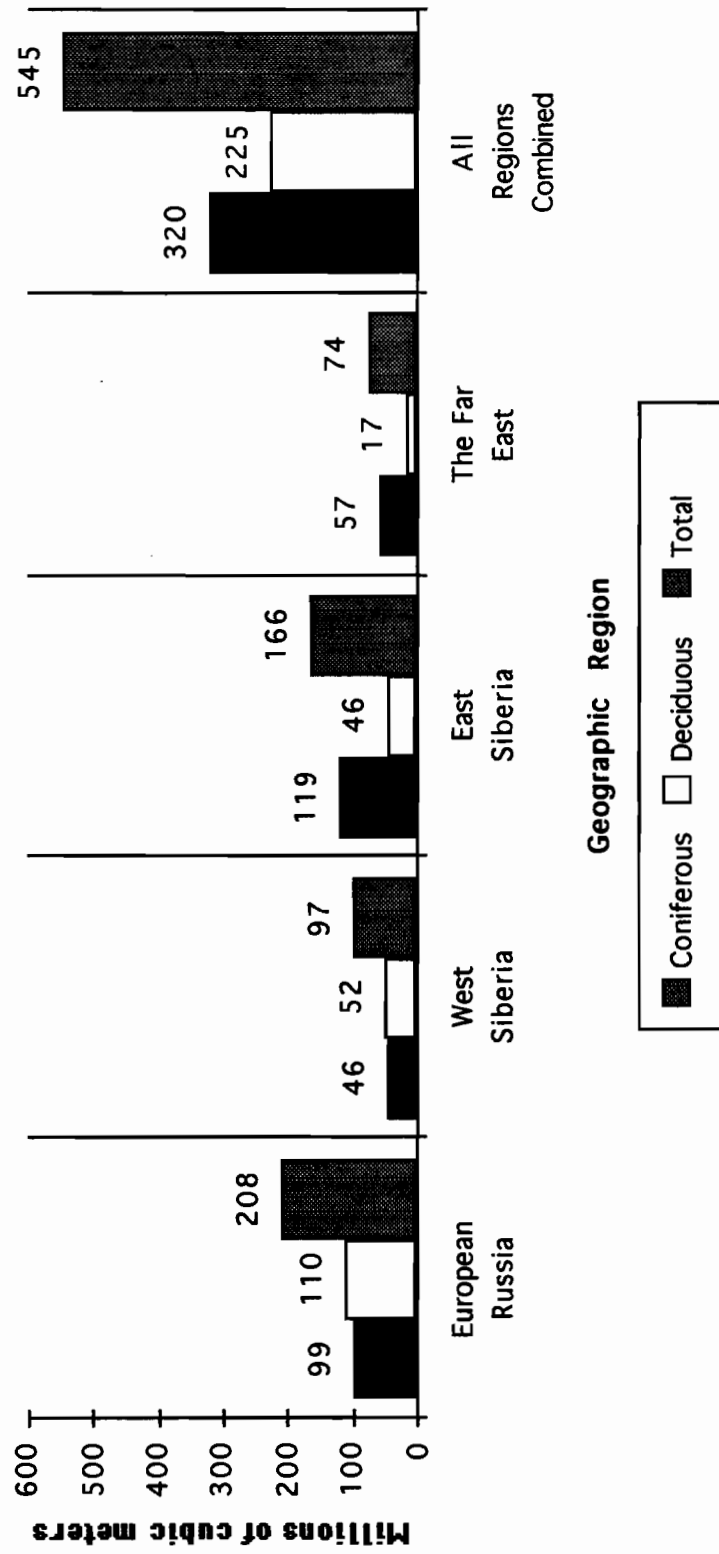
Only the principal harvest portion of the total roundwood supply is directly linked to the allowable annual cut (AAC). This (AAC) is the estimated volume of useable timber that could be harvested sustainably from existing forests under present levels of forest management and growth. Figures which describe the actual principal harvest since 1990 are not readily available, and in fact, are not very useful when estimating either the potential physical or economic accessibility of sustainable roundwood timber supply.¹⁵ Alternatively, a methodology was developed to estimate both the current and potentially physically and economically accessible sub-components of the Russian Republic calculated physical AAC's. This approach is based on actual levels of principal harvest which took place during the second half of the 1980's.

The forest resource which will be available for development by the forest sector in the short to medium term is realistically only the portion of the AAC which is currently accessible. Beyond this capacity, the potential AAC includes an additional amount of timber where economic access is linked to infrastructure development over the next ten to twenty years. An estimate of the combined currently accessible and potentially accessible AAC, segregated into coniferous and deciduous components and by geographic sub-region of Russia, is shown in **Figure 2**.¹⁶

¹⁵The former Soviet Union, up to the end of 1991, effectively functioned under the centrally planned system. As Backman (1993) notes, the degree to which costs and prices determined the level of harvest was not very high. In fact, industrial activity took place under a completely different economic and social system than which Russia is presently operating.

¹⁶The definition of potentially accessible AAC as used here excludes a portion of AAC included in Russian statistics as "potentially accessible" but is considered by the authors as not being realistically accessible in the near to medium term due to the lack of infrastructure development. Hence the total shown here is less than that cited for the physical AAC categories. The AAC in current and potentially accessible forests, including the portion of the potentially accessible AAC which is considered to be not realistically accessible, amounted to 634 million cubic meters in 1989.

FIGURE 2: RUSSIA and REGIONS: Currently and Potentially Accessible Allowable Annual Cut By Species Group



Source: C. A. Backman (1993)

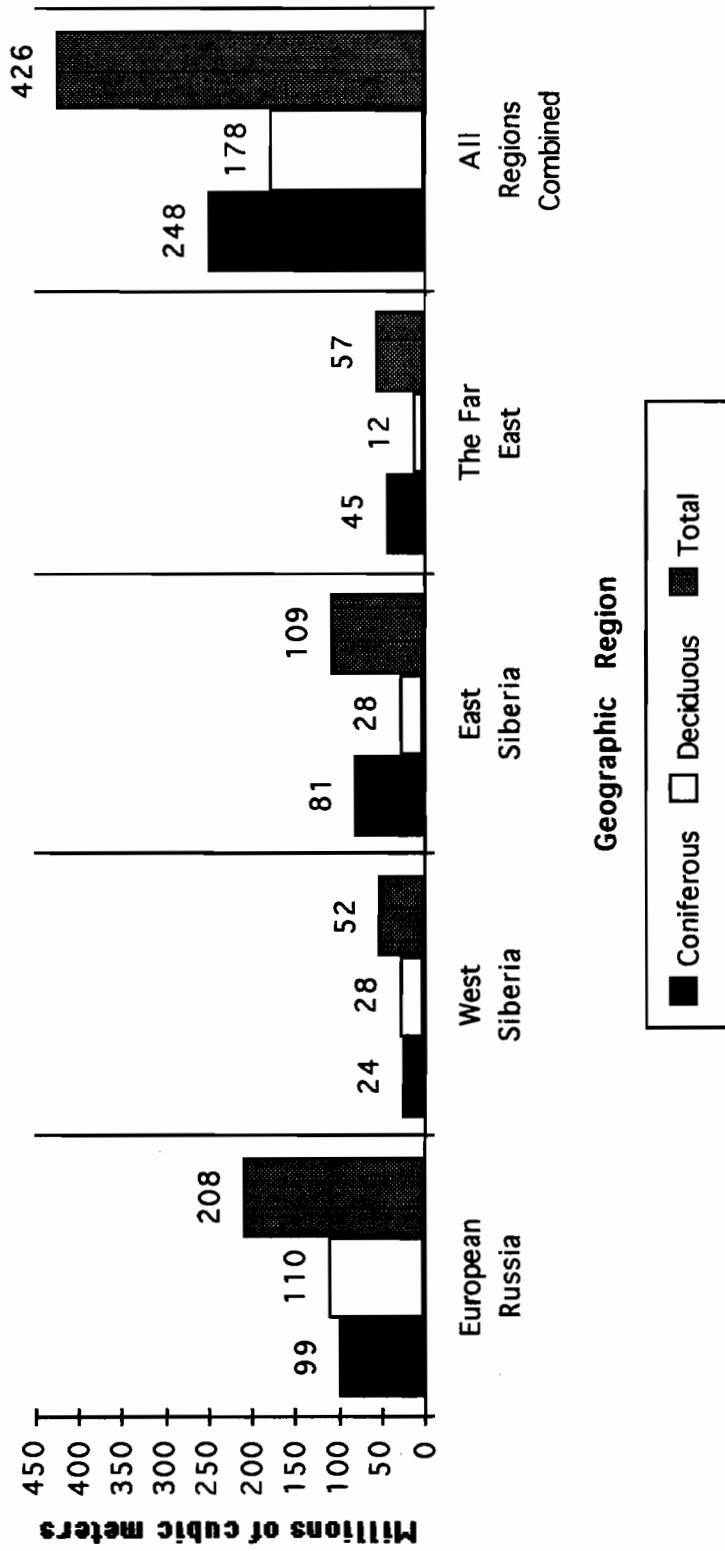
The AAC based on the combined current and potentially accessible forest is estimated at 545 million cubic meters. Of this total, 320 million cubic meters consist of coniferous species (58.7 percent) and 225 million cubic meters (41.3 percent) is made up of deciduous species. Nearly 40 percent of the total (current and potential) AAC is located in European Russia (208 million cubic meters). The West Siberia region accounts for approximately 20 percent or 97 million cubic meters of the estimated AAC, East Siberia accounts for 30 percent (166 million cubic meters), and the Far East accounts for 74 million cubic meters, or almost 15 percent of the estimated current and potential AAC.

Approximately one-half of the deciduous AAC is located in European Russia, compared with only one-third of the coniferous AAC. East Siberia has the largest component of conifer AAC (119 million cubic meters or 37 percent of total conifer AAC), followed by the European Russia region (99 million cubic meters, 31 percent), the Far East Region (57 million cubic meters, 18 percent) and West Siberia (46 million cubic meters, 14 percent).

Estimates of the currently accessible AAC are shown in **Figure 3**. European Russia dominates the other sub-regions in terms of the share of the total currently accessible AAC of Russia, accounting for 50 percent of the combined coniferous and deciduous AAC. Some 60 percent of the currently accessible deciduous AAC, and 40 percent of the currently accessible coniferous AAC are situated in the European Russia region.

In the European and West Siberian Russia sub-regions, the currently accessible coniferous and deciduous AAC are approximately equal. In contrast, in East Siberia the deciduous component of currently available AAC accounts for only one-quarter of the total, with conifer species accounting for 81 million cubic meters or almost 80 percent. In the Far East sub-region, deciduous species account for just 12 million cubic feet of currently accessible AAC (some 21

FIGURE 3: RUSSIA and REGIONS: Currently Accessible Allowable Annual Cut By Species Group



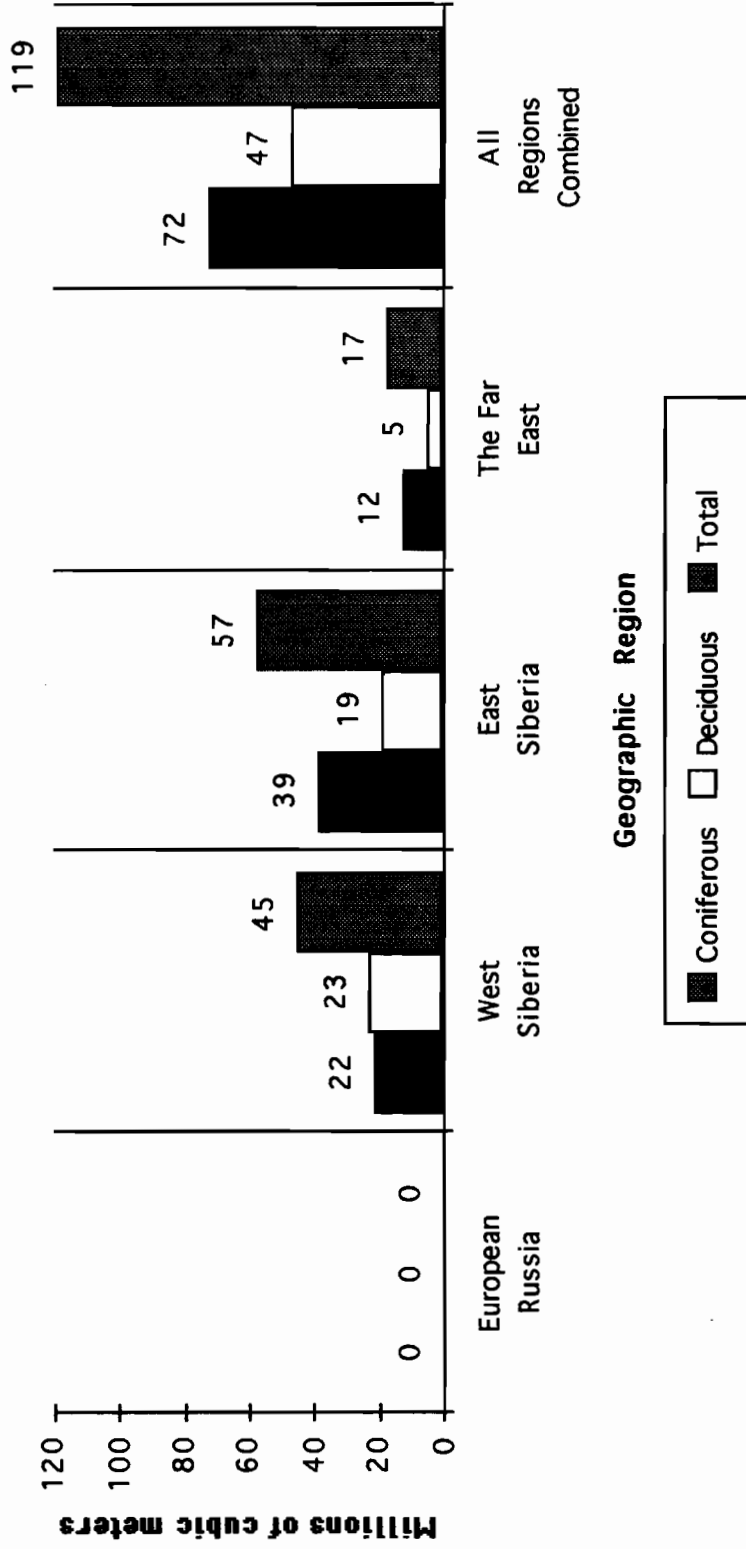
percent) while conifers account for 45 million cubic meters of the currently accessible AAC (79 percent).

Figure 4 provides estimates of the potentially accessible AAC based on the physical conditions (infrastructure) anticipated during the next ten years. This clearly reveals the lack of any significant increment of additional (potentially accessible) AAC in the European sub-region for either conifer or deciduous species. The majority of the potentially accessible AAC is located in the West Siberia and East Siberia sub-regions, which together account for approximately 103 million cubic meters of AAC, or about 85 percent of the estimated total of 119 million cubic meters of potentially accessible timber. The Far East sub-region has a potential of 17 million cubic meters of additional AAC, 12 million meters (71 percent) of which would be coniferous species.

The relationship of the current and potentially accessible AAC relative to previously published physical AAC volumes for Russia, and identified by subregion and species group, is summarized in **Table 1**. Although the aggregated total AAC for Russia approaches 833 million cubic meters, an estimated 200 million cubic meters is considered as inaccessible or is included in reserved forests at the present time.¹⁷ Further, some 88 million cubic meters included in the "Currently and Potentially Accessible" category in the Russian statistics are considered here to be not realistically accessible under the outlook for infrastructure development during the next two decades, reflecting the almost-certain lack of government capital investments supporting the forest products sector in the more remote, under-developed and inaccessible forest regions.

¹⁷The AAC figure normally presented in the literature excludes the portion attributed to "reserve forests" (200 million cubic meters) and some 30 million cubic meters attributed to forests which were not under the direct control of the forest sector authorities.

FIGURE 4: RUSSIA and REGIONS: Estimated Potentially Accessible Allowable Annual Cut By Species Group



Source: C. A. Backman (1993)

TABLE 1. RUSSIAN ANNUAL ALLOWABLE CUT
BY ACCESSIBILITY CATEGORY, SUBREGION AND SPECIES GROUP

	ANNUAL ALLOWABLE CUT (Mill cm)										CURRENT AAC		CURR & POTENTIAL	
	CURRENT POTENTIAL	SUBTOTAL	NOT REALISTIC	TOTAL	INACCESSIBLE	RESERVE & TOTAL	PHYSICAL AAC	AS SHARE OF TOTAL AAC (%)	AS SHARE OF TOTAL AAC (%)	(C1/C7)	(C3/C7)	AS SHARE OF TOTAL AAC (%)	AS SHARE OF TOTAL AAC (%)	
	(MILLION CUBIC METERS)													
RUSSIAN REPUBLIC														
TOTAL	426	119	545	88	633	200	833	51%	51%		65%			
CONIFER	248	72	320	71	391	177	568	44%	44%		56%			
DECIDUOUS	178	47	225	17	242	23	265	67%	67%		85%			
EUROPEAN														
CONIFER	208	0	208	30	238	5	243	86%	86%		86%			
DECIDUOUS	99	0	99	25	124	4	128	77%	77%		77%			
	110	0	110	5	115	1	116	95%	95%		95%			
WEST SIBERIA														
CONIFER	52	45	97	12	109	14	123	42%	42%		79%			
DECIDUOUS	24	22	46	5	51	9	60	40%	40%		77%			
	28	23	51	7	58	5	63	44%	44%		81%			
EAST SIBERIA														
CONIFER	109	57	166	13	179	100	279	39%	39%		59%			
DECIDUOUS	81	39	120	9	129	87	216	38%	38%		56%			
	28	19	47	4	51	13	64	44%	44%		73%			
FAR EAST														
CONIFER	57	17	74	31	105	83	188	30%	30%		39%			
DECIDUOUS	45	12	57	30	87	77	164	27%	27%		35%			
	12	5	17	1	18	4	22	55%	55%		77%			

Source: Backman (1993)
Vorob'ev (1979)

The greatest share of the inaccessible and reserved annual allowable cut is conifer (177 million cubic meters or 88.5 percent), located primarily in the Far East (77 million CM) and East Siberia (87 million CM) sub-regions. The portion of the "potentially" accessible AAC that is here considered unrealistically accessible (88 million CM) is also primarily conifer (80.7 percent), but primarily located in the Far East and European sub-regions.

It is important to note from Table 1 that the "Currently Accessible" AAC (426 million CM) constitutes only 51 percent of the aggregated AAC of 833 million cubic meters. For conifer species, the proportion is even lower at 44 percent. It is the currently accessible component that will provide the base for primary harvest during the near term period under analysis here. As is noted in the following sections, only a portion of the currently accessible AAC will in fact be economically accessible during this period.

While access to forests is most highly developed in the European sub-region, making 86 percent of the total AAC currently accessible, other sub-regions of Russia are less favorably developed at present. The proportion of total physical AAC that is currently accessible drops significantly moving from west to east across the sub-regions. While 42 percent of the total physical AAC for the West Siberian sub-region is currently accessible, only 39 percent is currently accessible for the East Siberian sub-region. For the Far East sub-region, current accessibility falls to only 30 percent of the overall physical AAC.

For conifer species, the currently accessible AAC is lower as a percent of total physical AAC. For Russia, the currently accessible conifer AAC is 44 percent of the estimated total. This ratio is the highest for the European region (77 percent), falling sharply for the conifer forests of West Siberia (40 percent), East Siberia (38 percent) and the Far East (27 percent).

Forests that are "potentially accessible" that are considered here to also be realistically accessible in the near term raise these proportions somewhat. Yet even under the limits of realistic near term conditions (requiring substantial capital investment), the combined current and potentially accessible AAC is only 65 percent of the total Russian physical AAC, and 56 percent for the total Russian conifer physical AAC. Clearly, a significant proportion of the Russian physical or biological AAC is and can be expected to remain beyond the reach of economic utilization in the near term.

Intermediate Harvesting

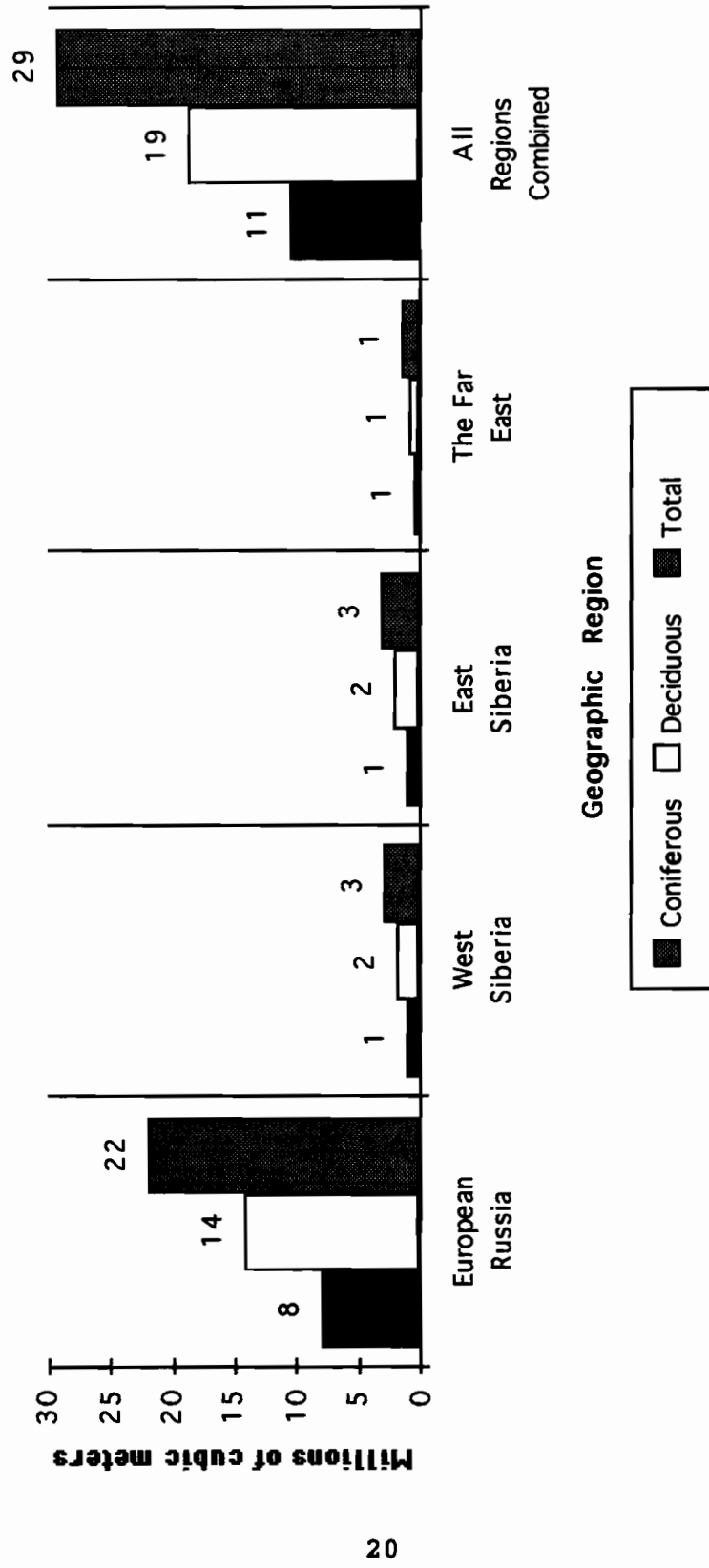
Intermediate harvesting accounted for nearly 6 percent of the overall solid wood and wood fiber produced in Russia in 1989. The contribution to total delivered timber supply from this source was much higher in the European region of the country, where the transportation network and markets are much more highly developed. In European Russia, intermediate utilization accounted for up to 10 percent of the overall regional fiber resource.

Figure 5 shows the estimated distribution of the intermediate harvest in 1989 by geographic region and major species groups. The European sub-region accounted for about 22 million cubic meters of intermediate harvest volume, or for over 76 percent of the Russian total. The largest component (14 million cubic meters, or 64 percent) of the European region intermediate harvest is deciduous fiber, while approximately 8 million cubic meters are coniferous.

Intermediate utilization in both West Siberia and East Siberia each total about 3 million cubic meters, with two-thirds being deciduous species. The small intermediate utilization of 1 million cubic meters in the Far East is almost equally split between conifer and deciduous species.¹⁸

¹⁸The values shown in Figure 5 are rounded to the nearest million cubic meters, and hence are not additive.

FIGURE 5: RUSSIA and REGIONS: Intermediate Utilization in 1989



Source: Backman (1993)

The future potential gains in intermediate harvest are difficult to predict within the context of the short to medium term economic conditions. For this analysis, only the possible increase of intermediate harvests in the European sub-region of Russia is considered feasible in formulating estimates of the total potentially available timber and fiber supply. This is due to the low level of capital investment and infrastructure development which can be anticipated in Siberia and the Far East in the near term.

The estimated potential increase in intermediate harvesting for the European sub-region is shown in **Figure 6**. This volume totals some 15 million cubic meters, and represents an increase of 68 percent over current sub-region intermediate harvest. As with the current intermediate utilization, the greatest potential increase is for deciduous species, accounting for 10 million cubic meters or two-thirds of the total.

Other Harvesting

The contribution of timber harvested from "other" forests not directly under the administration of forestry organizations or from activities such as land conversion has only recently exceeded 20 million cubic meters per year.

The total volume of timber derived from such "other" sources was 23 million cubic meters in 1989, with the largest share being in the European and West Siberian sub-regions, reflecting to some extent the greater accessibility of forests and the more immediate pressure for forest conversion. Of the total, almost 70 percent was coniferous species. Conifers accounted for the greater share of "other" harvests in all of the sub-regions.

FIGURE 6: RUSSIA and REGIONS: Potential Increase in Intermediate Harvest Volumes



Very little useful information is available about the determinants of the "other" sources of timber harvest, making projections of future levels from these sources difficult. Consequently, the estimate of the likely future contribution from "other" harvests to the total Russian timber and fiber supply is held constant at the 1989 level. This is shown by sub-region and species group in **Figure 7**. Changes in "other harvesting" therefore do not contribute to the estimated near term potentially available total timber and fiber supply for Russia in this analysis.

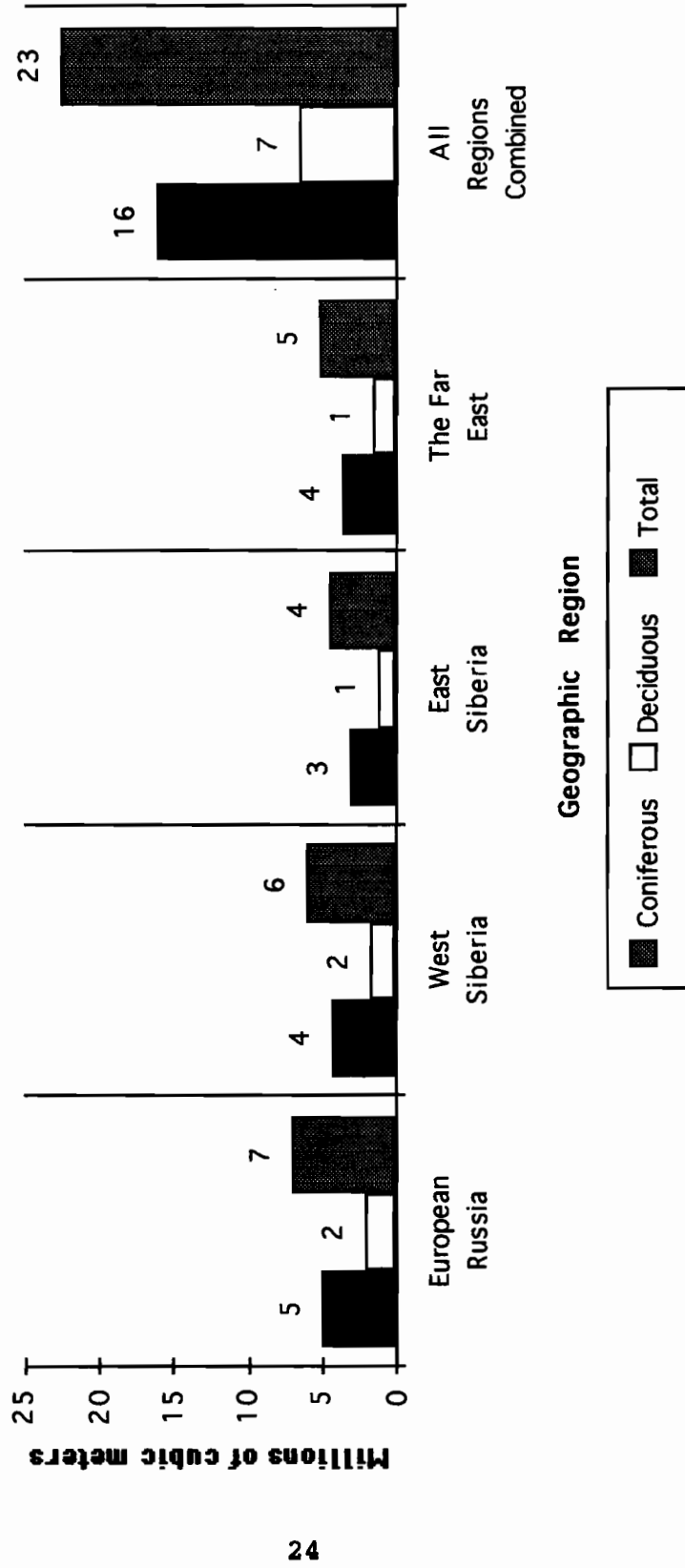
Secondary Timber Resources

Secondary timber supply and fiber materials, consisting of wood-based residues (from both harvesting and manufacturing) and recycled waste paper, have contributed significantly to the overall timber and fiber supply of Russia. In 1989, this source accounted for 16 percent of the total timber supply, or about 74 million cubic meters (roundwood equivalent) as was illustrated in **Figure 1**.¹⁹

The majority of secondary material was obtained and utilized in the European part of the country (**Figure 8**). Over 48 million cubic meters were utilized within the European sub-region, with almost all (42 million cubic meters) coming from waste and residues rather than recycled waste paper. In other sub-regions, essentially all secondary wood fiber is from residues, with less than one million cubic meters (roundwood equivalent) derived from waste paper. This pattern is not surprising, given the concentration of primary timber processing - lumber and plywood production - being located in the European sub-region, thereby generating the greatest volume and most accessible wood waste and residue from manufacturing, and a greater population to support paper recycling in this sub-region.

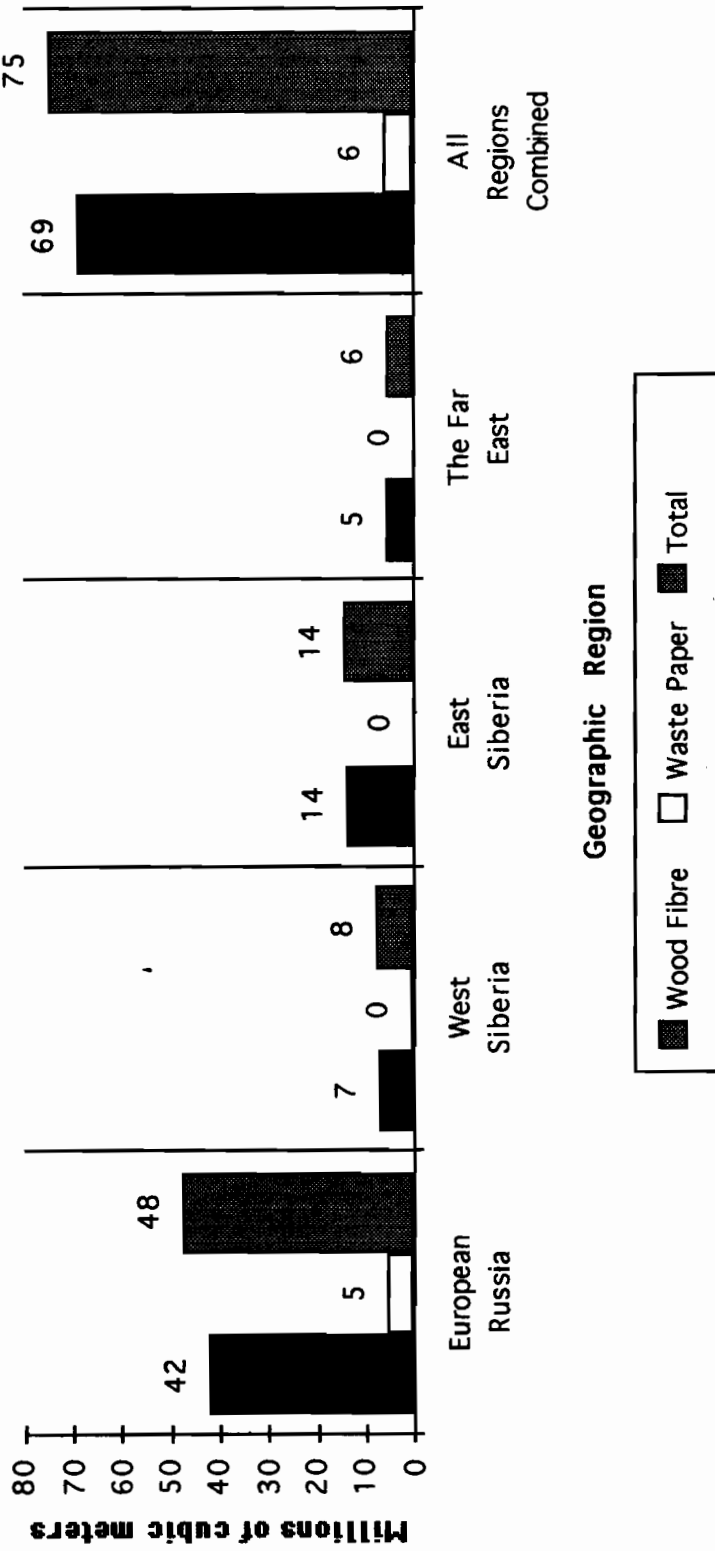
¹⁹Waste paper is used solely in the manufacture of paper and paperboard, while secondary wood-based material is used in the manufacture of pulp, particleboard and fiberboard. It is also used for non-manufacturing purposes in heating as a substitute for coal, oil, and gas.

FIGURE 7: RUSSIA and REGIONS: Estimated Distribution of Other Harvest by Species Group in 1989



Source: C. A. Backman (1993)

FIGURE 8: RUSSIA and REGIONS: Secondary Fibre Supply in Roundwood Equivalents for 1989



For the near term analysis of the forestry sector, the degree to which both waste paper and secondary wood resources (residues) will likely contribute to the total timber and wood fiber supply of Russia depends upon the general level of economic development and the resultant levels of activity in the forestry sector.²⁰

Future potential changes in the secondary wood fiber supply are considered exogenous, and are not considered in estimating the economic accessibility of the total Russian timber and fiber supplies in the near term within the context of this analysis.

Imported Timber

The domestic timber supply can be augmented by imports of either unprocessed roundwood and/or manufactured wood and fiber products for further processing or domestic consumption. Historically, wood and wood product imports have only played a very minor role, accounting for less than 1 million cubic meters (equivalent) in 1989 as was shown in **Figure 1**. Under current economic and political conditions existing in Russia, it is highly unlikely that timber or wood product imports will contribute in a significant way to the overall timber and wood/fiber products supply. Import of wood and wood-fiber products would require the expenditure of hard currency, which is not generally available to the forestry sector in any significant amount at the present time. Consequently, changes in imported timber or fiber was also excluded in developing estimates of the near term economic timber supply potential for Russia.

²⁰Chip supply was based on the domestic production of lumber while waste paper supply was based on the domestic consumption of paper products.

FUTURE TIMBER OUTLOOK: BASIC DETERMINANTS

The Russian Forest Sector Model (RFSM)

The Russian Forest Sector Model (RFSM) was utilized to estimate the likely outcome of sector activities over the next decade. This model, integrating the forest land and resource base, timber harvesting, timber processing, and markets, reflects both the constraints imposed by the physical resources and industry structure as well and the tradeoffs between domestic consumption and processing verses exporting roundwood to either former Republics, East European trading partners, or Western (hard currency) markets.

The controlling objective for the model was the assumed policy objective to satisfy domestic consumption levels within Russia based on prevailing domestic (distorted) prices for political, economic and social reasons. Exports are thereby constrained to any available "surplus", and only partially reflect the differences in prevailing international costs and prices in contrast to internal (domestic) costs and prices undergoing reform at mid-1992. As noted below, domestic consumption is based on prevailing internal prices and future levels of Russia's Gross Domestic Product (GDP).

Available information was reasonably sufficient to estimate the parameters of the RFSM as of 1989. This was the last year for which relatively complete statistical information was available and was prior to the erratic impacts of political and economic reform initiated in 1991. The model was then validated by contrasting the results of the model with actual conditions circa 1992 based on the dramatic changes in key model parameters which occurred during the 1990-91 period.

Major Factors Shaping Development of the Forest Sector

Backman (1993) identified a set of eight factors (parameters)

determining the performance of the forest products sector (including export markets) for Russia (Table 2).²¹

As is well recognized, The population and forest resources are not evenly distributed throughout Russia. The distribution of capital investment in forest processing is, by most measures, also not optimal from a Western investment efficiency perspective. Nevertheless, it is this current distribution pattern of resources, capital and domestic markets that define the initial near term conditions for harvesting, manufacturing and consumption. At present, the domestic markets and industrial capacity are heavily concentrated in the European sub-region. Timber resources are relatively more abundant in the Asia Pacific region including East Siberia and the Far East.

Resource development is costly. The patterns of industry capacity and markets, however, have historically emerged largely in the absence of influence from "normal" economic conditions. Resource allocation is quite likely sub-optimal, considering the inability of the old central planning systems to gauge economic preferences and resource values. It is also probable that, in the future, economic restructuring on the basis of international prices and costs will substantially alter the existing industrial patterns. However, rather substantial capital investments will be necessary, and will undoubtedly be slow in emerging. Hence the existing capital structure for the forest products industry will be critical with respect to future development over the next decade and beyond.

Availability of timber (both roundwood and secondary fiber) limits the capacity of the forest products industry and hence markets. In the short term, these limits are tied to existing forest conditions

²¹For a full discussion of the factors utilized in the RFSM, see Chapter 4, Backman, Charles A. "Prospects for Wood Raw Material Exports from Russia to Pacific Rim and European Markets up until the Year 2000", unpublished PhD Dissertation, University of Washington, Seattle. 1993.

Table 2.

KEY FACTORS DETERMINING THE PROSPECTS OF
THE RUSSIAN FOREST SECTOR

1. REGIONAL DISTRIBUTION OF THE EXISTING INDUSTRIAL PRODUCTION CAPACITY
2. RESTRUCTURING OF COSTS/PRICES TO REFLECT ECONOMIC MARGINAL COSTS AND PRICES AT WORLD LEVELS
3. ROUNDWOOD AND FIBER AVAILABILITY
4. ROUNDWOOD AND FIBER ALLOCATION
5. UTILIZATION OF DECIDUOUS RESOURCES
6. LEVEL OF INDUSTRIAL TECHNOLOGY
7. DOMESTIC CONSUMPTION LEVELS
8. TRADE LINKS WITH REPUBLICS OF FORMER SOVIET UNION

Source: Backman, C.A. 1993

(stocking, maturity and access). The degree to which timber and fiber will be available is also a function of existing transportation and infrastructure. Existing levels of technology in harvesting, transport, and processing are also limiting.

The mix between domestic consumption of timber harvested and export trade is dependent upon both the current economic capacity of the harvesting sector under changing price/cost structures and the central government policies towards domestic consumption. Near term domestic consumption is presently limited by the level of economic development. Exports are derived from the "surplus" of fiber above the current domestic consumption and the expected levels of harvest and utilization. The availability of capital for investment in improving forest productivity, as well as accessibility, will of necessity increasingly reflect domestic prices and costs that are rapidly changing.

Deciduous timber resources have historically been under-utilized relative to calculated allowable cuts, much more so than the preferred conifers. To some extent, greater utilization of deciduous timber, particularly in the European sub-region, could substitute in part for increasingly scarce conifer resources. To do so, however, both technology and market adjustments will be required.

The total installed industry capacity and technology, its age and condition of maintenance, impose a substantial limitation on processing, as well as constituting a potentially significant factor in environmental damage. Modern technology, generally available in the West, can increase productivity and reduce potential environmental damage. However, this will require substantial capital investment which will be unlikely forthcoming from central government sources in the future. Therefore, the reinvestment of scarce foreign currency earnings in modernization and expansion, and/or foreign capital investments will be critical

to sector development. Such investments will increasingly be based on calculations of profitability rather than central planning. Such improvements will also be critical to quality improvements needed for international competitiveness in manufactured product markets.

Consumption of forest products throughout the economy of Russia will reflect both policy and economic realities. It is anticipated that the central Russian government will place a high priority on meeting domestic demands at prevailing (even if distorted) domestic price levels in the near term, and will limit exports of forest products in the foreseeable future to levels deemed "surplus" to growing domestic demand. Prices remain distorted even as economic development takes hold and presently disrupted domestic markets recover. Although "prevailing domestic prices" influences consumption and are subject to administrative change, price reforms have not yet been freed to "float" to market levels reflecting the economic signals of supply and demand. The distortions from "international levels" keep the domestic market protected from the impacts of rapid escalation of prices and costs, loss of comparative advantage in domestic production, and possible diversion of greater volumes of unprocessed timber into export markets.

As a major supplier to other republics of the former Soviet Union, and the East European countries, Russia will be confronted with significant political issues of setting priority in meeting prior export trade obligations. The breakdown in traditional trade relations (including COMECON) could release substantial volumes of wood products for export to other markets, including hard currency markets of Europe and the Pacific Rim. Without such shifts, however, exports will be consigned to former trading partners in spite of probably higher returns in western markets.

Scenarios for the Near and Medium Term

In estimating the future developments of the forestry sector, a two-period analysis covering the periods 1990-95 (near term) and 1996-2000 (medium term) was utilized, permitting the estimation of the period averages, and thus overcoming the erratic short term year-on-year responses of the forest sector to ongoing events surrounding political and economic reform.

Three alternative scenarios were identified as a means of illustrating the possible range of outcomes for the Russian forest sector during the decade of the 1990's. First, a set of Baseline Conditions was formulated, reflecting the projected status by period of the eight key factors summarized above. This set of Baseline Conditions was used to control the RFSM and therefore determined the "most likely" forecasts for forest sector trends and development over the near term (1990-1995) and medium term (1996-2000) periods. These Baseline Conditions thus provided both the model constraints and key determinants for the most likely - the MIDDLE - future scenario.

These conditions are summarized in **Table 3** as the "Baseline Case", and are discussed below. **Table 3** also identifies the alternative assumptions utilized to develop two additional scenarios: the "Optimistic" and "Pessimistic" cases. Selective and limited changes in the "baseline" assumptions were made for one or more of the key factors in order to provide a representative range of conditions felt to be the most probable deviation from the baseline conditions. While not attempting to cover the almost-infinite variations on the basic conditions, these three scenarios were defined to illustrate the implications of changes in the most significant key factors thought likely to occur before the turn of the century and which have the most significant impact on the forest sector outcomes discussed in the following sections.

TABLE 3. Russian Forestry Sector Scenario Assumptions
1990-95 and 1996-2000 (Baseline, Optimistic and Pessimistic)

Determinants\Scenarios	Baseline Case	Optimistic	Pessimistic
Scenario Determinant			
1. Distribution of Industrial Capacity	<p>Installed Capacity as of 1989 Additions Allocated on Feasibility Period 1: \$400 million/yr Foreign Period 2: No change from Period 1 Assumptions</p>	<p>Installed Capacity as of 1989 Additions: Allocated on Feasibility Period 1: \$400 million/yr Foreign Period 2: Reinvest Hard Currency Permitted if Feasible</p>	<p>Installed Capacity as of 1989 Additions: Period 1: None Period 2: Unchanged from Period 1 Assumption</p>
2. Matrix of costs/prices	<p>Prevailing Domestic Costs/Prices Period 1: Qtr 2-3, 1992 Period 2: Qtr 2-3, 1992</p>	<p>Prevailing Domestic Costs/Prices Period 1: Qtr 2-3, 1992 Period 2: Period 1 Domestic Costs/Prices subject to Reform Adjustment by eliminating 25 percent of differential between domestic and international prices</p>	<p>Prevailing Domestic Costs/Prices Period 1: Qtr 2-3, 1992 Period 2: Qtr 2-3, 1992</p>
3. Fiber Availability	<p>Harvest from Currently Available Forest Stands: Volume based on domestic price and variable cost of harvest</p>	<p>Harvest from Currently Available Forest Stands: Volume based on domestic price and variable cost of harvest</p>	<p>Harvest from Currently Available Forest Stands: Volume based on domestic price and variable cost of harvest</p>
4. Fiber Allocation A. Domestic	<p>Meet Domestic Consumption as Priority: 1989 output mix Period 1: '92 GDP Domestic Demand Period 2: Unchanged from Period 1 Assumptions</p>	<p>Meet Domestic Consumption as Priority: 1989 output mix Period 1: '92 GDP Domestic Demand Period 2: 5% GDP Annual Growth Product mix changed based on price elasticity of consumption</p>	<p>Meet Domestic Consumption as Priority: 1992 output mix Period 1: '92 GDP Domestic Demand Period 2: Unchanged from Period 1 Assumptions</p>

TABLE 3. Russian Forestry Sector Scenario Assumptions
1990-95 and 1996-2000 (Baseline, Optimistic and Pessimistic)

Determinants\Scenarios	Baseline Case	Optimistic	Pessimistic
B. Hard Currency Trade	<p>EXPORTS: Surplus to Domestic Consumption & Former Republics</p> <p>Period 1: Exports Set by Harvest Levels & Domestic Demand</p> <p>Maximum of 89 Level</p> <p>Period 2: Unchanged from Period 1 Assumptions</p>	<p>EXPORTS: Surplus to Domestic Consumption & Former Republics</p> <p>Period 1: Exports set by Harvest Maximum: 1989 levels</p> <p>Period 2: Greater Market access for Low grade Non-Larch Conifer Pulpwood (Asian Pacific) and Deciduous Pulpwood (European)</p>	<p>EXPORTS: Surplus to Domestic Consumption & Former Republics</p> <p>Period 1: Exports Set by Harvest Levels and Domestic Demand</p> <p>Period 2: Unchanged from Period 1 Assumptions</p>
5. Use of Deciduous Resource	<p>Unrestricted: Price Determined (Recover Variable Cost)</p>	<p>Unrestricted: Price Determined (Recover Variable Cost)</p>	<p>Unrestricted: Price Determined (Recover Variable Cost)</p>
6. Level of Technology - Existing Capital & Investment	<p>Installed Capital Stock (1989)</p> <p>Period 1: No Reinvestment of Hard Currency; Foreign Investment: \$400 million per year in New Technology</p> <p>Period 2: Unchanged from Period 1 Assumptions</p>	<p>Installed Capital Stock (1989)</p> <p>Period 1: No reinvestment of Hard Currency; \$400 million/yr Foreign Investment in new technology</p> <p>Period 2: Reinvestment of Hard Currency; \$400 million/yr Foreign Investment in new Technology</p>	<p>Installed Capital Stock (1989)</p> <p>Period 1: No Hard Currency Reinvestment; no Foreign Investment</p> <p>Period 2: Unchanged from Period 1 Assumptions</p>
7. Domestic Consumption	<p>Period 1: Determined by 1992 GDP ratio to 1989 GDP</p> <p>Period 2: Unchanged from Period One Assumptions</p>	<p>Period 1: Determined by 1992 GDP ratio to 1989 GDP</p> <p>Period 2: Consumption growth as function of 5% growth in GDP and individual product Elasticity of Demand</p>	<p>Period 1: Determined by 1992 GDP ratio to 1989 GDP</p> <p>Period 2: Unchanged from Period 1 Assumptions</p>

TABLE 3. Russian Forestry Sector Scenario Assumptions
1990-95 and 1996-2000 (Baseline, Optimistic and Pessimistic)

Determinants/Scenarios	Baseline Case	Optimistic	Pessimistic
8. Former Trade Links	<p>Base consumption 75% of 1989</p> <p>Period 1: Imports from Russia are Difference in Former Republic's production and consumption with Maximum production at 1989 level</p> <p>Period 2: Unchanged from Period 1 Assumptions</p>	<p>Base Consumption 75% of 1989</p> <p>Period 1: Imports from Russia are difference in Former Republic's production and consumption with maximum production at 1989 level</p> <p>Period 2: Increased Republic consumption and imports based on 5% growth in GDP and individual product elasticity of demand</p>	<p>Base Consumption 75% of 1989</p> <p>Period 1: Imports from Russia are difference in Former Republic's production and consumption with Maximum production at 1989 level</p> <p>Period 2: Unchanged from Period 1 Assumptions</p>

Baseline Scenario

As is shown in Table 3, the anticipated baseline conditions for both the near term (Period 1: 1990-1995) and medium term (Period Two: 1996-2000) reflect the realities of the post-1990 disruptions to the Russian economy. The existing capital stock was taken as the starting point and served as a constraint on both volume and quality of production. Additions to capital were constrained to reflect the "apparent" profitability (prices covering "variable costs") based on assumptions about internal prices and costs. Subsidies were eliminated and no capital allocations from the central government were assumed. The matrix of domestic prices and costs evident in mid 1992 were used where these factors influenced "economic" decisions regarding harvesting, production and distribution.

Timber availability was restricted to currently available forests (no substantial capital investment in infrastructure), with actual harvests constrained to "profitable" levels based on the assumed domestic price and cost structure.²²

The allocation of available timber harvest between domestic processing or log exports was based on the assumed quality and competitiveness as evidenced by the patterns of allocation for 1988 - the latest "normal" year with available data at the required level. In large part, the initial allocation of timber was based on the assumed need to meet estimated domestic consumption requirements (Factor 7 in Table 3). As noted below, estimated domestic consumption was made a function of gross domestic product (GDP), and fluctuated in relation to the ratio of projected GDP for

²²Data relating to the basic cost and price structure utilized in this analysis is reported in the Appendix tables. Basic cost and price data for 1989 was adjusted to mid 1992 using quarterly nominal Ruble-Dollar exchange rates. Mid 1992 costs and prices were utilized for the Baseline analysis, and modified accordingly for the assumptions of each scenario for Period 2. Where appropriate, "world" or international price and cost information is provided in the Appendix tables.

the two periods compared to 1989 GDP and 1989 domestic wood consumption. The allocation of logs domestically between utilization sub-sectors (lumber, wood-based panels, pulp and paper) was based on the ratios for 1989. This "need" for timber to satisfy domestic consumption took priority over the near-term appearance of profitable exports due to distorted price-cost comparisons to prevailing "international levels." Exports thereby became subject to the "surplus timber" cap and the "export quality" ratios applied to harvest volumes.

The deciduous resource has long exhibited a pattern of under-utilization, even in those regions that are currently accessible. The RFSM incorporated the utilization of deciduous timber based on the perceived economic feasibility at the anticipated price-cost levels. In the second period, higher levels of export for low grade deciduous material for pulping was assumed for Western Russia (up to ratio for Asian Pacific exports) and a higher share of low grade conifers (non-Larch) was included for the Asian Pacific region. Low grade larch pulp material was constrained at 3 percent of harvest based on 1988 trade.

The level of production technology was critical to the development of the scenarios. As noted, the existing capital stock was taken as the starting point for the forest products sector. Changes in this capital stock required investment. In the Baseline case, it was assumed that there was no reinvestment of hard currency earnings from the forestry sector - with all earnings being drained off through taxes, transfers to the central bank, or for other uses outside the control of individual enterprises. Further, due to the high degree of uncertainty and risk of foreign investment, this source of capital was limited to \$400 million annually. New capital investment in turn is required to upgrade processing to meet international quality standards.

Domestic consumption of forest products was linked to Gross Domestic Product (GDP). Specifically, exogenously determined levels of GDP for both periods were compared to GDP for 1989 and domestic consumption adjusted proportionately from 1989 levels.

Finally, trade relations with the former Soviet republics were determined by the comparison of projected former republic consumption and their internal production, with a constraint of maximum production at 1989 levels. Further, such exports must also be "surplus" to domestic Russian consumption as noted above, and are assumed to take precedence over other hard currency exports.

Pessimistic and Optimistic Scenarios

While the Baseline scenario as described above represents the "most likely" set of circumstances based on a detailed examination of the evolving political and economic framework for Russia, it is useful and necessary to provide "sideboards" reflecting the likely influence of possible changes from the Baseline.

Two alternative scenarios were defined, based on selected modification to one or more of the above conditions for the baseline case. Unless otherwise noted, the conditions remained the same between these alternatives and the baseline case.

Pessimistic Scenario: Although the Baseline scenario was defined to represent the "most likely" course of events in Russia under ongoing reforms, not all factors may turn out to be as supportive of the forestry and forest products sector. The Pessimistic Scenario represents a modification of the baseline assumptions. The baseline assumptions for greater export utilization of low grade deciduous materials and low grade pulpwood from non-larch conifers was suspended. Further, the projected foreign capital investment of \$400 million per year was also deleted due to higher risk, limiting even further capital investment in new capacity and

technology. All other conditions of the baseline scenario were retained.

Optimistic Scenario: Development conditions in Russia could also potentially turn out to be more favorable to the forestry sector than in implied in the Baseline case. An Optimistic Scenario was defined to bracket this possibility. In the second period, it was assumed that Russian domestic prices and costs had been "corrected" to take account of 25 percent of the "gap" between administered Russian and comparable "International" prices and costs.

Further, GDP was increased in the second period by an average rate of 5 percent per year, driving higher domestic consumption, with the allocation of domestic timber supply to processing sectors based on approximated price elasticities of consumption. Reinvestment of hard currency earnings by the forest products sector was permitted in period two, resulting in expanded capacity capable of producing higher quality products for export. Trade with the former Soviet republics was also stimulated by a 5 percent growth in former republic GDP under this Optimistic scenario, recognizing the limits on their internal production capability.

ECONOMIC WOOD SUPPLY

Under the previous political, economical, and social conditions in Russia, the true economic accessibility of the domestic harvest and internal wood supply (including secondary sources and imported fiber) was difficult to estimate. Moreover, market-type economic feasibility played only a minor role in determining timber harvest levels, given the relative dominance of the centrally-planned State system and the "command" nature of supplying industrial raw materials including timber and fiber.

However, ongoing economic reforms and the liberalization of costs and prices initiated in Russia at the end of 1991 are providing both the opportunity and incentives to develop greater rationality in determining the true economic accessibility of timber based on the greater recognition of "true" costs and prices.

"Available Supply"

Backman (1993) divided the current and potential timber supply (AAC) into six levels of variable harvesting costs for both conifer and deciduous species groups in order to provide an indication of the economic accessibility of the Russian current and potential timber resource as a function of economic value.²³ This allocation was based on cost estimates obtained from Russian forest experts in the Ural Region and as adjusted for estimated regional differences.

It is assumed that actual future timber harvest decisions will be based on the ability to cover at a minimum the variable harvesting costs from the economic rents accruing from timber processing

²³The variable cost categories reflect the degree to which the timber value (economic residual or economic rent) accruing to the standing timber will cover (at a minimum) the true economic costs of access and harvesting. This concept closely mirrors the familiar concept of "stumpage value" used for timber valuation in the economies of the West. The cost categories are defined as the variable cost (net of fixed capital costs of harvest or investments in infrastructure development) and expressed as equivalent \$/CM at 1992 exchange rates.

and/or exporting, including the full prevailing costs of transportation to the point of deliver for manufacturing or export. Timber will be harvested if (and only if) increasing timber values justify the additional costs incurred. This condition reflects the existence of excess industry and harvesting capacity that, in the near term, can be depreciated without allowance for capital replacement. Thus the true total cost (including fixed capital) is temporarily avoided - but represents a serious problem in the longer term for the forestry sector.

Thus, it is possible to estimate an approximate "stair-step" solid wood harvesting supply function, making the estimated timber harvest volume a function of timber value. This in turn reflects both changing prices and costs. Harvest levels were determined at each price (value) level within the technical and physical constraints of currently accessible AAC as defined earlier.²⁴ As additional timber was demanded, the RFSM sought the lowest cost source (based on prevailing variable cost) as the next alternative increment of supply. Thus, higher cost resources were not deemed available for harvest until other lower cost sources were exhausted.

The distribution of "available harvest" (currently accessible AAC, intermediate harvest and "other harvest) is summarized in **Table 4** for Russia and the two major regions by estimated variable cost category and species group. As is shown, a significant share of

²⁴The cost categories were applied to the currently accessible AAC potential only. In practice, if the Russian government (or other authorities) allocated sufficient capital investments to development of access and infrastructure, the "potentially accessible" AAC could also be made part of the available inventory. However, such investments are not anticipated during the period of analysis used here (to the year 2000). Intermediate harvest would be derived from currently accessible forests also.

TABLE 4. RUSSIAN NEAR TERM "AVAILABLE HARVEST" BY COST CATEGORY
(CURRENTLY ACCESSIBLE AAC, INTERMEDIATE & OTHER HARVESTS)

REGION\COST CATEGORY	-----CURRENTLY ACCESSIBLE TIMBER & FIBER SUPPLY-----						
	-----TOTAL POTENTIAL TIMBER HARVEST VOLUME-----						
	TOTAL	COST1	COST2	COST3	COST4	COST5	COST6
	(VOLUME IN MILLION CUBIC METERS)						
RUSSIA	503.0	45.8	139.1	189.8	102.3	24.2	1.8
CONIFER	285.0	23.4	74.9	108.2	61.9	15.4	1.4
DECIDUOUS	219.0	22.6	64.6	82.0	40.6	8.9	0.5
=====							
EUROPE-WEST							
SIBERIA REGION	321.0	38.5	102.7	118.8	51.4	9.6	0.0
CONIFER	149.0	17.9	47.7	55.1	23.9	4.5	0.0
DECIDUOUS	173.0	20.8	55.4	64.1	27.7	5.2	0.0

Harvesting Cost (\$/CM)**		1.53	2.54	3.56	4.58	5.60	6.61
=====							
PACIFIC-ASIA							
REGION	182.0	7.3	36.4	71.0	51.0	14.6	1.8
CONIFER	136.0	5.4	27.2	53.0	38.1	10.9	1.4
DECIDUOUS	46.0	1.8	9.2	17.9	12.9	3.7	0.5

Harvesting Cost (\$/CM)**		1.53	2.54	3.56	4.58	5.60	6.61
=====							

Source: Backman (1993)

* Harvest cost is the Variable Cost of harvesting, excluding the value of the capital stock depreciation absorbed in logging. This is treated as a fixed cost in the short term given a present excess capacity. Intermediate and Other harvest adjusted to gross harvest volume in order to be equivalent to Primary AAC volumes. A 13 percent waste factor for logging and transportation assumed.

the total potential timber supply²⁵ could be obtained from the three lowest variable cost classes. Cumulatively, some 374.7 million cubic meters would be available if prices are sufficient to cover the variable costs of harvesting and transport for these three cost groups, being \$3.56 per cubic meter for the third harvest class. The volume, economically justified at this cost/price level, would amount to approximately 74.5 percent of the currently "available harvest" of 503 million cubic meters. Although not specified or constrained by the RFSM, this volume is approximately equal to the actual combined total volume of roundwood derived from principal harvest (AAC), intermediate harvest, and other harvest actually obtained in 1989.

The three lowest cost classes of "available" harvest would potentially yield a volume of 206.5 million cubic meters of conifer roundwood and 169.2 million cubic meters of deciduous roundwood. On a regional basis, the three lowest-cost classes of harvest together account for approximately 260 million cubic meters (81 percent) of the overall "available" wood and fiber supply for the European-West Siberian Russia region. This would include 120.7 million cubic meters of conifer roundwood, or 81 percent of the regional conifer total "available" supply.

This share of the regional total is higher than for the "available" roundwood supply in the Pacific Asia region where the three lowest cost classes account for only 63 percent of the total harvestable volume. Only 85.6 million cubic meters of conifer roundwood would be economic to harvest at prices covering variable costs for the lowest three cost classes.

²⁵The cost categories used apply to the combined timber harvested or derived from primary harvest (AAC), intermediate utilization, and "other" harvesting as discussed in earlier sections. Intermediate harvest and "other" harvests have been adjusted to a "gross" volume basis to reflect anticipated losses in harvesting and transportation to point of delivery of approximately 13 percent. See Appendix Table A.2. for cost and price information and Table A.5. for harvesting cost by harvest area.

It is obvious that, even when ignoring the fixed cost of capital investment required to bring "available" timber to the market, the harvesting and transport of timber in the Pacific Asian sub-regions of East Siberia and the Far East are relatively "high cost" sources of roundwood in comparison with the European and West Siberian sub-regions. Current domestic prices for roundwood are very low by world levels, and could not "justify" increasing harvests under the requirement that price at least cover variable costs. Domestic wood prices must ultimately be higher than the variable costs represented by the three lowest cost classes before increased harvests become attractive. Thus the success of domestic price and cost reform will be critical to bringing domestic roundwood prices to a level closer to prevailing world levels, justifying higher expenditures to harvest increased volumes from the currently "available" sources.²⁶

The relative economic accessibility of timber and fiber supply in the Pacific Asia region is further compromised by the high proportion of lower-valued species in the forest resource base. This factor decreases the effective average price received for the timber harvested. Lower timber prices (whether for domestic products or for export), combined with the higher harvesting and primary transportation costs, means more limited economic accessibility of the "available" supply potential of the Pacific Asia region in spite of the apparent and abundant physical forest resources.

Projected Near Term and Medium Term Roundwood Supply

Estimated volume of harvest which would be economically accessible given the vector of domestic prices and costs representative as of mid 1992 (the baseline for Period 1), and under the alternative conditions represented by the three alternative scenarios for Period 2. These estimates are summarized in **Table 5**.

²⁶Estimates of capital costs are included in Appendix Tables A.3. and A.5.

TABLE 5: RUSSIA and REGIONS: Delivered Harvest in 1989, Predicted Harvest in Period One, and Projected Harvest in Period Two by Scenario (millions of cubic meters)

	1989	<i>Period One</i>		<i>Period Two</i>		
				Pessimistic	Middle	Optimistic
RUSSIA						
TOTAL	339	250	214	244	332	
Coniferous	226	165	142	172	230	
larch	N/A	27	29	30	50	
other	N/A	138	113	143	181	
Deciduous	113	84	72	72	102	
EURO-SIBERIAN RUSSIA						
TOTAL	233	190	146	176	220	
Coniferous	135	113	83	114	128	
larch	N/A	4	3	4	5	
other	N/A	109	80	110	123	
Deciduous	98	76	62	62	92	
PACIFIC-ASIAN RUSSIA						
TOTAL	106	60	68	68	112	
Coniferous	90	52	59	59	102	
larch	N/A	23	26	26	45	
other	N/A	29	33	33	57	
Deciduous	16	8	9	9	10	

N/A = Not Available

Source: C.A. Backman (1993)

It was estimated that the economic level of delivered roundwood harvest would amount to no more than 250 million cubic meters for Period 1 (1990-95). This compares with the 1989 volume of 338 million cubic meters, and reflects the short term disruptions of the forestry and forest industry sector as reflected in the actual conditions of mid-1992.²⁷

Of the estimated harvest volume for Period 1, a total of 190 million cubic meters would be produced in European-West Siberia region and 60 million cubic meters would be produced in Pacific Asian Region.²⁸ The projections for Period 1 (1990-95) are considerably below the 1989 volume of some 338 million cubic meters, including over 230 million cubic meters from the European-West Siberia region. The projections for 1990-95 reflect the economic and political turmoil and disruption of the forestry sector during the 1991-92 period, including reduced harvests and the general level of activity in the forest products industry. The projections also show a greater proportion of the harvest (76 percent) deriving from the European region in contrast to 1989 (68 percent). In spite of higher past utilization, the forests in the European region are relatively more accessible and hence lower cost, therefore being the supply source of choice in the near term.

The near term scenarios reflect both changes in total harvest and the regional shares as a result of possible changes in political

²⁷In discussing harvest levels in comparison to delivered wood and fiber supply, recognition must be made for the considerable losses in harvesting, processing at upper landings, and transport. Delivered volumes are thus adjusted to a net basis to reflect current levels of such losses.

²⁸More significant for long-term wood supply, however, is the degree to which the current (mid-1992) timber prices can support replenishment of the capital stock in the harvesting process. Current prices are insufficient to cover both the variable costs and the capital costs connected with harvesting for the cost categories from which delivered harvest will flow. While the estimated harvests shown here can continue for at least for the next ten years based on recovery of variable costs only, due to depreciation of the capital stock left over from the previous regime, as this capital is depleted subsequent harvest levels will depend critically on the future level of new capital investment.

and economic outlook. The **baseline** projections ("middle" scenario) shows a further erosion of harvest, to a level of 244 million cubic meters for the period average for 1996-2000. Due to availability and access, the forests of the Pacific Asian region gain volume (up to 68 million cubic meters) during Period Two, while the European Region, in the face of declining mature forest) would see a further reduction to approximately 176 million cubic meters.

Projected harvest would rise to 338 million cubic meters per year under the more favorable **optimistic** scenario, reflecting the greater progress of adjusting internal prices and costs to international levels (but by only 25 percent of the 1990 "gap"), growing consumption due to rising GDP in both Russia and the former Republics of the USSR, and the partial reinvestment of hard currency earnings in the sector to rebuild capital capacity.²⁹ However, under this "optimistic" scenario, the harvest is projected to only reach the level experienced in 1989 prior to the active period of economic restructuring.

The **pessimistic** scenario projects a continuing decline in harvest, to a level of only 214 million cubic meters, with practically all of the decline (relative to the baseline case) occurring in the European region where depleted capital stocks and depreciated industry capacity are insufficient to maintain harvest levels. Under this scenario, even the limited level of foreign capital investment foreseen in the baseline case is not forthcoming. The relatively older capital stock in the European region will show the effects of this lack of investment much sooner than the Pacific Asian region. Without access to foreign investment, the first

²⁹The addition of foreign capital investment expands industry capacity and provides for improved technology leading to higher quality production meeting international export standards. However, this investment is insufficient to replace/remodel the depreciated capital stock in place at the start of the analysis. The delayed recognition of this capital depreciation does not materialize within the time frame of this analysis due to existing excess capacity but will become a serious problem after the year 2000.

period harvests for the European and West Siberian sub-regions cannot be maintained during Period Two. However, the harvest is still dependent upon the further depreciation of existing capital to achieve Period 2 harvests. The substantial impact of declining capital stock do not materialize until after the year 2000, where the problem can be expected to become acute.

Estimated Total Delivered Commercial Wood and Fiber Supply

The combined estimated industrial "delivered" supply of total wood and fiber is summarized in **Table 6**. This "supply" represents the delivered "net" volume from the "gross" harvest, as well as the estimated availability of secondary wood and fiber including logging and manufacturing (processing) wastes converted to chips and recycled waste paper.³⁰

Total wood and fiber supply is projected at 230.6 million cubic meters (roundwood equivalent) for the near term (1990-95) period, with 80 percent received for processing as roundwood (185.2 million cubic meters). An additional 40.5 million cubic meter (equivalent) would be obtained in the form of by-product chips, with just under 5 million cubic meters (equivalent) from recycled waste paper. The European region accounts for almost 175 million cubic meters of the total (76 percent) with a much more significant component of both by-product fiber and recycled waste paper. In contrast, 86 percent of the Pacific Asian regional total wood and fiber supply is in the form of commercial roundwood.

³⁰Table 6 excludes from the wood and fiber supply roundwood which is used for firewood, but which is included in estimates of total "delivered harvest". Firewood is included in the delivered harvest volumes presented in Table 5.

TABLE 6: RUSSIA and REGIONS: Roundwood and Wood Fiber Supply (Roundwood Equivalents) by Source Period One and Period Two for Three Scenarios

	Period One		Pessimistic		Middle		Optimistic	
	Value	%	Value	%	Value	%	Value	%
RUSSIA								
Total	230.6	100%	203.3	100%	228.7	100%	340.8	100%
Commercial Roundwood	185.2	80%	158.6	78%	184.0	80%	249.2	73%
By-Product Chips	40.5	18%	39.8	20%	39.8	17%	49.5	15%
Waste Paper	4.9	2%	4.9	2%	4.9	2%	42.1	12%
EURO-SIBERIAN								
Total	174.8	100%	139.5	100%	165.9	100%	238.1	100%
Commercial Roundwood	137.2	78%	104.4	75%	129.8	78%	157.8	66%
By-Product Chips	33.3	19%	30.8	22%	31.8	19%	39.0	16%
Waste Paper	4.4	3%	4.4	3%	4.4	3%	41.3	17%
PACIFIC ASIAN								
Total	55.8	100%	63.8	100%	62.8	100%	102.7	100%
Commercial Roundwood	48.0	86%	54.2	85%	54.2	86%	91.4	89%
By-Product Chips	7.3	13%	9.0	14%	8.0	13%	10.5	10%
Waste Paper	0.6	1%	0.6	1%	0.6	1%	0.8	1%

Source: C.A. Backman (1993)

Under the alternative scenarios, the delivered wood and fiber supply would range from a low of 203.3 million cubic meters (pessimistic) to 340.8 million cubic meters (optimistic), with the baseline projection for 228.7 million cubic meters. Under the pessimistic scenario, the greatest impact would be on commercial roundwood supply due to the loss of the limited foreign capital investment incorporated in the baseline case. This impact would be felt in the European region, with a slight increase in delivered supply projected for the Pacific Asian region.

Under the conditions for the optimistic case, total wood and fiber supply would increase significantly to 340.8 million cubic meters, an increase of just over 112 million cubic meters relative to the Period Two baseline projection. Over 65 million cubic meters of the increase would be from industrial roundwood, with the largest share of the increase being in the Pacific Asian region (40 million cubic meters). This is a result of the combined economic growth (5 percent annual GDP growth), the resultant price increases, growing consumption, and most importantly, the greater capital investment stimulating harvest in the Far East and East Siberia.

Equally significant would be the projected increases in by-product utilization (mainly in the European region) of 10 million cubic meters, and particularly recycled waste paper (projected to increase by 37.2 million cubic meters equivalent). This gain in recycling would be almost exclusively in the European region where population concentration makes collection much more economic. Under the optimistic scenario, waste paper would grow to fully 17 percent of wood and fiber supply in the European region and to 12 percent of supply overall for Russia.

Long term Economic Supply and Real Prices

The long-term economic solid wood supply is difficult to establish in the absence of realistic pricing and costing. In this analysis, it has been assumed that the distorted pricing and costing under the former system of a centrally-administered forest sector will be only gradually corrected.

However, by assuming a vector of "competitive" world prices and costs (circa 1992), and using the currently accessible and potentially accessible Russian forest timber base, the current economic wood supply was estimated to amount to about 216 million cubic meters (Table 7). Under these hypothetical conditions, the Pacific Asia region would account for an estimated harvest of 86 million cubic meters, while 130 million cubic meters are harvested in the Euro-Siberian region of Russia. While this total harvest is close to that projected for the pessimistic scenario, the regional distribution is somewhat different. A greater share of the harvest (40 percent) would be provided by the Pacific Asian region (East Siberia and the Far East) in comparison to only 32 percent that would be obtained from this region under the pessimistic case. This shift is due to the greater impact of world level prices on the economic feasibility of harvesting in the Pacific Asian region (even with "adjusted" costs) and the resulting availability of greater potential volumes in response to higher prices as was shown in Table 4.

Assuming that the "potentially accessible" roundwood timber supply gradually becomes economically accessible over the longer-term, an additional increment of approximately 49 million cubic meters could become available. Of this, 18 million are located in the Euro-Siberian Russia region while 31 million cubic meters are located in Pacific Asian Russia region, again reflecting the greater proportion of "potentially accessible" timber resources in this region.

Table 7: Russian Estimated Economic Roundwood Supply at 1992
World Prices and Costs and with Ten Percent Real Price Increase

REGION	1992 PRICES	'92 + 10%	ESTIMATED LONG TERM ECONOMICALLY ACCESSIBLE ROUNDWOOD SUPPLY	1992 PRICES	'92 + 10%	TOTAL
	CURRENTLY ACCESSIBLE	POTENTIALLY ACCESSIBLE				
EUROPEAN- WEST						
SIBERIA						
CONIFER	104	124	15	19	119	143
DECIDUOUS	26	73	3	8	29	81
REGION TOTAL	130	197	18	27	148	224
PACIFIC-ASIAN						
CONIFER	77	77	28	28	105	105
DECIDUOUS	9	15	3	6	12	21
REGION TOTAL	86	92	31	34	117	126
RUSSIA						
CONIFER	181	201	43	47	224	248
DECIDUOUS	35	88	6	14	41	102
RUSSIAN TOTAL	216	289	49	61	265	350

SOURCE:
Backman (1993)

As would be expected, conifer species make up the greatest share (almost 88 percent) of the additional "potentially accessible" timber under the 1992 price levels, and the greatest proportion for each region. Thus, without any increase in the real world prices for roundwood above 1992 levels, long-term economically accessible solid roundwood supply is estimated to be in the range of 265 million cubic meters annually.³¹ This would still be significantly below the actual volume of 338 million cubic meters reported for 1989.

If it is assumed (hypothetically) that there could be at least a ten percent increase in real world prices for timber over the medium term (by the year 2000), the economically accessible solid wood supply could increase further, to 350 million cubic meters as is shown also in Table 7.³² This is a level of roundwood harvest that is very close to the actual delivered harvest of 338 million cubic meters in 1989, and indicates the relative impact of the distortion between past harvest decisions made on the basis of central planning authority rather than reflecting resource values and actual costs of harvesting. In effect, an increase in real prices in the order of magnitude of ten percent (holding costs constant in real terms) would be required to overcome these distortions and economically justify the 1989 level of harvesting.

Perhaps surprisingly, the greatest impact of the assumed higher price level would be on the harvesting of deciduous timber, more

³¹It should be remembered that the accessibility of the "potentially available" harvest is directly dependent upon significant capital investment in infrastructure in order to make this resource truly economically available in spite of prevailing prices.

³²This would represent the maximum increase in harvest in response to the hypothetical real price increase, and includes harvest from both currently accessible and potentially accessible forests, thus implicitly assuming that sufficient capital investments would be made to access the "potentially" accessible forests. Without such investment, the real price increase would only result in a total harvest of 289 million cubic meters, or a gain of some 73 million cubic meters economically justified under 1992 real prices.

than doubling from 41 million cubic meters to 102 million cubic meters. Conifer harvest would also increase in response to higher real prices, but more modestly, from 224 million cubic meters to 248 million cubic meters. Also of interest is the fact that the probable response to higher real prices would be felt primarily in the European region, where harvest would increase by approximately 76 million cubic meters (51 percent). Pacific Asian region harvest would increase by only 9 million cubic meters, to a total of 126 million cubic meters. Thus it is clearly evident from Table 6 that harvests in the European region are constrained primarily by price and cost relationships (given greater infrastructure in place), while Pacific Asian harvest is constrained by accessibility.

ROUNDWOOD TIMBER AND FIBER ALLOCATION

The potential total economic timber supply, discussed in the previous sections, can be consumed domestically, exported to markets in the other Republics belonging to the former Soviet Union, or exported to countries outside of the former USSR. This allocation can be either in the form of logs, or alternatively, in the form of semi-processed or processed forest products.

At present, the distortions between internal (domestic) pricing and costs and the external "world" level of prices and costs makes a true "economic" allocation of wood unlikely. Although undergoing rapid structural adjustments, administratively constrained prices and costs are still considerably below world levels. This, taken together with higher world prices for products (logs and manufactured products) would economically dictate that all or most production would be exported, even at the expense of domestic consumption, if an economic profit maximization objective of distribution of Russian timber under perfect market information were adopted. Pursuit of critically needed hard currency may, in fact, result in a partial move in this direction. By policy decision, domestic consumption may be allowed to deteriorate modestly, given the desire of the central government to accrue hard currency. Thus policy concerns can be expected to outweigh economics in the near term as Russia struggles with the disequilibrium conditions now undergoing reform.

Domestic Consumption

It is believed that the Russian government will follow welfare policies in the near term which will seek to not deprive the Russian people of an "adequate level" of forest products for domestic consumption, and which will keep domestic prices well below competitive world levels. Thus, the probable future consumption levels of forest products within Russia will be largely "uneconomic" and administered by controls. These policies will also be critical in determining the degree to which forest product

harvests and/or basic production of forest products may or may not be deemed "surplus" to centrally controlled domestic "needs". It is only then that approximations of the timber available for export, either to the republics belonging to the former Soviet Union or to other countries.

The level of domestic consumption of wood and fiber materials was estimated for the five year period 1990-1995 as shown in **Table 8.**³³ The estimated annual domestic consumption of wood and fiber material amounts to 207 million cubic meters during Period One. The total estimated roundwood and fiber supply was estimated to be 229 million cubic meters. Thus, the timber "available" for export after satisfying controls for domestic consumption amounts to approximately 22 million cubic meters.

In Period Two (1996-2000), the size of available harvest and fiber material, domestic consumption, and available "surplus" for export fluctuated widely, in response to the conditions of the three scenarios developed to represent the range of likely economic and political outcomes.

For the **baseline** (middle) scenario, the total available timber amounts to 229 million cubic meters, 204 million cubic meters of which would be consumed domestically. In this scenario, about 25 million cubic meters of raw timber would be available for export. Under the **pessimistic** scenario, a total supply of 203 million cubic meters would be available, of which 190 million would be consumed domestically. Thus, only 13 million cubic meters would be "surplus" to domestic consumption and thus available for export.

³³The fiber supply discussed in this section refers to the share of the harvest identified in the previous section as the component of harvest which has commercial significance (excluding fuelwood) plus the supply of chips and by-product materials. Estimates of consumption by region are contained in Appendix Table A.9.

TABLE 8: RUSSIA ALLOCATION OF AVAILABLE ROUNDWOOD
AND FIBER SUPPLY: DOMESTIC CONSUMPTION AND EXPORT BY SCENARIO

VOLUME IN MILLION CUBIC METERS	---PERIOD ONE---		-----PERIOD TWO-----	
	VOLUME	PERCENT	VOLUME	PERCENT
Roundwood and Fiber Supply	229	100.0	229	100.0
			341	100.0
Domestic Consumption	207	90.4	190	89.1
Surplus Available for Export	22	9.6	13	6.4
			25	10.9
			85	24.9
			256	75.1

Under the conditions of the **optimistic** scenario, total roundwood and fiber supply available increases to 341 million cubic meters of which 256 million cubic meters were consumed domestically. Thus, commercial timber available for export would amount to an estimated 85 million cubic meters.

Domestic Production of Forest Products

Roundwood and fiber resources utilized within Russia will be allocated to the alternative major sub-sectors of the forest products industry in order to meet target consumption levels within Russia and the republics of the former Soviet Union, and to Western markets based on costs and prices in so far as exports to hard currency regions can be accommodated from "surplus" production.

Table 9 provides the estimated sector production for Period One (1990-1995) and for the three scenarios for Period Two (1996-2000). For comparison purposes, the estimated levels of production for 1989 are also shown.

Lumber

In 1989, Russian production of lumber was approximately 83 million cubic meters, with just over two-thirds produced in the European Region and one-third in the Asian Pacific Region. Production has fallen significantly due to the economic and political disruptions. Production is estimated at only 56 million cubic meters for period one, and ranges from 54 million cubic meters (**baseline** and **pessimistic** cases) to 68 million cubic meters (**optimistic** case). The ratio between the European and Asian Pacific regions is not projected to change significantly, although in the near term (Period One) the decline in the Pacific Asian region is notably greater. Output is estimated to decline from 25 million cubic meters in 1989 to only 14 million cubic meters in Period One.

TABLE 9: RUSSIA and REGIONS: Actual Production and Projected Production of Primary Forest Products in Period One and Period Two for Three Scenarios

	1989	PERIOD 1	Pessimistic	Middle	Optimistic
LUMBER (million)					
Total (cubic meters)	83	56	54	54	68
Euro-Siberian	58	42	36	38	47
Pacific Asian	25	14	18	16	21
PANEL PRODUCTS (million)					
Total (cubic meters)	11.7	5.9	5.8	5.8	7.7
Euro-Siberian	10.2	4.5	4.8	4.8	6.7
Pacific Asian	1.5	1.4	1.0	1.0	1.0
PULP/PAPER (million)					
Total (metric tons)	11.4	5.9	3.8	5.8	7.8
Euro-Siberian	8.6	3.5	2.1	4.1	5.9
Pacific Asian	2.8	2.4	1.8	1.8	1.8
of which from:					
VIRGIN FIBER					
Total	10.2	5.1	3	5	6.8
Euro-Siberian	7.5	2.7	1.3	3.3	5.1
Pacific Asian	2.7	2.4	1.7	1.7	1.7
RECYCLED FIBER					
Total	1.2	0.8	0.8	0.8	1.1
Euro-Siberian	1.1	0.8	0.8	0.8	1.0
Pacific Asian	0.1	0.1	0.1	0.1	0.2

Source: C.A. Backman (1993)

Coniferous species are estimated to account for 42.2 million cubic meters of lumber production, with approximately 35.8 million being species other than larch, with larch lumber totalling some 6.4 million cubic meters. Larch lumber production is most significant for the Pacific Asian region, accounting for 5.3 (or 83 percent) on the overall Russian larch lumber.

Total conifer lumber production ranges from 38.9 million cubic meters (**pessimistic**) to 57.7 million cubic meters (**optimistic**), with a baseline estimate of 44.2 million cubic meters for Period Two. Of the baseline conifer lumber production, 37 million cubic meters is species other than larch with 7 million cubic meters of larch.

Panel Products

Panel product production is estimated to drop from a level of 11.7 million cubic meters in 1989 to only 5.9 million cubic meters for Period One. Production is estimated to remain at this level in Period Two for the **baseline** and **pessimistic** scenarios, and increases only under the **optimistic** scenario, reaching 7.7 million cubic meters which is still well below 1989 (pre-reform) levels. Almost all wood-based panel production will continue to remain in the European region during the analysis period due to the absence of significant capital investment in the Asian Pacific region.

Pulp and Paper

Russia's production of pulp and paper products totalled some 11.4 million metric tons, with 8.6 million metric tons produced in the European region. Asian Pacific region production was 2.8 million metric tons. Period One estimates are for production of only 5.9 million metric tons in total, with European region production dropping significantly, to only 3.5 million metric tons, while Pacific Asian production declines to 2.4 million metric tons.

Period Two estimates vary from a low production of 3.8 million metric tons (**pessimistic**) to a high of only 7.8 million metric tons (**optimistic**). The **baseline** case estimate is for production of 5.8 million metric tons, essentially constant from Period One.

The utilization of pulpwood and chips (virgin fiber) and recycled fiber are also summarized in Table 9. As discussed relative to total roundwood and fiber supply, the majority of recycled fiber is in the European region where consumption is much higher due to population concentration and hence collection and processing is more feasible. The utilization of recycled fiber is, however, projected to decline in the near and medium term. In 1989, a total of 1.2 million metric tons was utilized, while the Period One and Period Two **baseline** estimates are only 0.8 million metric tons.

The use of pulpwood and chips for pulp and paper production is likewise concentrated in the European Region. Total virgin fiber utilization is projected to drop during Period One by 50 percent, from 10.2 million cubic meters to just 5.1 million cubic meters. Most of this decline is in the European region. During Period Two, Asian Pacific production remains static at only 1.7 million cubic meters (largely due to depreciated industrial capacity and the lack of investment). European production increases slightly (to 3.3 million cubic meters) in Period Two (relative to Period One) in the **baseline** case but only reaches 5.1 million cubic meters under the **optimistic** conditions or 2.4 million cubic meters below 1989 levels.

Export of Roundwood and Forest Products

Export of Roundwood and Chips

The roundwood material which is "surplus" to domestic consumption is "consumed" in two ways. First, unprocessed wood is directly exported to the republics of the former Soviet Union, reflecting the strong trade ties established within and between republics. Secondly, wood raw material is exported to Pacific Rim and European markets, primarily for hard currency.³⁴

Exports to the Former Republics

Projected roundwood exports for Period One amount to an estimated 8 million cubic meters, down considerably from the 20 million cubic meters evident in 1989. Exports of timber to the former republics during Period Two (1996-2000) are heavily dependent on the expectations of economic activity in these republics. Timber exports to the Republics are estimated to continue at about the 8 million cubic meter level in both the **pessimistic** and **baseline** (middle) scenarios, while export volumes double to 17 million cubic meters under the **optimistic** scenario. The large increase is brought on by the increased demand in the Republics resulting from improved economic performance, together with the limited and finite forest resource base in these areas.³⁵

³⁴Wood is also exported to the former Soviet Republics and other countries in the form of manufactured forest products. In the context of this analysis, however, it has been assumed that manufactured products for domestic consumption have priority over the export of roundwood or manufactured products. Consequently, the potential for substitution between the export of manufactured products and the underlying volume of unprocessed roundwood equivalent as represented by manufactured products is not considered. More detailed information on domestic consumption policies will be required to evaluate this potential substitution under the future of ongoing economic conditions.

³⁵Consumption estimates for the former Republics of the Soviet Union are provided in Appendix Table A.10.

Exports to European and Pacific Rim Markets

Exports of roundwood and chips to European and Pacific Rim markets during the Period One (1990-95) is estimated to average 13 about million cubic meters, down from 16 million cubic meters in 1989.

As summarized in **Table 10**, Period One (1990-1995) roundwood and chip exports to European markets are estimated to be 7 million cubic meters, of which nearly 30 percent are higher quality sawlogs. Another 30 percent consists of chip material, while 40 percent consists of low grade solid wood logs.

Exports to Pacific Rim markets are estimated to amount to 6 million cubic meters for Period One, two thirds of which are estimated to be sawlog quality. About one-sixth of exports consist of low grade logs, while the remainder is chip material.

The medium term predictions (Period Two) for roundwood and chip exports are much more difficult, and depend in large measure on the degree to which capital is available for re-investment in the forest sector.³⁶

Estimates of hard currency market exports of unprocessed roundwood and chip material to Europe and the Pacific Rim under the three scenarios for 1996-2000 are summarized in **Table 11**. Estimates of exports range from a low of only 7 million cubic meters in the **pessimistic** case, to a high of 29 million cubic meters in the **optimistic** scenario. The **baseline** estimate is for an export of 13 million cubic meters.

³⁶The analysis considered both "old" and "new" capital with respect to both harvesting and manufacturing technology. The lack of capital investment constrains capacity, and particularly the ability to produce manufactured products of a quality to be competitive on hard currency export markets. This is less of a constraint in harvesting. In fact, the inability to upgrade technology in order to achieve competitiveness in manufactured products due to capital constraints is a significant factor in encouraging continued export of unprocessed timber.

**TABLE 10: Russian Estimated Export of Roundwood and Chips
by Region - Period One (1990-1995) Million Cubic Meters**

	-----PERIOD ONE-----		
	TOTAL	HIGH GRADE	LOW GRADE
TOTAL	13	6	7
EUROPEAN MARKETS	7	2	5
PACIFIC MARKETS	6	4	2

**TABLE 11: Russian Estimated Export of Roundwood and Chips
by Region and Scenario- Period Two (1996-2000) Million Cubic Meters**

	-----PERIOD TWO-----		
	PESSIMISTIC	BASELINE	OPTIMISTIC
TOTAL	7	13	29
EUROPEAN MARKETS	2	7	17
PACIFIC MARKETS	5	6	12

In the **baseline** scenario, the total export volume amounts to 13 million cubic meters, of which 7 million are exported to European markets and 6 million are exported to Pacific Rim markets.

For the **pessimistic** scenario, exports of 7 million cubic meters are distributed with 2 million cubic meters going to European markets while 5 million cubic meters are exported to the Pacific Rim. In the **optimistic** scenario, European markets would absorb 17 million cubic meters, while the Pacific Rim markets account for the remaining 12 million cubic meters.

While the estimated exports of unprocessed roundwood and chip material under the baseline and optimistic scenario are plausible, it is realistic to expect that a minimum level of exports will continue to both European and Pacific Rim markets, regardless of pace of development within Russia. As noted, the Russian Forest Sector Model (RFSM) first allocates timber and fiber to satisfying politically acceptable levels of domestic demand, and restricts exports to the "surplus" volume based on the economically determined level of harvest.

However, hard currency exports are also important at a time when the Russian economy is experiencing significant inflation and deterioration of capital investments. Even if foreign earnings are withdrawn from the forestry sector, either by taxes or restrictions on enterprises holding foreign currency accounts, this source of foreign earnings cannot be ignored by central authorities. Maintaining basic levels of hard currency exports would be dictated by both traditional market relationships and the need/desire for generating hard currency revenues even at the expense of lower domestic consumption.

The actual projection of exports under the **pessimistic** scenario was zero. It is believed, however, that even in the pessimistic case the lowest export level will not be permitted, and politically and revenue driven exports will amount to some 7 million cubic

meters of which 2 million would be destined to European markets and 5 million would be sold in Pacific Rim markets.

Attempts to formulate longer term projections are currently fraught with peril. For example, rising consumption levels within Russia could effectively siphon off part of any increase in harvests brought on by a hypothetical 10 percent increase in real world roundwood prices as discussed previously. Changing trade opportunities between Russia and the Republics of the former Soviet Union could also alter the prospects for roundwood exports to the hard currency markets not belonging to the former Soviet Union. Additionally, the total physically available wood and fiber supply, including secondary fiber, if compared to a future per capita Russian demand for forest products approaching the level presently experienced in the United States, results in an estimated 10 million cubic meters of "uncommitted" roundwood capacity. The estimated Russian domestic demand formulated for this analysis did not include allowances for rising demand in Russia or in the Republics belonging to the former Soviet Union, except for the indirect consequences of the 5 percent rate of growth in GDP under the optimistic scenario for Period Two. If economic reforms are reasonably successful in the longer term, domestic consumption will undoubtedly be stimulated, thus raising questions of priorities for the future "uncommitted" share of the physical timber supply.

Exports of Manufactured Wood Products

While the primary focus of the analysis reported here was on outlook for the timber base of Russia and the utilization of that resource under the pressures of political and economic reforms, it was also necessary to consider the probable implications for trade in manufactured products. Prior to 1990, this trade was characterized in large part by the export of modest volumes of unprocessed roundwood from the Pacific Asian region (primarily to Japan and China) and export of conifer sawnwood and pulpwood from the European Region (primarily to Scandinavia, West Germany and

United Kingdom). In addition, there was limited trade from Russia to the other republics of the former Soviet Union as well as trade with the former communist countries of East Europe.

In the future, Russia will undoubtedly seek to increase the export of value-added manufactured wood products in lieu of unprocessed materials consisting of sawlogs, pulpwood and chip materials. This is seen as both a source of foreign currency but as a vehicle for greater employment and incomes supporting regional economic development in more remote forest areas with substantially less capital investment and infrastructure at the present time.

In the near term, the processing of manufactured products is largely dependent on relatively "old" technology, leading to poorer quality from many enterprises. Quality limitations are less critical for domestic consumption, but is an imposing constraint on the ability to open export markets, particularly those in the West where competition is substantial. This, together with market knowledge and information on pricing, reliable schedules and deliveries, and port and/or rail capacity will severely limit the export of processed forest products in the near term (Period One). Only as prices and costs adjust, the Russian industry gains experience in understanding Western markets, and supporting infrastructure is improved will exports likely expand in the medium term (Period Two).

Table 12 summarizes the estimates for solid wood product exports by region and period/scenario. For **lumber**, almost all Period One exports are conifer species, with the higher valued species predominant. Larch, the most abundant physical species, only reaches meaningful quantities for exports to European hard currency markets. In contrast, minor deciduous exports are estimated to take place for Pacific Rim markets. Total lumber exports for Period One are estimated at 4.5 million cubic meters. By far the largest share of these exports originate in the European region (4.1

TABLE 12. Russian Estimated Exports of Sawwood and Wood Panels by Market, Period and Scenario (Million Cubic Meters)

LUMBER (MILL CM)	Period 1				Period 2				Optimistic					
	European		Pacific		Total HC		Pessimistic		Baseline		Optimistic		Optimistic	
	HC Markets	Rim Markets	Exports	Total HC	Europ HC	Pac Rim	Total HC	Europe HC	Pac Rim	Total HC	Europe HC	Pac Rim	Total HC	HC
RUSSIA	4.1	0.4	4.5	4.8	4.6	0.2	4.8	3.1	0.2	3.3	5.6	0.2	5.8	
Conifer	4.1	0.3	4.4	5.1	4.9	0.2	5.1	3.1	0.2	3.3	5.5	0.2	5.7	
Larch	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	
Other	4.1	0.3	4.4	5.1	4.9	0.2	5.1	3.0	0.2	3.2	5.4	0.2	5.6	
Deciduous	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EUROPEAN Region	4.1	0.0	4.1	4.9	4.9	0.0	4.9	3.0	0.0	3.0	5.5	0.0	5.5	
PACIFIC ASIAN	0.0	0.4	0.4	0.2	0.0	0.2	0.2	0.0	0.2	0.2	0.0	0.2	0.2	
RUSSIA	0.4	0.0	0.4	0.3	0.3	0.0	0.3	0.3	0.0	0.3	0.3	0.0	0.3	
EUROPEAN REGION	0.4	0.0	0.4	0.3	0.3	0.0	0.3	0.3	0.0	0.3	0.3	0.0	0.3	
PACIFIC ASIAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

million cubic meters) while the Asian Pacific region accounts for 0.4 million cubic meters.

Lumber exports for Period Two are much more variable, depending upon the specific scenarios. Total Russian lumber exports to hard currency markets are estimated as ranging from a low of 3.3 million cubic meters under the **baseline** scenario to a high of 5.8 million cubic meters for the **optimistic** case. Under the **pessimistic** scenario, hard currency lumber exports are actually estimated to increase over the baseline case, to a total of 4.8 million cubic meters. This surprising result is due to the linkages between domestic consumption as well as consumption and trade with the former Republics of the Soviet Union. It also reflects that under the pessimistic scenario there is a reduced demand for roundwood, making prices lower and thus favoring lumber production, primarily in the European region, where there is an excess capital capacity at present. Depreciating the older installed capacity and technology for lumber production provides for a short term comparative advantage. Further, the overall lower delivered costs of products transported to the major markets of Russia and Western Europe, and the lower share of low-valued larch in the lumber production mix, favor the European region over the Pacific Asian region as a location for manufacturing.

With reduced domestic consumption under static or declining economic conditions, a relatively larger share of production becomes available for export. Trade from the Asian Pacific region is primarily with western Russia (7 million cubic meters) and the Central Asian Republics (2.5 million cubic meters). To some extent, the shipments from the Asian Pacific region into Western (European) Russia substitute for the hard currency exports to Europe from the European and West Siberian sub-regions.

Wood-Based Panel exports, including plywood, are minor in Period 1, estimated at 0.4 million cubic meters to hard currency markets.

These exports originate in the European region. Exports from the Asian Pacific region are primarily to the Central Asian republics rather than to hard currency markets.

In the longer term, export prospects for **wood-based panels** are more uncertain and variable. The development of new capital investment in manufacturing, and the upgrading of technology to provide higher quality production meeting international export standards will be critical. Also, the linkage between domestic production and consumption, reflecting the alternative assumptions regarding the success of economic reforms, and hence economic growth, will be critical to determining the potential exports to hard currency markets.

As noted previously, the differences in domestic and world prices temporarily act as a stimulus to greater harvests which would not be economic based on domestic product prices alone. As enterprises become aware of the price differentials, harvests rise faster in the Pacific Asian region, thus acting as a stimulus for greater lumber and/or panel production. However, much of this production response is in Western (European) Russia due to the existing capital investment and installed capacity constraints. In the Pacific Asian region, the results are generally restricted to harvesting and shipment of logs, with a proportionately smaller response in the manufacturing sector.

Total hard currency exports under the **Baseline** case in Period Two results in as estimated export of 0.3 million cubic meters, a slight decline of 0.1 million meters from Period One. All wood panel exports to hard currency markets originates in the European region. Likewise, all exports would go to European hard currency markets.

Export levels would be approximately equal for the **Baseline** and **Pessimistic** cases for hard currency wood panel exports, although

total exports would increase modestly under the **Optimistic** scenario. This increase, however, is through trade with the Asian Republics, rather than hard currency exports. Of total exports under this scenario of 1.9 million cubic meters, only 0.3 would go to the hard currency markets in Europe. The balance would be destined for the Asian Republics, originating principally in the European region (1.4 million cubic meters) with only minor exports (even to the Republics) originating in the Pacific Asian region of Russia (0.4 million cubic meters). No exports to hard currency markets is anticipated from the Pacific Asian region under any of the Period Two scenarios.

CONCLUSIONS

Russia continues to struggle with the processes of political and economic reform. The impacts of this process are not fully known. However, the forestry and forest products sector is not immune. The early 1990's have witnessed a tragic and substantial decline in the performance of this sector. As the general Russian economy has been disrupted, the performance of the forestry and wood products sector has shared in the disruptions and has seen the traditional patterns of production and markets lost.

As Russia seeks to implement greater utilization of "market-based" decision criteria and incentives, the forestry sector can anticipate substantial change. In the near term, the sector is faced with the existing structures and patterns of economic activity left over from the era of central planning. Timber harvest levels, the geographic distribution of harvesting and production, and the allocation of resources between domestic and export have all been distorted to a greater or lesser degree, but will impact the near term performance.

Prices and costs have not been a significant factor in guiding resource allocation within the forestry and forest industry sector in the past. Prices and costs remain distorted and largely administered. The price/cost structure is considerably at odds with the international forest products sector. Immediate full transition to international levels is unlikely in the near term, and it can be anticipated that Russia will continue to function under "partial" adjustments for the foreseeable future. These adjustments will, however, impact the perception of economic reality both within the Russian forestry sector and relative to export opportunities.

Russian policy makers will be faced with the dichotomy between desiring greater hard currency earnings from the export of available timber supply to international markets where prices

greatly exceed internal domestic prices and the competing desire to maintain adequate domestic consumption under declining aggregate economic output (GDP) and for future economic restructuring and growth. Both policies will be utilized, although it is estimated that maintaining an "adequate" domestic consumption will take precedence in the near to medium term.

Russia also finds itself with a deteriorating and obsolete capital structure for the forest products sector (in spite of individual examples to the contrary) which imposes a serious constraint on the quality of production, particularly for highly competitive international hard currency export markets. Reforming the forest products industry, restructuring, and rationalization of production will be a long term process. This process will be inhibited by the lack of investment capital. Allocations from the central government are a practice from the past. Increasingly, forest enterprises are not only expected to cover their own operating costs, but to also generate capital investment.

Technology for the forest products sector is generally available on the international market, but requires hard currency. To date, there is little indication that either central government regulations or local and regional authorities will encourage substantial reinvestment of existing hard currency earnings. Individual enterprises have little option at present to utilize these earnings for the purposes of technological improvement.

Foreign capital sources continue to look carefully at the Russian forest sector. Political and economic uncertainty however presently deter major investments in the forest products sector, relegating joint operations primarily to logging and infrastructure development largely related to the export of unprocessed timber. Changing costs, pricing, taxation and legal structures all cloud the ability to anticipate and plan for future profitable operations.

The present forest products industry has excess capacity, allowing a drawdown or depreciation of capital stock in the near term to sustain existing operating levels and to regain levels of the late 1980's. This apparent avoidance of significant capital costs (fixed costs) cannot be sustained, however, much beyond the year 2000. At that time, the existing capital stock will be sufficiently obsolete and/or depreciated to be inefficient not only for export processing but to serve the domestic market as well. Further, new technology is critically needed to upgrade production in the short term to permit the manufacture of sufficient quality output to become competitive in value-added exports.

The greatest asset for the sector is the considerable forest resources base. However, lack of infrastructure, reserves for non-timber purposes (including conservation and environmental protection) makes almost half of this resource beyond the economic margin for near-term utilization. In reality, Russia will be hard pressed to economically recover to the levels of harvest and output attained at the end of the 1980's under largely non-economic central planning.

Economic reforms approximating international levels of prices and costs does not significantly favor Russia in terms of comparative advantage. In fact, a real price increase of about 10 percent (reflecting international scarcity of timber) would be required, together with constant real international costs, to regain the 1989 levels of output under reasonable conditions of market economic feasibility. With growing resource scarcity from the conifer forests of North America and the tropical rain-forests, such an increase is not entirely unrealistic. However, it is too early to know how Russia may respond to such a change should it occur.

Trade in forest products with the hard currency trading regions of Europe and the Pacific Rim are expected to continue at levels close to those of the late 1980's and early 1990's. Prospects for the

period ending in 2000 depend on many emerging policies, including capital investment, reinvestment of hard currency generated by forest sector enterprises, and further price/cost reforms. The Russian Forest Sector Model, however, provides some insight into the near and medium term to probable developments for the forestry and forest products sector. It is estimated that on average some 7 million cubic meters of wood will be exported annually to European markets, with 6 million cubic meters exported to Pacific Rim markets over the 1990-1995 period. Prospects for the second period of analysis (1996-2000) are less clear, and will depend upon the availability of investment capital, price reforms, the level of future economic growth, and policies for domestic consumption and trade relations with the former Soviet republics. Exports during this period will likely fluctuate between 2 million and 17 million cubic meters to Europe and between 5 million and 12 million cubic meters to Pacific Rim markets depending upon how the internal economic situation continues and whether the "pessimistic" or "optimistic" conditions become a reality. Higher export volumes are potentially available should the political and economic ties between Russia and the other Republics of the former Soviet Union dissolve or weaken.

The long term outlook for the volumes of wood harvested and available for export is clouded with uncertainty. Rising domestic consumption resulting from economic restructuring and eventual economic growth, interacting with the economic realities of accessing and harvesting the presently inaccessible forest resources, may effectively limit the contribution which Russia is traditionally assumed to make to global timber supply outside of Russia.

REFERENCES

- Backman, Charles A. 1993
"Prospects for Wood Raw Material Exports from Russia to Pacific Rim and European Markets up until the Year 2000", PhD Dissertation, University of Washington, Seattle. 358 pp.
- Backman, Charles A. and Waggener, Thomas R. 1990
"Soviet Forests at the Crossroads: Emerging Trends at a Time of Economic and Political Reform", CINTRAFOR Working Paper 28, Center for International Trade in Forest Products, College of Forest Resources, University of Washington. Seattle. 382 pp.
- Backman, Charles A. and Waggener, Thomas R. 1991
"Soviet Timber Resources and Utilization: An Interpretation of the 1988 National Inventory, CINTRAFOR Working Paper 35, Center for International Trade in Forest Products, College of Forest Resources, University of Washington. Seattle. 296 pp.
- Barr, Brenton 1970
The Soviet Wood-Processing Industry, University of Toronto Press, Toronto, Canada. 135 pp.
- Barr, Brenton M. & Kathleen E. Braden 1988
The Disappearing Russian Forest - A dilemma in Soviet Resource Management, Rowman & Littlefield, Totowa, NJ. 252 pp.
- Burdin, N. A. 1990
Tsyellyulozano-Bumazhnaya Promishlyennost' v Uslovuyakh Radikal'noy Ekonomichyeskoy Ryeformi (The Pulp and Paper Industry Under Conditions of Radical Economic Reform), Bumazhnaya Promishlyennost' (Paper Industry), Lyesnaya Promishlyennost', Moskva, October. No. 10
- Burdin, N. A. 1989
Probyemi Razvitiya Otrasyevogo Lesnogo Komplyueksa (Problems of the Development of the Forest Sector), VNIPIEllesprom, Moscow, 142 pp.
- Cardellichio, Peter A., C.S. Binkley, & V. K. Zausaev 1989
"Potential Expansion of Soviet Far East Log Exports to the Pacific Rim, CINTRAFOR Working Paper 21, Center for International Trade in Forest Products, College of Forest Resources, University of Washington, Seattle. 23 pp.
- Eronen, J and S. Markhu, 1993
"Russia and Other Ex-Soviet Republics as Future Paper Markets", Conference Paper, Prima Conference, Helsinki, Finland, May 12-14.

Nilsson, Sten et al. 1992

The Forest Resources of the Former European USSR, IIASA, The Parthenon Publishing Group, Pearl River, NY. 408 pp.

United Nations 1989

The Outlook for the Forest and Forest Products Sector of the USSR, Publication Number ECE/TIM 48, United Nations, New York. 105 pp.

Waggener, T.R. and C.A. Backman 1990

Eastern Europe Trade in Forest Products: Changing Role of the USSR and Opportunities for the US Forest Products Industry, National Forest Products Association, Washington, D.C. October. 294 pp.

APPENDIX

- Table A.1. Soviet Union and Regions: Average Ruble Costs for Selected Products in 1989
- Table A.2. Russia: Costs and Prices in Rubles and Dollars of Selected Forest Products and Derivation of Ruble-Dollar Exchange Rate to Transform 1989 Ruble Costs to 1992 Dollar Cost Equivalents
- Table A.3. Russia and Regions: Average Ruble Costs in 1989 and Estimated Dollar costs in 1992 for Selected Products
- Table A.4. Russia and Regions: Estimated Current Cost of Transportation of Selected Products in Dollars per Unit
- Table A.5. Russia and Regions: Estimated Variable and Capital Costs of Selected Activities in Dollars per Unit
- Table A.6. Russia and Regions: Estimated cost of Transportation of Selected Products Between Russian Regions and Trading Regions - Current Domestic Prices and World Prices (*Italics*) in Dollars or Rubles per Unit
- Table A.7. Russia: Estimated Domestic and World Prices of Selected Forest Products (Dollars per Unit)
- Table A.8. Russia: Estimated Domestic and World Costs of Selected Forest Products (Dollars per Unit)
- Table A.9. Russia and Regions: Apparent Consumption of Forest Products in 1989, Estimated Consumption in 1992, and Projected Consumption Based on 5 percent GDP Growth
- Table A.10. Soviet Republics: Apparent Consumption of Forest Products in 1989, Estimated Consumption in 1992, and Projected Consumption Based on 5 percent GDP Growth

TABLE A.1.1. SOVIET UNION and REGIONS: Average Ruble Costs for Selected Products in 1989

		Average Ruble Cost		Average Ruble Capital Cost		Average Cost	
						Excl. Capital	Excl. Fiber
Harvest	Europe	17	60	14	NA		
	Asia	19	82	15	NA		
Lumber	Europe	60	172	54	19		
	Asia	66	232	58	18		
Pulp	Europe	306	1,580	253	152		
	Asia	317	2,133	244	135		
Panel	Europe	99	205	90	52		
	Asia	107	277	94	53		
paper int	Europe	353	2,520	287	185		
	Asia	481	3,402	359	239		
Paperboard	Europe	243	1,415	201	99		
	Asia	323	1,910	248	138		

Source: C.A. Backman, Lesnoy Kompleks SSSR

TABLE A.2. RUSSIA: Costs and Prices in Rubles and Dollars of Selected Forest Products and Derivation of Ruble-Dollar Exchange Rate to Transform 1989 Ruble Costs to 1992 Dollar Cost Equivalents

Harvesting

Year-Quarter	1991	1992-1	1992-2	1992-3
Prices - rubles	42	354	514	779
Costs - rubles	32	151	374	710
Prices - dollars		2.02	3.81	4.00
Costs - rubles		0.86	2.77	3.64
Year-Quarter		1989	1989	1989
Prices - rubles		23	23	23
Costs - rubles		17.4	17.4	17.4
Inferred Rate - Rubles per Dollar				
Prices		11.4	6.0	5.8
Costs		20.1	6.3	4.8

Lumber

Year-Quarter	1991	1992-1	1992-2	1992-3
Prices - rubles	170	1,445	2,096	2,339
Costs - rubles	122	901	1,560	1,997
Prices - dollars		8.26	15.52	12.00
Costs - rubles		5.15	11.56	10.24
Year-Quarter		1989	1989	1989
Prices - rubles		61	61	61
Costs - rubles		51	51	51
Inferred Rate - Rubles per Dollar				
Prices		7.4	3.9	5.1
Costs		9.9	4.4	5.0

Source: C. A. Backman, Sverdlesprom

TABLE A.2. (continued)

Particleboard

Time	1991	1992-1	1992-2	1992-3
Prices - rubles	254	4,217	5,168	5,016
Costs - rubles	245	1,665	3,177	4,083
Prices - dollars		24.10	38.28	25.72
Costs - rubles		9.51	23.53	20.94
Time		1989	1989	1989
Prices - rubles		115	115	115
Costs - rubles		108	108	108
Inferred Rate - Rubles per Dollar				
Prices		4.8	3.0	4.5
Costs		11.3	4.6	5.1

Activity	quarter	<i>Inferred Rate - Rubles per Dollar</i>		
		prices	costs	Q. 2+3 Ave.
Harvesting	3	5.76	4.78	
Harvesting	2	6.04	6.29	5.53
Harvesting	1	11.38	20.12	
Lumber	3	5.08	4.97	
Lumber	2	3.92	4.40	4.68
Lumber	1	7.38	9.88	
Particleboard	3	4.48	5.14	
Particleboard	2	3.01	4.58	4.86
Particleboard	1	4.78	11.32	
Ave All period		5.42	7.34	
Ave last 2 per.		4.44	4.73	
Third Period		4.92	4.62	
Second Period		3.97	4.84	
First Period		7.39	12.56	

TABLE A.3. RUSSIA and REGIONS: Average Ruble Costs in 1989 and Estimated Dollar Costs in 1992 for Selected Products

		Total Average Cost		Variable Cost		Wood Raw Material Cost		Estimated Capital Cost	
		rubles	dollars	rubles	dollars	rubles	dollars	rubles	dollars
Harvest	Europe	17	3.55	13	2.75	1	0.20	3	0.60
	Asia	19	4.04	14	2.93	1	0.23	4	0.88
Lumber	Europe	60	12.77	19	4.01	35	7.54	6	1.22
	Asia	66	14.04	18	3.87	40	8.52	8	1.65
Pulp	Europe	306	65.11	152	32.33	102	21.64	52	11.13
	Asia	317	67.45	135	28.72	109	23.15	73	15.58
Panel	Europe	99	21.06	52	11.04	38	8.19	9	1.83
	Asia	107	22.77	53	11.37	41	8.71	13	2.69
Paper	Europe	353	75.11	185	39.43	101	21.55	66	14.12
	Asia	481	102.34	239	50.96	119	25.39	122	25.99
Paperboard	Europe	243	51.70	99	21.06	102	21.70	42	8.94
	Asia	323	68.72	138	29.44	109	23.27	75	16.01

Source: Lesnoy Kompleks SSSR, various pages, C.A. Backman

TABLE A.4. RUSSIA and REGIONS: Estimated Current Cost of Transportation of Selected Products in Dollars per Unit

From Pacific Asia:		Pacific Asia	Euro-Siberia	West Hard Currency	European Republics	Central Asia	East Hard Currency
Roundwood	c.m.	0.60	6.50	7.10	7.10	4.00	4.10
Chips	c.m.	0.60	5.30	5.90	5.90	3.30	3.70
Lumber	c.m.	1.50	7.00	7.90	7.90	4.40	4.90
Panels	c.m.	1.90	6.50	7.40	7.40	3.90	5.30
Pulp	m.t.	1.30	8.70	9.60	9.60	5.50	5.30
From: Euro-Siberia:		Pacific Asia	Euro-Siberia	West Hard Currency	European Republics	Central Asia	East Hard Currency
Roundwood	c.m.	6.00	0.65	2.20	2.20	1.90	9.50
Chips	c.m.	5.10	1.10	1.90	1.90	1.40	8.00
Lumber	c.m.	7.30	1.30	2.50	2.50	1.90	10.70
Panels	c.m.	7.70	1.90	2.10	2.10	2.40	11.10
Pulp	m.t.	9.50	1.90	2.80	2.80	2.80	12.90

Source: Ministry of Transportation USSR, C.A. Backman

TABLE A.5. RUSSIA and REGIONS: Estimated Variable and Capital Costs of Selected Activities in Dollars per Unit

Variable Costs Per Unit Output

	Euro-Siberia	Euro-Siberia	The Far East	The Far East
<i>New Technology</i>				
	Russia	World	Russia	World
Harvesting				
area 1	1.53	12.78	1.53	12.78
area 2	2.54	21.30	2.54	21.30
area 3	3.56	29.82	3.56	29.82
area 4	4.58	38.34	4.58	38.34
area 5	5.60	46.86	5.60	46.86
area 6	6.61	55.38	6.61	55.38
Chip	0.50	5.00	5.00	5.00
Lumber	4.00	19.00	3.87	19.00
Panel	11.00	46.00	11.37	46.00
Pulp	32.33	203.00	28.72	203.00
<i>Old Technology</i>				
Chip	0.50	8.89	5.00	8.89
Lumber	4.00	35.00	3.87	35.00
Panel	11.00	59.00	11.37	59.00
Pulp	32.33	356.00	28.72	356.00

Capital Stock Necessary To Support One Unit Output

	Old Technology	New Technology	Old Technology	New Technology
Harvesting	12.77	48	17.45	66
Chip	6.10	50	8.23	67
Lumber	36.60	300	49.36	405
Panel	43.62	380	58.94	513
Pulp	336.17	1,680	453.83	2,268

Source: C.A. Backman, Lesnoy Kompleks, Industry Sources

TABLE A.6. RUSSIA and REGIONS: Estimated Cost of Transportation of Selected Products Between Russian Regions and Trading Regions - Current Domestic Prices and World Prices (*Italics*) in Dollars or Rubles per Unit

	From Pacific Asia to				Euro-Siberia				Europe				European Republics				Central Asia				Asia				
	Pacific Asia Consumption	Pacific Asia Consumption	Pacific Asia Consumption	Pacific Asia Consumption	Euro-Siberia Consumption	Euro-Siberia Consumption	Euro-Siberia Consumption	Euro-Siberia Consumption	Europe	Europe	Europe	Europe	European Republics	European Republics	European Republics	European Republics	Central Asia	Central Asia	Central Asia	Central Asia	Asia	Asia	Asia	Asia	
Harvesting	0.60	11	6.50	34	7.10	36	7.10	36	7.10	36	7.10	36	7.10	36	7.10	4.00	24	4.10	24	4.10	24	4.10	24		
Chips	0.60	9	5.30	70	5.90	80	5.90	80	5.90	80	5.90	80	5.90	80	5.90	3.30	45	3.70	45	3.70	45	3.70	45		
Lumber	1.50	10	7.00	43	7.90	49	7.90	49	7.90	49	7.90	49	7.90	49	7.90	4.40	28	4.90	28	4.90	28	4.90	28		
Panel	1.90	13	6.50	44	7.40	50	7.40	50	7.40	50	7.40	50	7.40	50	7.40	3.90	27	5.30	27	5.30	27	5.30	27		
Pulp	1.30	19	8.70	84	9.60	93	9.60	93	9.60	93	9.60	93	9.60	93	9.60	5.50	58	5.30	58	5.30	58	5.30	58		
From Euro-Siberia to:																									
Pacific Asia Consumption																									
Harvesting	6.00	32	0.65	11	2.20	17	2.20	17	2.20	17	2.20	17	2.20	17	2.20	1.90	16	1.90	16	1.90	16	1.90	16	1.90	16
Lumber	7.30	45	1.30	10	2.50	17	2.50	17	2.50	17	2.50	17	2.50	17	2.50	1.90	13	10.70	13	10.70	13	10.70	13	10.70	13
Chips	5.10	60	1.10	11	1.90	26	1.90	26	1.90	26	1.90	26	1.90	26	1.90	1.40	20	8.00	20	8.00	20	8.00	20	8.00	20
Panel	7.70	52	1.90	25	2.10	27	2.10	27	2.10	27	2.10	27	2.10	27	2.10	2.40	17	11.10	17	11.10	17	11.10	17	11.10	17
Pulp	9.50	91	1.90	25	2.80	27	2.80	27	2.80	27	2.80	27	2.80	27	2.80	2.80	37	12.90	37	12.90	37	12.90	37	12.90	37

Source: Burlington Northern, Ministry of Transportation of USSR

TABLE A.7. RUSSIA: Estimated Domestic and World Prices of Selected Forest Products (Dollars per Unit)

	Russian Domestic	World
High Grade Log:		
Non Larch Coniferous	8.85	86
Larch Coniferous	6.54	75
Deciduous	7.08	69
Low Grade:		
Non Larch Coniferous	4.42	44
Larch Coniferous	4.42	44
Deciduous	4.42	44
Chip:		
Non Larch Coniferous	4.42	44
Larch Coniferous	4.42	44
Deciduous	4.42	44
Lumber:		
Non Larch Coniferous	18.32	250
Larch Coniferous	13.53	218
Deciduous	12.83	175
Panel	32.00	254
Pulp	100.00	677

Source: FAO, Finansovye Izvestiya, European Market Update

TABLE A.8. RUSSIA: Estimated Domestic and World Costs of Selected Forest Products (Dollars per Unit)

Variable Costs Per Unit Output

Euro-Siberia

Percent of the Difference between Domestic and World Values

	Old Technology				New Tech.	
	Russia	25	50	75	90	World
Harvesting						
area 1	2	4	7	10	12	13
area 2	3	7	12	17	19	21
area 3	4	10	17	23	27	30
area 4	5	13	21	30	35	38
area 5	6	16	26	37	43	47
area 6	7	19	31	43	51	55
Chip	1	2	3	4	5	5
Lumber	4	8	12	15	18	19
Panel	11	20	29	37	43	46
Pulp	32	75	118	160	186	203
Chip	1	3	5	7	8	9
Lumber	4	12	20	27	32	35
Panel	11	23	35	47	54	59
Pulp	32	113	194	275	324	356

Capital Stock Necessary To Support One Unit Output

Percent of the Difference between Domestic and World Values

	Old Technology				New Tech.	
	Russia	25	50	75	90	World
Harvesting	13	22	30	39	44	48
Chip	6	17	28	39	46	50
Lumber	37	102	168	234	274	300
Panel	44	128	212	296	346	380
Pulp	336	672	1,008	1,344	1,546	1,680

Source: C.A. Backman, Lesnoy Kompleks, Industry Sources

TABLE A.8. (continued)

Variable Costs Per Unit Output

The Far East

Percent of the Difference between Domestic and World Values

	Old Technology				New Tech.	
	Russia	25	50	75	90	World
Harvesting						
area 1	2	4	7	10	12	13
area 2	3	7	12	17	19	21
area 3	4	10	17	23	27	30
area 4	5	13	21	30	35	38
area 5	6	16	26	37	43	47
area 6	7	19	31	43	51	55
Chip	1	2	3	4	5	5
Lumber	4	8	11	15	17	19
Panel	11	20	29	37	43	46
Pulp	29	72	116	159	186	203
Chip	1	3	5	7	8	9
Lumber	4	12	19	27	32	35
Panel	11	23	35	47	54	59
Pulp	29	111	192	274	323	356

Capital Stock Necessary To Support One Unit Output

Percent of the Difference between Domestic and World Values

	Old Technology				New Tech.	
	Russia	25	50	75	90	World
Harvesting	17	29	42	54	61	66
Chip	8	23	38	53	62	67
Lumber	49	138	227	316	369	405
Panel	59	173	286	400	468	513
Pulp	454	907	1,361	1,814	2,086	2,268

TABLE A.9. RUSSIA and REGIONS: Apparent Consumption of Forest Products in 1989, Estimated Consumption in 1992, and Projected Consumption Based on 5 Percent GDP Growth

	RUSSIA	Euro-Siberian	Pacific Asian
Unmanufactured Roundwood (cubic meters)			
1989	33.5	30.0	3.5
1992	24.8	22.2	2.6
5 % GDP Growth	28.8	25.8	3.0
Lumber (cubic meters)			
1989	65.6	58.0	7.6
1992	48.5	42.9	5.6
5 % GDP Growth	57.5	50.9	6.6
Panel Products (cubic meters)			
1989	5.9	5.2	0.7
1992	4.4	3.9	0.5
5 % GDP Growth	5.9	5.3	0.7
Pulp/paper Products (metric tons)			
1989	4.8	4.2	0.6
1992	3.5	3.1	0.4
5 % GDP Growth	4.5	4.0	0.5
Miscellaneous Manufacturing			
1989	53.3	47.1	6.1
1992	39.4	34.9	4.5
5 % GDP Growth	45.7	40.5	5.3

Source: C.A. Backman

TABLE A.10. SOVIET REPUBLICS: Apparent Consumption of Forest Products in 1989, Estimated Consumption in 1992, and Projected Consumption Based on 5 Percent GDP Growth

	TOTAL	European Republics	Central Asian Republics
Unmanufactured (cubic meters)			
1989	32.2	20.7	11.5
1992	23.8	15.3	8.5
5 % GDP Growth	27.6	17.8	9.9
Lumber (cubic meters)			
1989	27.3	19.8	7.5
1992	20.2	14.7	5.6
5 % GDP Growth	23.9	17.4	6.6
Panel Products (cubic meters)			
1989	6.0	4.2	1.8
1992	4.4	3.1	1.3
5 % GDP Growth	6.0	4.2	1.8
Pulp/paper Products (metric tons)			
1989	4.6	2.9	1.7
1992	3.4	2.2	1.2
5 % GDP Growth	4.3	2.8	1.6
Miscellaneous Manufacturing			
1989	50.4	32.4	18.0
1992	37.3	24.0	13.3
5 % GDP Growth	43.3	27.8	15.5

Source: C.A. Backman