THE RUSSIAN FOREST SECTOR
Prospects for Trade with the Former Soviet Republics

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Foreword

Siberia's forest sector has recently gained considerable international attention. IIASA, the Russian Academy of Sciences, and the Russian Federal Forest Service, in agreement with the Russian Ministry of the Environment and Natural Resources, signed agreements in 1992 and 1994 to carry out a large-scale study on the Siberian forest sector. The overall objective of the study is to identify policy options that encourage sustainable development of the sector. Specific goals include assessment of Siberia's forest resources, forest industries, and infrastructure; examination of the forest's economic, social, and biospheric functions; with these in mind, identification of possible pathways for their sustainable development; and translation of these pathways into policy options for Russian and international agencies.

The study is a large multidisciplinary endeavor encompassing nine research areas, one of which is an examination of the forest industry and markets. Other components include studies of greenhouse gas balances, forest resources and forest utilization, effects on biodiversity, landscapes, and bioproductivity, non-wood products and functions, environmental status, transportation infrastructure, and socioeconomic impacts.

The first phase of the study concentrated on the generation of extensive and consistent databases of the total forest sector of Siberia and Russia. Current work in phase II focuses on the preparation of background policy papers that rely on the databases generated during phase I. The article in this report is part of the industry and market component of phase II.

Sten Nilsson
Project Leader
Siberian Forest Study

The Russian Forest Sector: Prospects for Trade with the Former Soviet Republics

Charles A. Backman[1]

Abstract: A specialist on the Russian forest industry reviews the production, trade, and consumption of forest products in seven macroregions of the former Soviet Union and estimates future trade activity using a model of the forest sector incorporating 10 five-year periods of analysis. Past and present trends in production, consumption, and trade are outlined via 12 tables derived from original statistical sources. Future estimates of forest-sector activity are presented through seven tables that extrapolate behavioral patterns of market economies with respect to the consumption of forest products to the former Soviet republics. 19 tables, 49 references.

The forest sector of the former Soviet Union was enormous in size, having jurisdiction over one-quarter of the global forest resource, although commanding somewhat smaller shares of world output, trade, and consumption of forest products (Table 1) (Barr and Braden, 1988; Backman and Waggener, 1990; FAO, 1993; Backman, 1995c). Although Russia dominated the former USSR's production, little has been known concerning the degree to which the forest sector in each of the 15 constituent republics of the former Soviet Union (FSU) was able to satisfy domestic demand within those republics (Backman, 1993). Furthermore, although *intra*-Soviet Union trade accounted for more than one-half of the forest product exports of Russia in 1989, the extent to which forest products originating in Russia supported consumption patterns in each of the other republics under the former regime was not very clear, although Russia certainly dominated (Backman, 1993, 1995b).

General trade among (and economic activity within) the republics, including that linked to the forest sector, declined steeply following the demise of the USSR and the centrally planned economy (Table 2).[2] A rebounding economy in each of the republics, however, brought on by a subsiding of the chaos engendered by the collapse of the centrally planned economy and the political union of the USSR—as well as the re-establishment of linkages connecting the different participants in economic, social, and political systems supporting general activity—can be expected to create a potential market for Russian exporters and those elsewhere. Furthermore, domestic manufacturers and dis-

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[2]Activity within the former Soviet Union is discussed in terms of seven geographic aggregations—Russia West, Russia East, the Baltic, Southwest, Transcaucasus, Kazakhstan, and Central Asia. Russia West consists of European Russia plus West Siberia; Russia East consists of East Siberia and the Far East; the Baltic region consists of Estonia, Lithuania, and Latvia; the Southwest region consists of Belarus', Moldova, and Ukraine; the Transcaucasus region consists of Azerbaijan, Armenia, and Georgia; and the Central Asian region consists of Tajikistan, Turkmenistan, Uzbekistan, and Kyrgyzstan.

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Table 1. World, Former USSR, and Russia: Selected Forest-Sector Statistics for 1989

Statistic	Units	World total	Former USSR total	Russia total	USSR share of world total	Russian share of USSR total	Russian share of world total
Total land area	million ha.	13,033.0	2,240.3	1,707.5	0.17	0.76	0.13
Forest land area	million ha.	4,136.2	941.5	884.1	0.23	0.94	0.21
Stocked forest land area	million ha.	2,985.6	814.3	771.1	0.27	0.95	0.26
Growing stock	billion c.m.	338.8	85.9	81.6	0.25	0.95	0.24
Industrial roundwood production	million c.m.	1,672.5	295.0	270.3	0.18	0.92	0.16
Exported industrial wood	million c.m.	126.8	18.7	n.a.	0.15	n.a.	n.a.
Imported industrial wood	million c.m.	126.2	0.2	n.a.	0.00	n.a.	n.a.
Lumber output	million c.m.	508.0	101.1	83.0	0.20	0.82	0.16
Exported lumber	million c.m.	98.6	7.8	n.a.	0.08	n.a.	n.a.
Imported lumber	million c.m.	96.5	0.2	n.a.	0.00	n.a.	n.a.
Wood panel output	million c.m.	125.0	14.8	10.6	0.12	0.72	0.08
Exported wood panels	million c.m.	27.3	1.1	n.a.	0.04	n.a.	n.a.
Imported wood panels	million c.m.	27.8	0.0	n.a.	0.00	n.a.	n.a.
Pulp production	million m.t.	136.1	10.7	10.2	0.08	0.95	0.07
Exported pulp	million m.t.	24.3	1.0	n.a.	0.04	n.a.	n.a.
Imported pulp	million m.t.	24.4	0.2	n.a.	0.01	n.a.	n.a.
Pulp and paperboard output	million m.t.	239.1	10.7	8.5	0.04	0.80	0.04
Exported pulp and paperboard	million m.t.	52.2	1.0	n.a.	0.02	n.a.	n.a.
Imported pulp and paperboard	million m.t.	55.6	0.7	n.a.	0.01	n.a.	n.a.

Abbreviations and explanations: c.m. = cubic meters; m.t. = metric tons; n.a. = not available.
Sources: Derived from Vorob'yev (1986), Goskomles (1990), VNIPIEllesprom (1991), FAO (1993).

tributors of forest products in the non-Russian republics also should have opportunities to capitalize on the latent economic rebirth (Backman, 1995c; Poliakov, 1995).

This paper seeks to present and assess in a structured way the balance between supply and demand for forest products within the geographic area defined by the former USSR. The extent to which *inter*-republican trade in forest products contributed to historical and present consumption patterns provides an indication of the potential markets available upon economic recovery in the FSU republics once the turbulence caused by dissolution of the Soviet Union fades away. Projection of future demand via four economic-growth

Table 2. Former USSR and Regions: Activity in GDP, Republican Trade, and Forest Sector (1990 = 1.00)

	Year	Former USSR	Russia	Baltic	South-west	Trans-caucasus	Asia	Kazakh-stan
Gross domestic product	1990	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	1991	0.94	0.95	0.88	0.91	0.93	0.92	0.88
	1992	0.79	0.81	0.61	0.79	0.55	0.79	0.77
	1993	0.72	0.74	0.50	0.72	0.41	0.70	0.65
	1994	0.60	0.65	0.50	0.54	0.33	0.60	0.49
Trade turnover, total	1990	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	1991	0.72	0.72	0.61	0.75	0.64	0.74	0.72
	1992	0.52	0.56	0.37	0.54	0.28	0.41	0.75
	1993	0.34	0.36	0.16	0.39	0.17	0.31	0.49
	1994	0.23	0.24	0.10	0.25	0.11	0.21	0.33
Forest industry output	1990	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	1991	0.93	0.91	0.96	1.02	0.98	1.09	0.83
	1992	0.80	0.78	0.57	1.00	0.58	0.99	0.59
	1993	0.68	0.63	0.39	0.97	0.46	0.98	0.55
	1994	0.49	0.44	0.27	0.70	0.23	0.89	0.41

Source: Derived from Belkindas et al. (1995); World Bank (1995).

scenarios provides a framework for examining future levels of forest-sector activity into the 21st century. After an examination of the past, present, and likely future structure of the forest sector, general observations and policy implications are presented.

THE FOREST RESOURCE AND MAXIMUM SUPPORTABLE ROUNDWOOD SUPPLY

Russia accounted for virtually all of the forest resource of the former Soviet Union, contributing 95 percent to both growing stock (85.9 billion cubic meters total) and stocked forest land (814 million hectares total) (Table 3). Some two-thirds of the Russian total stocked forest land was situated in the Russia East region. The largest share of the USSR balance of stocked forest land (outside Russia) was concentrated in the southwest region (principally Ukraine), and in Kazakhstan. Together, these two regions accounted for one-half of the remainder. Nearly equal shares were located in the Baltic region, mainly Latvia, and the Central Asian region, dominated by riverine forest located in Turkmenistan and Uzbekistan. The Transcaucasus region contained the smallest forest resource, the principal share of it being located in Georgia.[3]

The area with the greatest degree of forest cover lies in Russia East, where one-half of the land mass is covered by forest. Both the Baltic and Russia West regions also have a significant share of their territory in forest, nearly 40 percent of the total land area of both. For the Transcaucasus and Southwest regions, only one-fifth of the territories in each

[3]The forest resources of the former Soviet Union have been extensively discussed in Vorob'yev et al. (1979) and Isayev (1991a, 1991b) as well as being reviewed in Barr and Braden (1988). The forest resources in the European part of the former USSR were addressed in Nilsson et al. (1992).

Table 3. Selected Statistics Describing the Forest Resource in the Former USSR and Regions

Region	Population, mill.	Total land area, mill.ha.	Stocked forest land			Growing stock			Degree of forest cover (s.f.l/t.l.a.)[a]	Per capita growing stock, cu.m/person	Growing stock per hectare		
			Total, mill.ha.	Coniferous, mill.ha.	Deciduous, mill.ha.	Total, bill.c.m.	Coniferous, bill.c.m.	Deciduous, bill.c.m.			Total, cu.m/ha.	Coniferous, cu.m/ha.	Deciduous, cu.m/ha.
Former USSR	288.6	2,240.3	814.3	567.5	181.6	85.9	66.4	18.1	0.36	297.7	106	117	100
Russia	148.0	1,707.5	771.1	552.0	157.0	81.6	64.0	16.2	0.45	551.5	106	116	103
Russia West	130.8	673.7	256.1	162.8	92.4	31.1	20.2	10.8	0.38	237.5	121	124	117
Russia East	17.2	1,033.9	515.0	389.2	64.7	50.6	43.8	5.4	0.50	2,937.7	98	113	83
Baltic	8.0	17.5	6.3	3.8	2.5	1.0	0.6	0.3	0.36	123.9	158	170	138
Southwest	66.5	84.5	16.0	8.7	7.1	2.3	1.4	0.9	0.19	34.2	143	157	128
Transcaucasus	15.9	18.6	4.1	0.5	3.3	0.6	0.1	0.5	0.22	37.0	144	247	135
Central Asia	33.6	127.7	7.2	0.7	5.2	0.1	0.0	0.0	0.06	1.6	7	33	4
Kazakhstan	16.7	271.7	9.6	1.8	6.4	0.4	0.2	0.1	0.04	21.9	38	128	20

[a]Stocked forest land/total land area.
Source: Derived from Goskomles (1990); Goskomstat SSSR (1990b).

region are covered with forest. Very little difference exists among the republics of the Baltic region in terms of the degree of forest cover, but in the Southwest region, the degree of forest cover ranges from 10 to 15 percent in Moldova and Ukraine to 35 percent for Belarus'. In the Transcaucasus region, Armenia and Azerbaijan are little forested (between 10 and 12 percent), although in Georgia forests cover 40 percent of the land area. The Central Asian region and Kazakhstan regions are the least forested, with only some 5 percent of the territory in each covered by forest. Within the Central Asian region, Turkmenistan contains the greatest forest cover, amounting to 17 percent of the territory, followed by Uzbekistan (8 percent) and Kyrgyzstan and Tajikistan, both with 5 percent.

Russia contains the largest reserve of growing stock supporting consumption by the local population, particularly Russia East. Although the Baltic region, especially Latvia and Estonia, supports more than 100 cubic meters per inhabitant, the Central Asian and Kazakhstan regions, suffering from lack of the resource and a large and growing population, support less than 5 cubic meters per person in the case of Central Asia and less than 25 cubic meters in the case of Kazakhstan. The Transcaucasus and Southwest regions contain a moderate amount of growing stock, amounting to some 35 cubic meters per person. Georgia in the Transcaucasus and Belarus' in the Southwest region contain more growing stock per capita than the regional average would suggest.

Although deciduous forest accounts for slightly more than 10 percent of growing stock in the Russia East region, deciduous forest contributes about one-third of the total resource in Russia West and the Baltic regions, with little difference existing among the three republics constituting the Baltic region. Almost one-half of the forest resource in the Southwest, rising to more than three-quarters in the Transcaucasus region, consists of deciduous forest. Within the Transcaucasus, coniferous forest is present only in Georgia, where it accounts for less than one-quarter of the republic's total growing stock. Little difference exists among the republics of the Southwest region. Although some 70 percent of the forested land in Kazakhstan and the Central Asia is covered by deciduous forest, higher volumes per hectare in its coniferous resource contribute to the latter's greater contribution to growing stock, for which it accounts for some 50 percent of the volume. Little differences exist among the four republics of the Central Asian region.

The forest resource of the former USSR supports an allowable annual cut (AAC)[4] of almost 900 million cubic meters (Table 4), almost two-thirds of which are considered to be currently and potentially accessible.[5] More than 95 percent of the total, not surprisingly, is located in Russia, including virtually all of the reserve AAC, which is situated primarily in Russia East.

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[4]Allowable annual cut (AAC) is the average volume of wood that may be harvested annually under sustained yield management. It equals roughly the amount of new growth produced by the forest each year minus deductions for losses due to fire, insects, and diseases. Not included in the volume available through utilization of the AAC are harvest supported by intermediate harvest (such as thinning and harvest to improve the structure of the forest) and harvest connected with infrastructure development. Both other harvest and intermediate harvest contribute to the overall available fiber supply, although the largest share of fiber supply is supported by the AAC.

[5]The level of the AAC is not static, and can change from year to year in response to changing values placed on the different benefits flowing from the resource (recreational, food production, environmental protection, or wood production, for example), or increased knowledge connected with the underlying growth dynamics of the forest resource and thereby its ability to support an annual harvest. In the former USSR, for example, the AAC (excluding that classified as reserve) dropped from 640 million cu.m in 1975 to just 558 million cu.m by 1991 (Backman, 1995a, p. 88). Most of the decline took place in Russia, for which the AAC fell from 620 million cu.m to 540 million cu.m between 1978 and 1991 (Backman, 1995a, p. 89; VNIUPIEIlesprom, 1991, p. 19). Indeed, by 1994, the AAC in Russia had declined further to 502 million cu.m (FSLKhR, 1995—Appendix 1, p. 2). Readers should note, however, that the AAC figures presented in this footnote do not include the AAC supported by nonforest-sector forests (cf. Table 4).

Table 4. Allowable Annual Cut (AAC) Supported by the Forest Resource (million cu.m, roundwood equivalent)

Region	Allowable annual cut			Reserve AAC			Potential AAC			Current AAC		
	Total	Conif-erous	Decid-uous	Total	Conif-erous	Decid-uous	Total	Conif-erous	Decid-uous	Total	Conif-erous	Decid-uous
Former USSR	859.0	581.6	277.3	301.5	262.5	39.0	163.7	101.7	62.1	393.6	217.5	176.2
Russia	833.8	570.1	263.6	301.5	262.5	39.0	162.7	101.0	61.7	369.5	206.6	162.9
Russia West	366.0	190.8	175.1	86.8	63.2	23.6	35.3	13.6	21.7	243.8	114.0	129.9
Russia East	467.8	379.4	88.5	214.7	199.3	15.4	127.4	87.4	40.0	125.7	92.7	33.0
Baltic	6.5	2.9	3.6	0.0	0.0	0.0	0.0	0.0	0.0	6.5	2.9	3.6
Southwest	14.2	6.8	7.5	0.0	0.0	0.0	0.0	0.0	0.0	14.2	6.8	7.5
Transcaucasus	0.9	0.1	0.8	0.0	0.0	0.0	0.2	0.1	0.2	0.7	0.0	0.7
Central Asia	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Kazakhstan	3.3	1.7	1.6	0.0	0.0	0.0	0.8	0.6	0.2	2.5	1.1	1.5

Sources: Derived from Goskomstat SSSR (1990a), Backman (1994, 1995a), FSLKhR (1995).

Slightly more than one-half of the total former USSR's currently and potentially accessible AAC is supported by forest located in Russia West.[6] Virtually all of the remaining AAC is located in Russia East, with minor amounts being located in the Southwest, primarily in Belarus' and Ukraine, and in the Baltic region. Kazakhstan and the Transcaucasus regions each contain a small volume of AAC, whereas insignificant volumes are located in the Central Asian region. Within the Transcaucasus region, AAC is virtually absent in Armenia and only marginally present in Azerbaijan, with most of the regional total situated in Georgia. Within the Central Asian region, some two-thirds of AAC is located in Uzbekistan, whereas it is absent in Turkmenistan.

Slightly less than 90 percent of the reserve AAC (not feasible for development in the foreseeable future) in the Russia West and East regions is supported by coniferous forest. Although three-quarters of the potentially available AAC (economically feasible for development in the near future) in Russia East is so supported, the deciduous resource contributes the major share of potentially available AAC in Russia West, where it accounts for almost 60 percent. Very little potential AAC is to be found outside of Russia, the largest part of which is located in Kazakhstan, where coniferous forest supports three-quarters of its total. The balance is situated in the Transcaucasus region, in Georgia. The potential AAC in the Kazakhstan region amounts to one-quarter of the total AAC (including both current and potential components), while in the Transcaucasus region, it contributes 20 percent. In the Russia West region, the potential AAC accounts for one-eighth of the total, whereas potential AAC in Russia East accounts for almost half of the total.

With the exception of Russia East, the deciduous forest supports more than one-half of the currently accessible AAC, rising to nearly 100 percent in Central Asia and the Transcaucasus. It is only in Georgia that coniferous forest supports noticeable AAC, but accounts for only 25 percent of its total. In Russia East, dominated by coniferous forest, the deciduous resource supports only one-quarter of the AAC believed to be currently accessible.

When factoring in sources of roundwood (i.e., unprocessed [raw] wood in round form) other than that provided through utilization of the current and potentially accessible AAC, the total solid wood supply possibly available in the geographic area defined by the former Soviet Union (Table 5) amounts to more than 650 million cubic meters.[7] Not surprisingly, the currently accessible share contributed roughly 70 percent of the total, with virtually all of the potentially available wood supply located in Russia, primarily Russia East.[8]

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[6]The AAC, excluding reserve AAC, can be divided into two components. The first component is the quantity accessible with the current technology and infrastructure. The second is that which requires additions of either technology or infrastructure, both of which depend on capital investment. Backman (1994) provides a description of the two components as they apply to Russia. The AAC figures presented here include both that supported by the forest-sector resource and that which belongs to nonforest-sector agencies, including those dedicated for use by agricultural interests. Backman (1994) shows the contribution of the nonforest sector AAC to the maximum fiber supply possibly supportable by the forest resource in each of the economic regions of Russia.

[7]The reserve AAC under the former regime lay beyond the region thought to be accessible within the course of the following two decades through construction of major transportation networks. Under the present environment, the construction of transportation infrastructure supported by government investment may not be realistic even in the two-decade time frame originally envisaged. As such, this volume is not considered when developing an estimate of the physically accessible wood supply available in the short to medium term. Furthermore, as transportation arteries encroach upon the forest supporting this volume, emerging criteria placing higher value on nonindustrial utilization of the forest may preclude a significant part from actually being used by the wood-demanding forest products manufacturing sector. Consequently, when developing an estimate of the maximum available wood supply, it is only the potential and current AAC that are considered.

[8]The maximum available roundwood supply is based on current levels of AAC (forest sector and nonforest sector components) and contributions by harvest activities (intermediate harvest and other harvest) other than those connected with utilization of the AAC. As such, reassessment of the AAC taking place inside the republics of the former USSR will have an impact on the maximum levels of available roundwood sometime in the future.

Table 5. Maximum Accessible Annual Roundwood Supply (million cu.m, roundwood equivalent)

Region	Potential fiber supply			Current fiber supply			Grand total fiber supply		
	Total	Conif-erous	Decid-uous	Total	Conif-erous	Decid-uous	Total	Conif-erous	Decid-uous
Former USSR	201.0	130.5	70.4	460.3	255.4	204.9	661.3	385.9	275.3
Russia	200.0	129.8	70.1	417.6	235.7	181.9	617.6	365.5	252.0
Russia West	65.5	26.4	39.0	280.3	132.3	147.9	345.8	158.7	186.9
Russia East	134.5	103.4	31.1	137.4	103.4	33.9	271.9	206.8	65.0
Baltic	0.0	0.0	0.0	10.1	4.6	5.5	10.1	4.6	5.5
Southwest	0.0	0.0	0.0	27.5	13.4	14.2	27.5	13.4	14.2
Transcaucasus	0.2	0.1	0.2	1.4	0.1	1.2	1.6	0.2	1.4
Central Asia	0.0	0.0	0.0	0.3	0.1	0.2	0.4	0.1	0.2
Kazakhstan	0.7	0.6	0.1	3.4	1.4	1.9	4.1	2.1	2.0

Source: Derived from Goskomstat SSSR (1990a), Backman (1994, 1995a), FSLKhR (1995).

Although sources of roundwood other than that connected with the AAC contribute only a small share of the current roundwood supply in Russia West and Russia East, they account for between one-quarter and one-half of the fiber flow (utilized roundwood) possibly available from the currently accessible resource of the non-Russian regions. These fiber sources are particularly important in the timber-deficient regions of the Southwest, Transcaucasus, and Central Asia, where they contribute between one-half and three-fifths of the total. Other harvest [than AAC] in the Baltic republics and Kazakhstan contributes somewhat less, with only 35 percent and one-quarter of the currently accessible roundwood supplies, respectively, originating from other harvest. Little difference exists among the Baltic, Transcaucasian, and Southwestern republics. Within the Central Asian region, at least three-quarters of the possible harvest is accounted for by non-AAC sources in Tajikistan, Kyrgyzstan, and Turkmenistan. Since these republics contribute only a small share to current regional fiber flow, it is the contribution from Uzbekistan that dominates the total. In Russia West, 13 percent of the currently accessible fiber flow is supported by activities not directly linked to the AAC, whereas only 8 percent are so supported in Russia East.

Not all of the maximum flow of fiber currently and potentially available, however, has industrial utility at the present time. Although some 30 percent of the grand total fiber supply at the FSU level of aggregation has nonindustrial uses, the share varies among the different regions, depending on the contribution of deciduous forest to the regional totals and the region in which the forest is located (Table 6). Excluding the Central Asian region, the commercial share of coniferous forest does not fluctuate widely, although the share of deciduous forest ranges from a low of 20 percent in Kazakhstan to some 60 percent in Russia and in the Southwest region.[9] The absence of commercial wood in the Central Asian region underscores the degree to which the

[9]Since a much higher share of the coniferous resource has industrial significance, its contribution to the industrial possibly available wood supply is much higher than is apparent from the data in Table 5.

Table 6. Percentage Share of Maximum Accessible Roundwood Supply That Is Commercial

Region	Potential fiber supply			Current fiber supply			Grand total fiber supply		
	Total	Conif-erous	Decid-uous	Total	Conif-ferous	Decid-uous	Total	Conif-erous	Decid-uous
Former USSR	0.7	0.8	0.6	0.7	0.8	0.6	0.7	0.8	0.6
Russia	0.7	0.8	0.6	0.7	0.8	0.6	0.7	0.8	0.6
Russia West	0.7	0.8	0.6	0.7	0.8	0.6	0.7	0.8	0.6
Russia East	0.7	0.8	0.6	0.7	0.8	0.6	0.7	0.8	0.6
Baltic	n.a.	n.a.	n.a.	0.7	0.8	0.5	0.7	0.8	0.5
Southwest	n.a.	n.a.	n.a.	0.7	0.8	0.6	0.7	0.8	0.6
Transcaucasus	0.5	0.7	0.4	0.5	0.7	0.4	0.5	0.7	0.4
Central Asia	n.a.	n.a.	n.a.	0.0	0.0	0.0	0.0	0.0	0.0
Kazakhstan	0.7	0.7	0.2	0.4	0.7	0.2	0.5	0.7	0.2

Sources: Derived from Goskomstat SSSR (1990a), Goskomles (1991), Backman (1994, 1995a), FSLKhR (1995).

republics of this region must rely on imported forest products to satisfy domestic demand.

Additions of capital and labor to the Russian forest could possibly increase maximum fiber flows, although such increases are difficult to quantify (Barr and Braden, 1988; A. Shvidenko, pers. comm., 1996). Further increments to maximum fiber flows in the non-Russian forests are not beyond the realm of possibility, for example, with rises on the order of one-third postulated for Ukraine (Poliakov, 1995). Increases in harvest potential can be significant in the European republics, whereas potential increases from Russian forests appear to be more modest (Nilsson et al., 1992). However, these increases cannot be expected to occur immediately, and in fact may require periods of up to four decades before full realization. Thus, this time lag must be factored into decisions regarding allocation of human and financial capital for the purpose of satisfying rising domestic demand or creating future export opportunities for users of the forest resource.

FOREST-RESOURCE UTILIZATION, ROUNDWOOD TRADE, AND RAW-MATERIAL SUPPLY

The wood raw-material supply supporting activity in the forest sector consists, first and foremost, of domestically produced commercial roundwood,[10] traded (imported) wood, and secondary wood fiber (wood chips). In addition to wood fiber, paper and paperboard manufacture is supported (through the intermediate product of wood pulp) by traded wood pulp and the use of post-consumer paper and paperboard (i.e., waste paper). Secondary wood material has not contributed a large share to the available wood

[10]The volume of harvested roundwood includes both a commercial and a firewood component. Firewood is available for use within the regions, but has been assumed not to have industrial utility at the present time. Therefore, the firewood component has not been included in the discussion of the roundwood harvest in this paper. Changing technology underlying both the harvesting and manufacturing processes, as well as rising prices in general for wood fiber, however, in the future could shift a portion of the total harvested wood now considered as firewood into the category having industrial significance and thereby commercial utility.

Table 7. Maximum Commercial Fiber Supply Versus Actual Harvest (million cu.m, roundwood equivalent)

Region	Maximum fiber supply	Maximum potential fiber supply	Maximum current fiber supply	Delivered harvest		
				1989	1992	1993
Former USSR	454.2	139.8	314.4	311.1	211.1	159.8
Russia	425.2	139.3	286.0	286.3	192.2	140.8
Russia West	231.5	43.3	188.2	195.5	134.0	100.1
Russia East	193.8	96.0	97.8	90.7	58.1	40.8
Baltic	6.7	0.0	6.7	6.5	4.8	6.0
Southwest	19.6	0.0	19.6	16.1	12.7	11.9
Transcaucasus	0.8	0.1	0.6	0.3	0.3	0.2
Central Asia	0.0	0.0	0.0	0.0	0.0	0.0
Kazakhstan	2.0	0.5	1.5	1.9	1.1	0.9

Sources: Derived from Goskomstat SSSR (1990a), Goskomles (1991), VNIPIEIlesprom (1991), Andousypine (1994), Backman (1994, 1995a), FAO (1994), Goskomstat Rossii (1994a, 1994b), Kairiukstus (1994), Kuzmenkov (1994), SNG Stat (1994b), and Poliakov (1995).

fiber supply, varying between 11 percent in the Central Asian region to 30 percent in the Transcaucasus. The average for the FSU, dominated by behavior in Russia, amounts to 20 percent. Waste paper and traded pulp likewise have not played a major role in the overall fiber balance, accounting for ca. 19 percent and up to 9 percent, respectively, of the overall fiber supply (wood fiber plus waste paper plus traded pulp). It is thus the domestic commercial harvest, discussed first in conjunction with the trading of roundwood, that has most influenced the fiber balance within the former USSR.

The forest resource in the non-Russian regions was for the most part almost completely utilized internally until the demise of the USSR.[11] It was only in Russia, primarily Russia East, that substantial reserves of wood fiber could be found, although most of these reserves were found in the category of the potentially accessible fiber supply. Although the deciduous resource was heavily used, it was not utilized nearly as intensively as the coniferous forest, which appears to have been overcut relative to the ability of the resource to support harvest in some cases (Backman, 1995b). Among the non-Russian regions, both the coniferous and deciduous fiber supplies were nearly completely utilized.

Since the collapse of the USSR, harvest levels have fallen, although the decline has been more precipitous in the deciduous resource.[12] Furthermore, the decline in harvest

[11]The harvest data presented in Table 7 represent the delivered commercial harvest (*vyvozka delovoy drevesiny*), routinely presented by the former USSR and post-Soviet statistical organizations. These figures have not been inflated to account for losses in the harvest that are believed to have taken place but are not reflected in the official statistical sources as identified in Backman (1995b, 1995c). Furthermore, average harvest data based on utilization of the AAC and intermediate and other sources of wood fiber for the period 1985 to 1989 inclusive show similar harvest numbers for 1989 as those presented in Table 7 for all regions except for the Transcaucasus and Kazakhstan. In the case of the Transcaucasus, commercial harvest is understated by some 300,000 cu.m, whereas it is overstated by some 600,000 cu.m for Kazakhstan.

[12]Although official data are not complete for Central Asia, the Transcaucasus, and Kazakhstan, by 1993 the deciduous harvest as a share of the industrial harvest had fallen from 36 percent to only 30 percent in Russia West and from 9 percent to 6 percent in Russia East. More pronounced declines are evident for the Baltic region (Latvia and Estonia only), which sustained a decline in deciduous harvest from 45 percent of the industrial harvest in 1989 to only 26 percent in 1993 (FAO, 1994; FSKLKhR, 1995).

has been more pronounced in the major exporting region of Russia East than in Russia West, because of the differences in the degree to which export markets supported domestic activity in the various regions. Additionally, more rapidly rising energy prices have increased the relative prices of delivered roundwood imported by the non-Russian regions relative to the cost of securing the same quantity of roundwood from domestic forests, particularly in the Southwest region. Thus, commercial harvest levels in Russia West and East fell by 49 and 55 percent, respectively, between 1989 and 1993, while that in the Southwest region fell by less than one-quarter. Within the Southwest region, harvest levels in Belarus' seemingly held up slightly better than those in Ukraine and Moldova. Harvest levels actually increased after 1992 in the Baltic region, as proximity to markets in the West allowed these countries to transform themselves from net importers to large net exporters between 1989 and 1993.[13] Levels of harvest in the Transcaucasus region declined by as much as one-half.[14] Kazakhstan's harvest also declined, although the fall is believed more modest, approaching that experienced by Russia West.

The non-Russian republics historically have relied on Russia to supplement domestic roundwood supplies, with imports accounting for between 20 percent and 80 percent of their delivered commercial roundwood (Table 8). Imported roundwood represented a substantial proportion of the commercial roundwood supply in Central Asia (100 percent) and the Transcaucasus (~ 80 percent), declining in the Southwest region to under 40 percent, but represented only one-fifth of the commercial roundwood supply in the Baltic region. The Southwest region was the largest market for roundwood within the non-Russian regions, representing the destination for more than one-half of the exported wood in 1989, with Ukraine dominating this regional market. Kazakhstan and Central Asia accounted for the next largest share, together contributing over 25 percent, with Uzbekistan and Kyrgyzstan accounting for four-fifths of the market in the Central Asian republics. The Baltic region, with Lithuania accounting for one-half, and Transcaucasus region, with Georgia contributing one-half, accounted for the remainder in 1989. Exports to the non-Russian republics in 1989 directly supported almost 7 percent of the commercial harvest in Russia, with another ~ 7 percent being supported by exports beyond the boundaries of the former USSR.

Within the Southwest region, imported roundwood accounted for nearly 50 percent of the delivered supply in Ukraine, but less than 10 percent in Belarus'. In Moldova, which accounted for a minuscule proportion of the region's imports, imported roundwood accounted for more than 90 percent of the delivered roundwood supply. In the Transcaucasus region, imported roundwood provided virtually all of the supply in Armenia and Azerbaijan, whereas in Georgia, which possessed a domestic harvesting sector of its own, imports accounted for two-thirds of delivered roundwood supply. The

[13]Although Estonia and Latvia were net importers of roundwood in 1989, they exported some 65 thousand cubic meters while importing almost 900 thousand cubic meters (Goskomstat, 1990b, p. 110). By 1992, these two republics were collectively exporting some one million cubic meters, while apparently eschewing imports. By 1993, exports of roundwood amounted to some 800 thousand cubic meters (FAO, 1994). In 1989, imports accounted for slightly more than 15 percent of the delivered commercial wood available for use, whereas in 1993 exports accounted for some 15 percent of domestic production of commercial roundwood. Although trade data are not presented for roundwood for Lithuania, it appears likely that Lithuania also transformed itself into a net exporter, as imports from Russia collapsed and higher domestic harvest levels apparently overcompensated for falling imports and lower output of domestically manufactured forest products.

[14]Forest-sector activity in the Georgian republic has not been available in recent years. Activity in this republic is based on data available for Azerbaijan and Armenia, with the Georgian values being calculated as a residual. Since Georgia accounts for a significant share of the Transcaucasus region's forest-sector activity, the data supporting the discussion for the region is not as reliable as that existing for the other regions.

Central Asian region relied almost completely on imported roundwood, although levels of imports varied among the constituent republics. Within the Baltic region, imported roundwood accounted for almost 30 percent of the delivered supply of Lithuania, while both Estonia and Latvia were less reliant. Net roundwood exports from Russia West represented less than 10 percent of its commercial harvest, while net exports from the Russia East region accounted for more than one-fifth of total output of commercial roundwood (the figures include exports to both the Near and Far Abroad).

Since 1989, however, traded roundwood volume has declined markedly, in part because of sharply higher costs for transportation. Exports to the Southwest, Kazakhstan, and Central Asia fell by roughly 80 percent, whereas those to the Transcaucasus apparently plummeted to nearly zero. By 1993, cumulative exports to the former republics of the Soviet Union had fallen by some 85 percent, representing less than 2 percent of Russian output of commercial roundwood. Exports to the Far Abroad had declined as well, but still accounted for 8 percent of the Russian harvest. In the Southwest region, which had absorbed the largest share of roundwood exported from Russia, imported roundwood fell to less than 9 percent of the delivered roundwood supply, this regional behavior being influenced almost entirely by developments in Ukraine. Belarus' contrarily, became a net exporter of wood fiber, although imports fell by two-thirds in Moldova. The Baltic region became a net exporter, with all republics believed to have participated in the export activity. Whereas Russia West continued to operate as a net exporter, the share of harvest directly supported by the export industry declined to only 5 percent, while in Russia East, the share exported climbed to nearly 25 percent, on falling volume. For those regions that supported a significant domestic harvest sector, imports as a share of the delivered commercial roundwood supply available for distribution fell at a faster rate, as domestic harvest began to be substituted for higher-priced imported fiber.

Domestic roundwood supply in several of the non-Russian republics has been supplemented not only by traded wood fiber, but also through the utilization of secondary wood waste (e.g., wood chips) produced in the process of manufacturing solid wood products. In the Southwest region, byproduct wood-chip material has contributed one-quarter of the wood material consumed by the forest sector, and accounts for one-fifth of the wood fiber supply in the Baltic region. Wood chips contributed slightly less in the Central Asian republics, with the lowest contribution being found in the Transcaucasus. Secondary wood chips contributed one-fifth of the wood supply available for use by the domestic forest sector in each of the two regions of Russia, providing an indication of the degree to which consumption of secondary wood fiber has liberated unprocessed roundwood for export to the Near and Far Abroad.

By 1993, the physical supply of wood chips had declined, as lumber output in each of the regions fell, underscoring the degree to which the fiber balance previously had depended on output of solid wood manufactured products, including lumber. Except for the Transcaucasus and the Kazakhstan regions, secondary wood material decreased in importance as a purveyor of wood fiber, although the decline in the Southwest region was minor. In Ukraine, the share contributed by chip material actually rose, as the domestic lumber industry was able to continue operating using domestic roundwood sources.[15]

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[15]Although the lumber industry continued to operate, the plywood sector collapsed, having depended to a large extent on roundwood imported from Russia. This underscores the risk associated with building a manufacturing sector dependent upon an imported raw material source (Polaikov, 1995).

Table 8. Fiber Supply Balance for Various Years (in mill. cu.m, roundwood equivalent)

Region	Year	Domestic output output of comm. roundwood	Traded commercial roundwood	Secondary wood fiber	Total delivered comm. wood fiber[b]	Domestic production, wood pulp	Traded pulp	Waste paper	Total fiber for paper/paperboard manufacturing	Total delivered comm. fiber
Former USSR	1989	311.1	-19.0	72.9	365.0	54.1	-4.0	10.6	60.7	371.6
	1992	211.1	-11.8	39.4	238.7	35.2	-5.3	6.5	36.4	239.9
	1993	159.8	-13.4	30.8	177.2	26.6	-4.1	4.8	27.3	177.9
Russia	1989	286.3	-38.5	59.6	307.4	51.4	-7.9	5.9	49.3	305.3
	1992	192.2	-17.1	30.6	205.6	33.6	-7.6	3.3	29.4	201.4
	1993	140.8	-14.2	24.0	150.6	25.7	-5.5	3.0	23.3	148.1
Russia West	1989	195.5	-18.6	43.5	220.5	37.6	0.0	5.5	43.1	226.0
	1992	134.0	-5.5	21.3	149.8	23.9	-1.8	3.1	25.3	151.2
	1993	100.1	-4.6	18.2	113.6	19.1	-0.8	2.8	21.1	115.7
Russia East	1989	90.7	-20.0	16.1	86.9	13.8	-7.9	0.4	6.2	79.4
	1992	58.1	-11.6	9.3	55.9	9.7	-5.8	0.2	4.1	50.2
	1993	40.8	-9.6	5.8	37.0	6.7	-4.5	0.2	2.3	32.6
Baltic	1989	6.5	1.6	2.0	10.1	1.3	0.9	0.4	2.7	11.4
	1992	4.8	-1.1	1.5	5.2	0.6	0.1	0.2	0.9	5.5
	1993	6.0	-1.8[a]	1.0	5.2	0.3	0.1	0.1	0.4	5.4
Southwest	1989	16.1	11.5	9.7	37.3	1.0	2.7	3.2	6.9	43.2
	1992	12.7	3.3	6.5	22.5	0.7	2.0	2.6	5.3	27.0
	1993	11.9	1.6	5.2	18.7	0.5	1.3	1.4	3.2	21.4
Transcaucasus	1989	0.3	1.2	0.2	1.8	0.1	0.0	0.4	0.5	2.1
	1992	0.3	0.2	0.1	0.6	0.1	0.0	0.1	0.2	0.7
	1993	0.2	0.0	0.1	0.3	0.1	0.0	0.0	0.1	0.3
Central Asia	1989	0.0	2.7	0.5	3.2	0.0	0.2	0.4	0.6	3.8
	1992	0.0	1.2	0.1	1.4	0.0	0.1	0.2	0.4	1.7
	1993	0.0	0.5	0.1	0.6	0.0	0.1	0.1	0.2	0.7
Kazakhstan	1989	1.9	2.4	0.9	5.2	0.3	0.1	0.4	0.8	5.7
	1992	1.1	1.7	0.6	3.4	0.2	0.1	0.2	0.4	3.6
	1993	0.9	0.5	0.4	1.7	0.1	0.0	0.1	0.2	1.9

[a]Exported roundwood volume in 1993 for the Baltic region includes that estimated for Lithuania.

[b]Domestically produced wood pulp fiber is included in the wood fiber supply.

Sources: Derived from Goskomstat SSSR (1990a), Goskomles (1991), VNIPIEIlesprom (1991), Andousypine (1994), Backman (1994, 1995a), Goskomstat Rossii (1994a, 1994b), Kairiukstus (1994), Kuzmenkov (1994), SNG Stat (1994a, 1994b), FSLKhR (1995), Poliakov (1995).

In the Transcaucasus, secondary wood fiber's contribution to the fiber balance rose from less than 15 percent to almost 30 percent, even though imports of roundwood had collapsed. The share contributed by wood chips in the Central Asian republics declined marginally, with only Tajikistan showing an increased contribution by secondary fiber during this time period. The share of secondary fiber in Kazakhstan rose moderately, but fell in the Baltic region.

Domestic consumption[16] of wood fiber fell sharply between 1989 and 1993, although the decline was more severe in those regions that had relied to large extent on imported roundwood, primarily from Russia. Although the drop in consumption (see the column for "Total delivered commercial fiber," Table 8) amounted to some 50 percent in Russia West and the Southwest region, steep decreases also occurred in the Transcaucasus and Central Asian regions, where the declines exceeded 80 percent. Trends in the individual Central Asian republics were similar, but within the Southwest region, consumption fell much more steeply in Ukraine (declining by 60 percent) than in Belarus' (40 percent), since the latter republic did not rely on imported fiber for a large share of its wood supply. The trend in Moldova is thought to resemble that of Ukraine. The relative decline in wood fiber consumption in Kazakhstan (66.6 percent from 1989 to 1993) exceeded that in Ukraine, although only marginally. Consumption in the Baltic republics apparently declined by one-half compared to 1989; however, the decrease in Russia East was slightly greater, reaching ~ 60 percent.

The bulk of solid wood consumed in FSU has gone into lumber production—accounting for one-half of the total available for domestic consumption. The corresponding shares are slightly lower in the Baltic region and slightly higher in the Kazakhstan and the Transcaucasus. The output of panel products accounted for the next largest share in the Baltic region, approaching one-quarter of the overall supply, but no panel output was reported from the Central Asian region. In the Southwest region, almost 15 percent of the fiber was consumed in panel production, whereas in the remaining regions panels accounted for minor shares. Pulp production also is a major consumer of fiber in the two Russian regions, consuming nearly one-fifth of the available supply in 1993, but significantly less elsewhere in the former Soviet Union. In general, the shares have not fluctuated noticeably between 1989 and 1993, although the changes are more apparent in the Transcaucasus and Central Asia, which to a large degree had relied on imported roundwood to support domestic processing.

The small shares allocated to the output of domestic pulp in the non-Russian regions provide an indication of the degree to which domestic production and consumption of paper and paperboard relied on imports either of the finished product or of the pulp semiproduct, as well as the consumption of waste paper. Imported pulp has not played a major role in the supply of raw material for the forest sector in Russia, and in fact, Russia has been a net exporter of pulp to the Near and Far Abroad.

Traded pulp (Table 8) accounted for roughly one-third of the fiber supply consumed in the production of paper and paperboard in the Baltics and Southwest regions. Waste paper, on the other hand, played an important role in the Southwest and Kazakhstan regions, where it contributed one-half of the raw material supply for paper and paperboard production and nearly two-thirds in the Transcaucasus and Central Asia. In 1989,

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[16]Domestic consumption for each of the regions is identified in Table 8 under the column identified as "total delivered commercial fiber." This column is the sum of the columns for "total delivered comm. wood fiber," "traded pulp," and "waste paper."

waste paper contributed only 6 percent of the raw material consumed by the paper and paperboard sector in Russia East and 13 percent in Russia West. Domestically manufactured pulp dominated the fiber supply in Russia, where it contributed some 90 percent of the supply. In the Baltic republics and Kazakhstan, domestically produced pulp contributed nearly or greater than one-half of the supply, whereas in the Southwest, Central Asia, and Transcaucasus, domestic pulp production provided only a marginal contribution.

As in the case of the total wood fiber supply, the supply of wood-based raw material for the paper and paperboard manufacturing industry declined between 1989 and 1993, with the least significant declines occurring in the Southwest and Russia West regions, which supported a large domestic demand. Sharper declines took place in the Baltic region, the Transcaucasus, and Kazakhstan, whereas the fall in Russia East and the Central Asian region amounted to roughly two-thirds. The decline in the Baltic region was driven by collapsing pulp imports and a growing export market for roundwood; in the other regions, the declines reflect reductions in imported fiber, traded pulp, and waste-paper consumption.

FOREST SECTOR ACTIVITY BY REGION

The fiber supply, which in 1989 amounted to 371 million cubic meters (Table 8), provided the raw material for an active forest manufacturing sector in the FSU, which encompassed the production of 100 million cu. m of lumber, 15 million cu. m of panel products, and almost 11 million tons of pulp. Pulp, together with recycled waste paper, supported the production of 10 million tons of paper and paperboard. By 1993, collective output in the FSU had fallen steeply, with lumber, pulp, and paper and paperboard falling by one-half, while production of panel products fell by one-third, reflecting a 50 percent decline in fiber availability.

As is evident from Table 9, Russia dominated the activity in the forest sector of the former USSR to varying degrees, with the largest share of production taking place in Russia West. However, Russia, while accounting for four-fifths of the lumber output and nearly 100 percent of the pulp and paper product production, accounted for less than three-quarters of the panel production. Russia East accounted for one-third of the Russian total lumber production, but less than 15 percent of the paper and paperboard and panel output (a significantly higher share of the pulp production was located in Russia East, accounting for one-quarter of the Russian total). By 1993, lumber output in Russia West had declined by nearly 50 percent, whereas that in Russia East had fallen more steeply, by nearly three-fifths. Although pulp production had fallen by one-half in each of the two Russian regions, paper and paperboard production fell less steeply in Russia West, where the decline amounted to only 45 percent of the 1989 level; in Russia East, the decline amounted to almost two-thirds. The output of panel products fell the least, with the decline in Russia West amounting to slightly more than one-quarter and 45 percent in Russia East.

The Southwest region accounted for most of the forest products output taking place outside of Russia, contributing over 12 percent to total USSR production of lumber, almost one-fifth of the panel output, and roughly 12 percent of the paper and paperboard output. Ukraine dominated the lumber output of the Southwest region, contributing two-thirds of the total in 1989, although by 1993, its share had declined. Output fell more quickly in Ukraine and Moldova than in Belarus', where lumber production fell by

Table 9. Production Levels of Selected Forest Products

Region	Lumber (million cu. m)			Panel products (million cu. m)			Pulp (million metric tons)			Paper and paperboard (million metric tons)		
	1989	1992	1993	1989	1992	1993	1989	1992	1993	1989	1992	1993
Former USSR	100.1	65.0	49.5	14.6	11.5	9.9	10.7	7.0	5.3	10.7	7.0	5.3
Russia	81.9	53.4	40.9	10.5	8.5	7.3	10.2	6.7	5.1	8.5	5.8	4.5
Russia West	57.1	38.0	30.9	9.0	7.2	6.5	7.4	4.7	3.8	7.4	5.0	4.1
Russia East	24.8	15.3	9.9	1.5	1.2	0.8	2.7	1.9	1.3	1.1	0.8	0.4
Baltic	2.4	1.8	1.1	1.1	0.6	0.5	0.3	0.1	0.1	0.5	0.2	0.1
Southwest	12.0	8.0	6.4	2.7	2.2	1.9	0.2	0.1	0.1	1.3	0.9	0.6
Transcaucasus	0.8	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0
Central Asia	1.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Kazakhstan	2.0	1.3	0.9	0.2	0.2	0.1	0.1	0.0	0.0	0.2	0.0	0.0

Sources: Derived from VNIPIEIlesprom (1991), FAO (1994), Goskomstat Rossii (1994a, 1994b), SNG Stat (1994b), LDS (1995).

just one-third, panel production by 40 percent, paper and paperboard output (amounting to more than one million tons in 1989) by almost 50 percent. The decline in panel output was lower in Belarus' than in Ukraine, although the region's behavior was more influenced by developments in Ukraine. Paper and paperboard output in Ukraine, accounting for three-quarters of the region's output, fell by 50 percent, while that in Belarus' fell marginally faster. No paper and paperboard output was recorded in Moldova.

The Baltic republics each supported a sawmilling sector, which collectively accounted for 2.4 million cubic meters of production in 1989. By 1993, however, output had declined by more than 50 percent, as domestic demand collapsed (although export opportunities had begun to emerge). The panel sector accounted for more than one million cubic meters of output in 1989, but fell by more than one-half by 1993. The pulp sector in the Baltic republics produced some three hundred thousand tons in 1989, a large share of the supply required for the paper sector. By 1993, even though pulp output had declined by one-third, sufficient pulp and waste paper resources existed domestically to meet the demand of the domestic paper and paperboard sector, thus obviating the need to import pulp. The output of paper and paperboard, amounting to one-half million tons in 1989, fell by some 80 percent by 1993. While each of the three republics supported an active panel sector, Lithuania dominated the production of paper and paperboard and accounted for the largest share of the decline in output occurring in the region between 1989 and 1993.

In 1989, the Central Asian republics produced nearly one million cubic meters of lumber, almost entirely from imported roundwood, although this had fallen to ~200,000 cu. m by 1993 (Table 9). Virtually no panel products and pulp are produced domestically, whereas paper and paperboard output, which depended on use of waste paper supplemented by the importation of limited quantities of pulp, was insignificant as well.

Although Georgia has been the dominant producer of lumber in the Transcaucasus, both Azerbaijan and Armenia have satisfied at least some of their domestic consumption from local resources as well. Small volumes of panel products are produced, although pulp

production does not occur; this underscores the degree to which domestic paper and paperboard output relies on both waste paper and imported pulp to meet raw material needs.

In Kazakhstan, lumber output amounted to some two million cubic meters in 1989, but declined by more than 50 percent by 1993 in conjunction with the downturn in overall economic activity. Panel output, amounting to 200 thousand cubic meters in 1989, also fell by one-half between 1989 and 1993. Although Kazakhstan did produce some pulp, waste paper and imported wood fiber were necessary to meet the demands of the local paper and paperboard industry.

Despite a certain level of diversification in forest-sector activity in each of the regions, the non-Russian forest sector still had to import significant quantities of forest products, primarily from Russia, to meet domestic demand. Russian exports to the Near Abroad, in addition to those to the Far Abroad, accounted for a significant share of Russian production, approaching 20 percent in 1989. Lumber exports to the other republics, supporting more than 10 percent of Russian production, amounted to nearly 9 million cubic meters of lumber at the end of the 1980s. The Southwest region, receiving almost one-half of this amount, together with the Central Asian republics, received almost 90 percent of Russia's lumber exports within the former USSR. Uzbekistan and Tajikistan imported almost four-fifths of the Central Asian total, whereas Ukraine was the dominant destination for imports into the Southwest region. Although lumber exports to the Near Abroad by 1993 had plummeted to one-fifth of their 1989 levels, trade in lumber to both the Near and Far Abroad still supported nearly 15 percent of Russian output in 1993. The Baltic region by that time had become a net exporter. Over the same period, lumber exports to the Transcaucasus had fallen by more than 90 percent, and exports to Central Asia by roughly three-quarters.

Lumber imports from Russia into Central Asia represented almost three-quarters of Central Asian consumption in 1989, and rose to more than four-fifths in 1993, as the supply of domestically produced commercial roundwood used as raw material in Central Asia collapsed (Table 10). Although imports of lumber accounted for a small share in the Baltic region, becoming insignificant by 1993 as the region became a net exporter, lumber imported into the Southwest region (primarily imports into Ukraine) and Kazakhstan represented more than one-quarter of the total consumed in those regions in 1989. By 1993, the contribution of domestic lumber production to domestic consumption continued to hold up in Kazakhstan, although it fell in the Southwest region to only 10 percent of domestic consumption. Within the Southwest region, Belarus' became a net exporter, while Ukraine continued to be an importer, but to a lower degree than previously.

The Russian Federation exported almost one-quarter of its output of panel products in 1989; slightly less than one-half of this—or some one million cubic meters—was destined for the non-Russian regions of the former USSR. Export markets for panel products continued to support almost 20 percent of domestic production in Russia by 1993, and markets in the Near Abroad continued to absorb nearly one-half of the volume, unlike in the case of lumber. The Central Asian region, primarily Uzbekistan, received some 40 percent of Russian exports to the Near Abroad countries and, together with Kazakhstan, supported almost three-fifths of the Russian exports to the non-Russian republics. The balance was divided between the Transcaucasus region (primarily Georgia), and the Southwest region (primarily Ukraine). The Baltic region imported an insignificant amount of panel products in 1989 before turning into a net exporter by 1992.

Table 10. Imports/Exports as a Share of Regional Consumption or Production, Selected Forest Products[a]

Region	Lumber			Panel products			Paper and paperboard		
	1989	1992	1993	1989	1992	1993	1989	1992	1993
Former USSR	-0.09	-0.05	-0.10	-0.09	-0.04	-0.09	-0.02	-0.01	-0.06
Russia	-0.23	-0.14	-0.16	-0.23	-0.15	-0.18	-0.19	-0.21	-0.19
Russia West	-0.18	-0.02	-0.02	-0.21	-0.12	-0.18	-0.21	-0.24	-0.26
Russia East	-0.32	-0.42	-0.57	-0.36	-0.32	-0.12	-0.12	-0.15	-0.01
Baltic	0.13	-0.05	-0.41	0.01	-0.17	-0.44	0.21	0.35	0.38
Southwest	0.27	0.18	0.09	0.10	0.10	0.06	0.41	0.49	0.39
Transcaucasus	0.60	0.61	0.66	0.71	0.55	0.51	0.79	0.82	0.90
Central Asia	0.72	0.77	0.81	0.96	0.96	0.96	0.64	0.70	0.49
Kazakhstan	0.24	0.41	0.28	0.47	0.54	0.41	0.49	0.75	0.55

[a]Minus sign = share of domestic production exported; plus sign = share of domestic consumption supported by imports.
Sources: Derived from VNIPIEIlesprom (1991), Goskomstat Rossii (1994a, 1994b), SNG Stat (1994b).

Although imported panel products contributed to less than 10 percent of the domestic consumption in the Southwest region, and a negligible share in the Baltics, they accounted for between one-half and nearly 100 percent of the consumption in the Transcaucasus, Central Asia, and Kazakhstan (Table 10). Volumes imported by these regions declined at a faster rate than domestic production, leading to a decreasing share of domestic consumption accounted for by imports. In the Baltic region, export markets emerged as a significant supporter of domestic production, amounting to nearly 50 percent in 1993, significantly more than in Russia, though, of course, the volumes involved were much less.

One-fifth of Russian paper and paperboard production, almost two million tons in all, was exported in 1989. Nearly three-quarters of that amount was destined for the non-Russian republics, one-half of which was consumed in the Southwest region (primarily in Ukraine). The balance was distributed nearly equally among the remaining regions. Within the Central Asian region, Uzbekistan continued to be a major consumer of imported paper and paperboard, accounting for one-half of the regional imports, with the balance more or less distributed equally among the remaining three republics.

By 1993, the total volume of paper and paperboard exports from Russia declined by nearly 50 percent, with most of the decline occurring in exports to the Near Abroad. Exports still supported 20 percent of domestic output in Russia, underscoring the degree to which activity in the forest sector of Russia today relies on export markets for its economic well-being. With the exception of Azerbaijan, exports to the Transcaucasus disintegrated, whereas those to Central Asia and Kazakhstan fell by 20 and 25 percent, respectively.[17] Although the volume of imports by the Baltic republics declined by two-thirds, imports to the Southwest region declined by only 55 percent.

[17]In 1993, Azerbaijan imported 120 thousand tons of paper from Ukraine, with only small amounts being imported directly from Russia (SNG Stat, 1994a).

Imported paper and paperboard accounted for between 40 and 80 percent of domestic consumption in all non-Russian regions except for the Baltics in 1989. These levels of dependence persisted in 1993, when even the Baltic republics had become increasingly reliant upon imported paper products to meet domestic demand.

Between 1989 and 1993, consumption of forest products in the FSU republics has fallen sharply, although the bulk of the decline has been absorbed by contracting trading activity. Consumption of lumber fell most steeply, with 1993 levels as a percentage of 1989 ranging from a low of 8 percent in the Transcaucasus to 65 percent in Russia West (Table 11). Panel consumption fell less dramatically, while consumption of paper and paperboard products declined at similar rates as those for lumber, except in the Transcaucasus region.

Consumption activity within the Southwest region varied, with declines in Belarus' being generally less severe than those experienced in Ukraine. While behavior in the Central Asian region was driven by events in Uzbekistan, sharper drops occurred in Kyrgyzstan and Tajikistan, with a more moderate decline in Turkmenistan. Within the Transcaucasus region, consumption in Azerbaijan appeared to hold up better than that in Georgia or Armenia. Within the Baltic region, Estonia sustained the lowest drop in consumption. In general, the greatest declines in consumption have been experienced in those regions that relied to the greatest degree on imported products to meet their historical levels of demand, underscoring the extent to which transportation tariffs can play a role in determining the economic range (delivery area) of forest products.

Although the general consumption levels for forest products have fallen throughout the former USSR, per capita consumption levels have varied widely among the regions (Table 12). Consumption levels generally have been highest in the Russian Federation and Baltic republics, followed closely by the republics of the Southwest region. Consumption levels generally have lagged in the Central Asian and Transcaucasus regions, whereas consumption in Kazakhstan generally was moderately higher, except with respect to the per capita consumption of paper and paperboard.[18] Within the Southwest region, per capita consumption was significantly greater in Belarus', while lagging in Moldova behind levels in the other two republics. Although per capita consumption in the Transcaucasus in 1989 was highest in Georgia, differences among the three republics had narrowed by 1993. Within the Baltic region, Estonia supported the highest per capita consumption.

PROSPECTS FOR FUTURE ACTIVITY

Although economic activity and consumption and trade of forest products have fallen steeply since 1989, the outlook for the future is based on a different set of assumptions connecting producer with consumer and republic with republic. The future activity and prospects in the forest sector, as well as opportunities for trade among the former Soviet republics, although linked to the past through the existing human, financial, and physical capital stock left over from the previous regime (and the cumulative experience of the peoples of the former Soviet Union), are expected to reflect a more

[18]The different consumption levels provide some hint of preferences existing in the different regions, driven by differences in culture, climate, and history. Although not providing an indication of what future consumption levels might be, the consumption levels in 1993 provide a starting point from which a picture of future prospects can be developed for the forest sectors belonging to the republics of the former USSR.

Table 11. Consumption of Selected Forest Products (1989 = 1.00)

Region	Lumber			Panel products			Paper and paperboard		
	1989	1992	1993	1989	1992	1993	1989	1992	1993
Former USSR	1.00	0.68	0.49	1.00	0.83	0.68	1.00	0.66	0.48
Russia	1.00	0.73	0.54	1.00	0.89	0.74	1.00	0.66	0.53
Russia West	1.00	0.80	0.65	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Russia East	1.00	0.53	0.25	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Baltic	1.00	0.63	0.24	1.00	0.42	0.25	1.00	0.42	0.21
Southwest	1.00	0.60	0.43	1.00	0.84	0.69	1.00	0.80	0.46
Transcaucasus	1.00	0.23	0.08	1.00	0.48	0.39	1.00	0.49[a]	0.38
Central Asia	1.00	0.37	0.24	1.00	0.95	0.85	1.00	0.62	0.27
Kazakhstan	1.00	0.85	0.47	1.00	0.94	0.64	1.00	0.45	0.26

[a]Consumption of paper and paperboard in the Transcaucasus for 1992 is based on estimated trade activity and may be overstated.
Sources: Derived from VNIPIEIlesprom (1991), FAO (1994), Goskomstat Rossii (1994a, 1994b), SNG Stat (1994b), LDS (1995).

Table 12. Per Capita Consumption of Selected Forest Products

Region	Lumber (cu. m)			Panel products (cu. m)			Paper and paperboard (metric tons)		
	1989	1992	1993	1989	1992	1993	1989	1992	1993
Former USSR	0.315	0.214	0.154	0.046	0.038	0.031	0.036	0.024	0.017
Russia	0.429	0.312	0.233	0.055	0.048	0.040	0.045	0.029	0.024
Russia West	0.356	0.284	0.231	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Russia East	0.983	0.519	0.249	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Baltic	0.341	0.214	0.081	0.146	0.060	0.037	0.080	0.033	0.017
Southwest	0.246	0.147	0.105	0.045	0.038	0.031	0.034	0.027	0.016
Transcaucasus	0.122	0.028	0.009	0.019	0.009	0.007	0.026	0.013	0.010
Central Asia	0.110	0.041	0.027	0.013	0.013	0.011	0.007	0.005	0.002
Kazakhstan	0.158	0.134	0.075	0.022	0.020	0.014	0.019	0.009	0.005

Sources: Derived from Goskomstat SSSR (1990b), VNIPIEIlesprom (1991), FAO (1994), Goskomstat Rossii (1994a, 1994b), SNG Stat (1994b), LDS (1995).

market-oriented environment in which prices play a role in resource allocation rather than serving simply as an indicator in monitoring the implementation of a central plan.

Analytical Framework

The future outlook for the forest sector in the seven regions of the former USSR employed in this study can be elaborated through a forest-sector developmental model that provides insights into the ability of the various sectors in each region to match demand for forest products with supply. In this model, the quantity of wood fiber available for export, or the quantity necessary to meet projected levels of demand,

becomes the net trade of the region. Relative prices and costs of production of forest products in different regions are not explicitly considered.[19]

Within the model, the products considered include roundwood produced through the commercial harvest activity, and lumber, panels, pulp, and paper and paperboard generated through the manufacturing activity. The magnitude of roundwood output is constrained in the model by the availability of capital (see below) and the ability of the forest resource to support a harvest. The output of lumber is limited by the amount of capital and the availability of sawlog-quality roundwood generated by the harvesting process. Output of panel and pulp products, which can consume sawlog-grade roundwood, lower-grade roundwood, and byproduct wood waste material generated through the manufacture and consumption of lumber, is limited by the availability of fiber and installed capacity. The production level of paper and paperboard assumed in the model relies, first, on a raw-material supply consisting of pulp and waste paper, with an upward limit being set on the contribution that waste paper can make to the raw material supply supporting paper and paperboard production, and, second, on the available capital stock. Linkage among the ten time periods used in the model (see below) is through additions and deletions to capital stock and additions and deletions to the maximum currently available fiber supply. A maximum increase in the capital stock supporting the production of each product is exogenously determined, with the proportion of the maximum actually utilized depending upon the availability of fiber. The initial capital stock supporting production of the different forest products in Period 1 is based on levels existing in 1993.

Final demand for lumber, panels, and paper and paperboard is determined by linking growth in Gross Domestic Product (GDP) with growth in the demand for final products through elasticities of consumption with respect to GDP.[20] Domestic demand for the intermediate product of pulp and waste paper is determined by consumption of paper and paperboard. The demand for roundwood is linked to demand for lumber, panels, and paper and paperboard through the intermediate product of pulp, as well as a residual

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[19]The rapid changes that have taken place in the relative position of prices within the former USSR hinder the use of long-term price projections using relative prices and costs to determine activity within and between regions. However, although relative costs and prices have not been explicitly factored into a determination of future forest-sector activity, the economic accessibility of the forest resource within each of the regions has been acknowledged (Backman, 1995c). The processing of this resource into the various forest products is assumed to be economically viable, with delivery within the boundaries of regions defined here taking place profitably. The profitability of delivery from resource-endowed regions to resource-poor regions will depend on such factors as the level of tariffs on the Russian railway system, which reportedly recently have been lowered to encourage increased timber exports from forest enterprises located in remote areas (CBK, May 1995, p. 3).

[20]Projections of future economic activity are based on scenarios assuming average annual growth rates of 1.25, 2.5, 5, and 7.5 percent (see below), although increase in demand for individual forest products is not expected to rise at the same rate as economic activity. The lower two growth rates are linked to continued uncertainty over the future structure and course of the transition in Russia, with the ability to attract capital being diminished. The latter two growth rates are connected with increasing economic activity brought about by a more stable environment for economic activity. A modified high-growth scenario in which economic growth after 25 years decreases to 2.5 percent annually appears to be the most likely scenario. Ewing and Chalk (1985) linked future demand for a selection of forest products to changes in Gross Domestic Product (GDP) through elasticities of demand with respect to changes in GDP. For the mid-1980s, lumber varied between 0.02 and 1.14, depending on whether countries were developed or developing. The variation for panel products was 0.56 and 2.10, whereas that for paper and paperboard varied between 0.99 and 1.63. Following the second five-year period of the model, these demand elasticities have been employed to generate demand levels. For Periods 1 and 2, elasticities derivable for the period 1992-1993 for each of the republics has been used. On a regional basis, elasticities for lumber varied from 2.8 in the Transcaucasus region to a high of 3.5 in the Baltics. In Russia, the elasticity was 2.9. Elasticities for panel products varied from 0.8 in the Transcaucasus region to 2.2 in the Baltics. In Russia, the elasticity was 1.9. For paper and paperboard consumption, the elasticities varied from 0.9 in the Transcaucasus region to 5.3 in the Central Asian region, with that in Russia amounting to 2.2. These elasticities are generally higher than those presented in Ewing and Chalk (1985), which may reflect in part a legacy of raw-material intensity in the Soviet economy.

demand for wood fiber to account for the consumption in the chemical industry and use in the production of energy.

The maximum commercial fiber supply available in the base case is linked to information presented in a previous section of the paper ("Forest-Resource Utilization, Roundwood Trade, and Raw-Material Supply"), with an upper limit set for the share being economically accessible at the present time based on previous research (Backman, 1995b, 1995c). The quantity of waste paper available for consumption is based on that existing in 1989. Additional sources of wood fiber that can be drawn upon include a portion of the presently uneconomic current fiber source that might become available through a rise in real wood prices, commercial use of a portion of the fiber supply that presently is classified as firewood, partial use of the fiber resource tied up in the potentially accessible forest resource, and liberation of additional fiber as a result of better management of forest resources. In addition to other sources of wood fiber, an increasing share of post-consumer paper and paperboard can be recycled, with an exogenously determined upper limit on the share of consumed paper and paperboard. There is a maximum quantity of waste paper that can be consumed based on an exogenously determined upper limit on the share that waste paper contributes to the paper and paperboard raw-material supply.

Important Factors

Although prices and costs will play a role, future activity in the forest sector will be based on three major overriding factors. First, the extent to which domestic demand rebounds following the re-establishment of linkages among the various participants in the republic economies will provide the foundation upon which future consumption levels will rest. Although the magnitude of change in demand brought about by re-establishing the framework within which economic activity takes place is uncertain, some indication of the range within which future demand might fall can be developed by assuming low, middle, modified high, high, and very high scenarios for economic growth for a ten-period time horizon, with each period lasting five years (the scenarios are described in the section on Demand Projections, p. 40).[21] The most likely scenario is the one calling for modified high growth. Second, fiber availability to support domestic manufacturing and consumption (as well as the possible export of forest products) is crucial in order to provide the raw material upon which deeper processing and investment depends. Third, capital must be attracted to the forest sector to replenish the existing capital stock and add to manufacturing capacity to meet rebounding domestic demand and to seize export opportunities. Furthermore, capital also must be attracted to improve infrastructure development to facilitate the transfer of forest products from regions that are rich in resources to those that are resource poor. Without capital, rising demand can be met only through imports, often at prices significantly higher than those possible if the products were manufactured in Russia.

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[21] In line with falling economic activity, demand in each of the regions declined sharply between 1989 and 1993, with most of the decline being absorbed through falling imports rather than decreasing domestic output. The declines in economic activity between 1992 and 1993 continued into 1994, thus requiring some assumptions regarding the extent to which the level of current economic activity is representative of the annual average for Period One (1994-1998 inclusive). It is only in the second period that positive growth on a 1993 base is expected to take place. Accordingly, the Period One decline in economic activity is expected to vary from zero percent for the Baltic region to a negative 4 percent for the Central Asian, Transcaucasus, and Southwest regions relative to 1993. In Russia, the decline is projected to be 2 percent.

Table 13. Fiber Demand in 1989 and Average Annual Demand for Ten Periods for Five GDP Growth Assumptions (mill. cu. m, roundwood equivalent)[a]

Region/ assumption	1989	P(1) 1994-1998	P(2) 1999-2003	P(3) 2004-2008	P(4) 2008-2013	P(5) 2014-2018	P(6) 2019-2023	P(7) 2024-2028	P(8) 2029-2033	P(9) 2034-2038	P(10) 2039-2044
Baltic region											
Very high	11.7	3.0	5.1	9.5	14.5	20.5	27.2	36.1	47.7	62.2	82.7
High	11.7	3.0	4.2	6.5	9.1	12.4	15.9	19.9	24.5	29.8	35.7
Modified high	11.7	3.0	4.2	6.5	9.1	12.4	15.0	16.7	18.6	20.6	22.8
Medium	11.7	3.0	3.5	4.4	5.2	6.2	7.3	8.4	9.8	11.3	13.0
Low	11.7	3.0	3.2	3.6	4.0	4.3	4.7	5.1	5.6	6.0	6.5
Transcaucasus											
Very high	6.0	1.3	1.5	2.6	4.6	8.0	13.5	22.4	34.9	51.1	73.1
High	6.0	1.3	1.3	1.9	2.8	4.0	5.9	8.4	11.8	16.7	23.8
Modified high	6.0	1.3	1.3	1.9	2.8	4.0	5.3	6.4	7.7	9.1	10.9
Medium	6.0	1.3	1.1	1.4	1.7	2.0	2.4	3.0	3.6	4.4	5.3
Low	6.0	1.3	1.1	1.2	1.3	1.4	1.6	1.7	1.9	2.1	2.3
Southwest											
Very high	50.8	16.5	21.0	41.0	58.4	79.0	113.3	169.6	239.5	324.5	443.6
High	50.8	16.5	16.3	26.2	34.5	42.5	51.7	64.7	82.8	108.2	142.4
Modified high	50.8	16.5	16.3	26.2	34.5	42.5	48.8	54.3	60.9	68.5	77.5
Medium	50.8	16.5	12.9	16.6	19.5	23.0	26.4	29.7	33.6	37.4	41.1
Low	50.8	16.5	11.6	13.3	14.5	15.6	17.0	18.4	20.0	21.5	22.9
Central Asian											
Very high	9.0	2.2	2.4	4.1	7.1	11.3	17.4	26.2	39.1	60.2	97.0
High	9.0	2.2	2.2	3.1	4.5	6.5	8.9	11.8	15.8	20.8	27.1
Modified high	9.0	2.2	2.2	3.1	4.5	6.5	8.3	9.5	11.0	12.7	14.7
Medium	9.0	2.2	2.0	2.4	2.8	3.4	4.1	4.9	5.6	6.4	7.4
Low	9.0	2.2	1.9	2.1	2.3	2.5	2.7	3.0	3.3	3.6	4.0
Kazakhstan											
Very high	7.7	2.2	2.8	5.2	8.5	14.1	23.9	37.2	55.3	75.6	94.1
High	7.7	2.2	2.3	3.6	5.0	7.0	9.9	14.1	20.3	27.5	35.6
Modified high	7.7	2.2	2.3	3.6	5.0	7.0	8.9	10.7	12.8	15.4	18.5
Medium	7.7	2.2	1.9	2.4	2.9	3.4	4.0	4.8	5.7	6.8	8.2
Low	7.7	2.2	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.3	3.6
Russia West											
Very high	162.0	80.1	111.9	201.3	324.8	447.9	558.3	697.5	865.2	1099.6	1428.0
High	162.0	80.1	94.2	141.7	195.4	271.2	342.1	395.6	466.3	567.3	678.7
Modified high	162.0	80.1	94.2	141.7	195.4	271.2	328.1	354.9	381.0	411.0	446.8
Medium	162.0	80.1	80.1	99.2	116.5	137.2	161.8	191.3	226.5	264.2	294.4
Low	162.0	80.1	74.2	82.8	89.7	97.3	105.7	114.7	124.6	135.5	147.3
Russia East											
Very high	61.1	16.8	21.4	36.3	52.0	69.8	89.3	107.6	129.6	160.4	203.7
High	61.1	16.8	18.5	26.6	35.9	48.8	61.5	73.9	86.4	99.7	114.4
Modified high	61.1	16.8	18.5	26.6	35.9	48.8	50.7	64.1	70.3	77.6	83.9
Medium	61.1	16.8	16.2	19.5	22.7	26.4	30.7	36.9	41.9	40.5	54.2
Low	61.1	16.8	15.2	16.7	18.0	19.4	21.0	22.6	24.4	26.4	28.5

Table 13. Continued

Region/ assumption	1989	P(1) 1994-1998	P(2) 1999-2003	P(3) 2004-2008	P(4) 2008-2013	P(5) 2014-2018	P(6) 2019-2023	P(7) 2024-2028	P(8) 2029-2033	P(9) 2034-2038	P(10) 2039-2044
Russia											
Very high	223.1	96.9	133.3	237.6	376.8	517.7	647.6	805.0	994.9	1260.0	1631.7
High	223.1	96.9	112.8	168.4	231.3	320.0	403.6	469.5	552.7	667.0	793.2
Modified high	223.1	96.9	112.8	168.4	231.3	320.0	386.5	419.0	451.3	488.6	530.6
Medium	223.1	96.9	96.3	118.7	139.2	163.6	192.6	227.1	268.5	312.7	348.6
Low	223.1	96.9	89.4	99.5	107.8	116.8	126.6	137.3	149.0	161.8	175.8
European[b]											
Very high	68.5	20.7	27.6	53.2	77.5	107.6	153.9	228.1	322.2	437.8	599.4
High	68.5	20.7	21.8	34.6	46.4	58.9	73.5	93.0	119.1	154.6	201.9
Modified high	68.5	20.7	21.8	34.6	46.4	58.9	69.0	77.4	87.2	98.3	111.2
Medium	68.5	20.7	17.6	22.4	26.4	31.2	36.1	41.1	46.9	53.0	59.4
Low	68.5	20.7	15.9	18.1	19.7	21.4	23.2	25.2	27.4	29.6	31.7
Central Asia and Kazakhstan											
Very high	16.7	4.4	5.2	9.3	15.5	25.4	41.3	63.4	94.3	135.9	191.1
High	16.7	4.4	4.5	6.7	9.4	13.5	18.8	25.9	36.1	48.2	62.7
Modified high	16.7	4.4	4.5	6.7	9.4	13.5	17.2	20.2	23.8	28.1	33.3
Medium	16.7	4.4	3.9	4.8	5.7	6.8	8.2	9.6	11.3	13.2	15.6
Low	16.7	4.4	3.7	4.1	4.4	4.8	5.3	5.8	6.3	6.9	7.6

[a]P(1) = Period 1, etc. The very high-growth scenario assumes increase in GDP of 7.5 percent beginning in the second period. High-growth scenario assumes 5 percent, the medium-growth assumes 2.5 percent, and the low-growth assumes 1.25 percent. In the first period, increase (decrease) in GDP on 1993 levels has been assumed to be -2 percent in the Russian regions and -4 percent in all other regions, except for the Baltics. In the Baltics, GDP has been assumed not to increase on 1993 levels during the first period.

[b]The European region consists of the Baltic, Transcaucasus, and Southwest regions.

Demand Projections

After projecting a general decline in economic activity in the first five-year period that varies among the republics, the model projects demand based on very high-, high-, modified high-, medium-, and low-growth scenarios. As is evident in Table 13, future demand for forest products is quite dependent on the likely trends in economic activity embodied in these scenarios.[22]

[22]Demand projections for forest products are based on the association with changes in GDP through elasticities of demand. The elasticities have not been constant over time, and indeed have fallen in the case of the industrialized countries. Between 1955 and 1965, demand elasticity with respect to income was 0.4 for lumber, falling to 0.18 in the period 1965-1975, and then to 0.02 for the period 1975-1985. The corresponding figures for panel products are 1.79, 1.64, and 0.56 for these three time periods, respectively. Elasticities for paper and paperboard products have not exhibited the same declines, however, falling from 1.08 to 0.94 before rising slightly to 0.99 (Ewing and Chalk, 1985, pp. 62-66). Rising real prices for wood fiber can be expected to affect the elasticities, decreasing them and thus placing downward pressure on overall demand. The demand projections presented in Table 13, however, do not incorporate this type of feedback mechanism. Furthermore, new products appearing in response to rising prices can effectively change consumption patterns in the future, reducing the demand for fiber even if overall demand by the end users of forest products remains unchanged. Panel products, such as fiberboard and particleboard, made from lower-grade and waste wood material, can substitute for lumber in many uses. Ol'shanksiy et al. (1985, p. 48) claim that one cubic meter of particleboard, for example, requiring between 1.7 and 1.8 cu. m of wood fiber, can substitute for between 2 and 3 cu. m of lumber, requiring from 3 to 4 cu. m of roundwood. One thousand sq. m of fiberboard requiring 8 to 10 cu. m of wood fiber can similarly replace 14 to 16 cu. m of lumber produced from 21 to 24 cu. m of wood fiber.

A very high-growth scenario assumes that a successful transition has been completed and that the republics can sustain economic growth of 7.5 percent per year beginning in the second period. Consumption levels in 1989 are only re-attained in Periods 3 through 5, depending on the republic, with the encounter occurring earliest in Russia West and latest in the Central Asian republics. A high-growth scenario assumes a more modest 5 percent growth rate, with return to pre-USSR-disintegration consumption levels correspondingly postponed. The modified high-growth scenario assumes 5 percent growth for the first five periods, followed by a more modest increase of 2.5 percent for the last five periods, with the pre-break-up consumption levels correspondingly postponed.

A low-growth scenario assumes a growth rate of 1.25 percent beginning in the second period, with none of the regions reattaining pre-disintegration consumption levels. A middle scenario assumes an average annual growth rate of 2.5 percent, in which 1989 levels of consumption are only attained, at the earliest, in Period 6, in Russia West. Preexisting consumption levels are not encountered within the ten-period time horizon employed in the analysis for the Russia East, Southwest, Transcaucasus, and Central Asian regions.

Assuming no change in manufacturing capacity and fiber availability, the need to import forest products and the surplus available for export changes under the different expectations of growth. Table 14 indicates that the Baltic region continues to be in a net export position (negative values), focusing on the export of logs and lumber, with all republics of this region contributing in varying degrees to the net surplus position. The region is a net exporter in the second period in all growth scenarios. By the third period under the modified high-, high-, and very high-growth assumptions, rising domestic demand encounters the limits imposed by capital and fiber, with the region becoming a net importer of fiber. In the middle-growth scenario, the region continues as an exporter until the fourth period, after which it must import forest products to meet rising domestic demand. Even in the low-growth scenario, the Baltic region is transformed into a net importer, although this occurs later in the time horizon, as the slower rate of increase simply postpones the time at which the shift from exporter to importer takes place and not the actual occurrence.

The Southwest region, a net importer under the former regime, becomes a net exporter in Period 1 for all growth assumptions, and only for the very high-growth scenario does the Southwest region return to being a net importer during later periods. The Transcaucasus, Central Asian, and Kazakhstan regions, faced with a limited resource base and a high share of historic consumption linked to the importation of forest products, remain net importers in all growth scenarios.

Both regions in Russia are net exporters in the first period, whereas Russia West quickly becomes dependent on imported fiber beginning in the second period under the very high-growth scenario, the period at which importation takes place only being postponed later for the other growth assumptions. Russia East, endowed with surplus harvesting capacity, available fiber, and low domestic demand, continues to be a net exporter until the third period for the very high- and fourth period for the high-growth scenarios, at which times Russia East becomes a net importer as well, as rising demand intersects with an inflexible boundary of capital constraints. Under the low-growth assumption, Russia East is a net exporter in Period 10 even in the absence of additions to manufacturing and harvesting capacities.

Thus, as a whole, the European republics are net exporters of fiber in the first period for all growth scenarios and it is only under the very high growth scenario that the

European regions must begin imports, starting in the second period. However, by the fourth period, except in the low-growth scenario, all regions must import to meet rising demand. Kazakhstan and Central Asia must continue to import forest products in all periods and, given the distance separating them from the more fortunate European regions, must rely on imports from Russia to meet their rising needs.

Although capital can play an important role in meeting future demand and in expanding manufacturing capacity to meet domestic requirements and create export opportunities (Table 15), it is the availability of the fiber supply that imposes the limitations affecting the ability of the region to meet future demand and capitalize on emerging export opportunities. Without additions to the fiber base, additions of capital can play only a limited role in meeting future domestic demand and creating a surplus for potential export opportunities. Adopting a low-growth scenario does not change the long-term outlook for supply and demand, only postpones it, although it does create opportunities to capitalize on export opportunities as the gap between installed capacity and current demand takes a longer time to narrow. Furthermore, in cases where roundwood exports exist, capital can be consumed constructing manufacturing facilities to produce more deeply manufactured (i.e., higher value added) products from currently exported roundwood.

Fiber Availability

The fiber base can be expanded in four ways. First, given rising relative prices for forest products, the economic accessibility of the currently accessible resource can be expanded, as hitherto uneconomic resources become sufficiently profitable to harvest (D. Adams, pers. comm., 1996).[23] Second, additions of technology to utilize lower-quality wood or wood of inferior species can expand the commercial fiber independent of the effect rising prices have in bringing forth additional supplies. Furthermore, advances in technology can decrease the quantity of raw material required per unit of output independent of the quality of wood fiber being employed.[24] Third, there exists a forest resource that presently is located far from existing transportation infrastructure for which the forest sector cannot alone support its development. Bringing this resource into current accessibility increases fiber availability, but also adds to the stock available for competing users. Fourth, the use of secondary fiber, such as byproduct wood chips and the recycling of waste paper, can provide a mechanism by which fiber is made available for use within the domestic economy, for import substitution with appropriate additions of capital, or for export.

Although unutilized fiber supply exists in Russia West and to a larger extent in Russia East, little surplus fiber supply is available save for that generated by increasing the volume of recycled paper and paperboard consumed as a substitute for pulp in the manufacture of paper and paperboard. Under the high-growth scenario, Table 16 provides an indication of the effect that a modest increase in the level of recycling can have on the fiber balance of the republics. Particularly important in heavily populated regions is an

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[23]For a further discussion of the likely trends in raw material prices, see Parez-Garcia (1993) and Haynes et al. (1995).

[24]Although it is not expressly considered in this analysis, under the former regime, changing technology was having an impact on the efficiency with which the fiber resource was being utilized in the production of paper products. During the 1980s, the average weight of a square meter of a broad cross section of paper product declined between 2 and 10 percent (Goskomstat SSSR, 1988, p. 214). The declining weight per square meter translated into less wood fiber required to produce a given quantity of paper product.

Table 14. Trade in 1989 and Annual Net Trade of Forest Products by Period for Different Growth Scenarios, with Only Replacement of Existing Capital (mill. cu. m, roundwood equivalent)[a]

Region/ assumption	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
Baltic											
Very high	3.7	-2.5	-0.4	3.9	8.7	14.4	20.8	29.6	41.1	55.5	75.8
High	3.7	-2.5	-1.3	0.9	3.5	6.6	10.0	13.7	18.2	23.4	29.2
Modified high	3.7	-2.5	-1.3	0.9	3.5	6.6	9.1	10.7	12.5	14.5	16.6
Medium	3.7	-2.5	-2.0	-1.1	-0.3	0.6	1.7	2.8	4.1	5.5	7.1
Low	3.7	-2.5	-2.2	-1.8	-1.5	-1.2	-0.8	-0.4	0.0	0.5	0.9
Transcaucasus											
Very high	5.1	0.9	1.1	2.2	4.1	7.5	12.9	21.8	34.2	50.2	72.1
High	5.1	0.9	0.9	1.5	2.3	3.6	5.4	7.9	11.2	16.0	23.1
Modified high	5.1	0.9	0.9	1.5	2.3	3.6	4.8	5.9	7.2	8.6	10.3
Medium	5.1	0.9	0.8	1.0	1.3	1.6	2.0	2.5	3.2	3.9	4.9
Low	5.1	0.9	0.7	0.8	0.9	1.0	1.2	1.3	1.5	1.7	1.9
Southwest											
Very high	25.4	-0.4	3.7	22.7	39.8	60.3	94.3	150.0	219.4	303.6	421.6
High	25.4	-0.4	-0.6	8.6	16.3	24.0	33.1	46.0	64.0	89.1	123.1
Modified high	25.4	-0.4	-0.6	8.6	16.3	24.0	30.2	35.7	42.2	49.8	58.7
Medium	25.4	-0.4	-3.7	-0.2	2.6	5.7	8.8	11.7	15.4	19.1	22.6
Low	25.4	-0.4	-4.9	-3.3	-2.2	-1.1	0.1	1.5	3.0	4.4	5.7
Central Asian											
Very high	8.4	1.9	2.1	3.8	6.7	10.9	17.0	25.7	38.5	59.6	96.2
High	8.4	1.9	1.9	2.7	4.1	6.1	8.5	11.4	15.4	20.3	26.6
Modified high	8.4	1.9	1.9	2.7	4.1	6.1	7.9	9.1	10.6	12.3	14.3
Medium	8.4	1.9	1.7	2.0	2.5	3.0	3.7	4.5	5.2	6.0	7.0
Low	8.4	1.9	1.6	1.8	1.9	2.2	2.4	2.7	2.9	3.3	3.6
Kazakhstan											
Very high	4.5	0.7	1.2	3.6	6.7	12.3	22.0	35.3	53.3	73.6	91.9
High	4.5	0.7	0.7	1.9	3.3	5.2	8.0	12.2	18.4	25.6	33.7
Modified high	4.5	0.7	0.7	1.9	3.3	5.2	7.1	8.9	11.0	13.6	16.7
Medium	4.5	0.7	0.3	0.8	1.2	1.8	2.4	3.1	4.0	5.0	8.3
Low	4.5	0.7	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.7	2.0
Russia West											
Very high	-52.8	-18.0	12.8	98.9	217.2	337.6	447.1	585.0	751.4	983.7	1309.2
High	-52.8	-18.0	-4.4	41.4	92.8	165.3	232.1	285.2	355.3	455.3	565.9
Modified high	-52.8	-18.0	-4.4	41.4	92.8	165.3	218.7	244.8	270.7	300.4	335.9
Medium	-52.8	-18.0	-18.1	0.3	16.9	36.7	60.2	88.4	122.0	157.7	185.5
Low	-52.8	-18.0	-23.8	-15.6	-8.9	-1.6	6.3	15.0	24.5	34.8	46.2
Russia East											
Very high	-37.4	-26.2	-21.8	-7.3	7.8	25.0	44.3	62.4	84.3	114.8	157.7
High	-37.4	-26.2	-24.5	-16.7	-7.7	4.7	16.8	29.0	41.5	54.7	69.2
Modified high	-37.4	-26.2	-24.5	-16.7	-7.7	4.7	14.2	19.3	25.5	32.7	38.9
Medium	-37.4	-26.2	-26.8	-23.6	-20.5	-16.9	-12.7	-7.8	-1.9	4.4	9.8
Low	-37.4	-26.2	-27.7	-26.3	-25.0	-23.7	-22.2	-20.6	-18.9	-17.0	-14.9

Table 14. Continued

Region/ assumption	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
Russia											
Very high	-90.2	-44.3	-9.0	91.7	224.9	362.5	491.4	647.4	835.7	1098.6	1466.9
High	-90.2	-44.3	-29.0	24.7	85.1	170.0	248.9	314.3	396.8	510.0	635.1
Modified high	-90.2	-44.3	-29.0	24.7	85.1	170.0	233.0	264.1	296.2	333.1	374.9
Medium	-90.2	-44.3	-44.9	-23.3	-3.6	19.7	47.5	80.6	120.1	162.0	195.3
Low	-90.2	-44.3	-51.6	-41.9	-33.9	-25.3	-15.8	-5.6	5.6	17.9	31.2
European[b]											
Very high	34.2	-2.0	4.4	28.9	52.6	82.2	128.0	201.4	294.7	409.2	569.4
High	34.2	-2.0	-0.9	11.0	22.2	34.2	48.5	67.6	93.4	128.6	175.4
Modified high	34.2	-2.0	-0.9	11.0	22.2	34.2	44.1	52.3	61.8	72.9	85.6
Medium	34.2	-2.0	-4.9	-0.3	3.4	7.9	12.5	17.1	22.6	28.5	34.6
Low	34.2	-2.0	-6.4	-4.3	-2.8	-1.2	0.5	2.4	4.5	6.6	8.5
Central Asia and Kazakhstan											
Very high	12.9	2.5	3.3	7.2	13.3	23.1	39.0	61.1	91.9	133.2	188.1
High	12.9	2.5	2.6	4.7	7.3	11.3	16.5	23.6	33.9	45.9	60.4
Modified high	12.9	2.5	2.6	4.7	7.3	11.3	15.0	18.0	21.5	25.8	31.0
Medium	12.9	2.5	2.0	2.9	3.7	4.8	6.1	7.5	9.1	11.0	13.3
Low	12.9	2.5	1.8	2.2	2.5	2.9	3.4	3.8	4.4	4.9	5.5

[a]P(1) = Period 1, etc. For explanation of growth scenarios, see Table 13.
[b]The European region consists of the Baltic, Transcaucasus, and Southwest regions.

increase in recycling content distributed over a four-period span, most noticeable in the Baltic, Russia West, and Russia East regions.[25] However, even assuming that a modest increase in the consumption of post-consumer paper and paperboard, to 50 percent levels, takes place, the need to focus on expansion of the raw wood base remains, since there are limits to the substitutibility of waste paper for pulp manufactured from virgin wood fiber; furthermore, waste paper cannot directly be substituted for lumber and panel production (Sten Nilsson, pers. comm., 1996).[26]

Table 17 shows the impact that increasing the domestic fiber supply has on the need to import (positive values) or on levels of exports (negative values), demonstrating the degree to which future demand can be met by fiber existing within the former USSR.[27] Sufficient raw material resources are potentially available to satisfy the consumption levels evident with the high-growth scenario until the middle of the fourth period (P4) and the modified high-growth scenario in the tenth period, although not being capable of generating sufficient fiber to meet emerging demand between the fifth

[25]It is not possible immediately to increase the degree of recycling, even if sufficient infrastructure were in place. Much also depends on developing in the population an awareness and an interest in actively participating in the recycling process (Tarja-Riitta, Metsälä, pers. comm., 1996).

[26]The impact of increasing the recycling rate to 50 percent is not substantial in the Southwest, Central Asian, and Kazakhstan regions, since recycling rates already were quite high under the former regime—37 percent, 42 percent, and 31 percent, respectively, of estimated paper and paperboard consumption in these regions in 1989.

[27]The base domestic fiber supply considered here assumes that only the currently accessible fiber resource factored for economic accessibility (after Backman, 1995c) is available. Other sources of fiber include waste paper, use of the firewood component, use of the share presently considered uneconomic, and use of the potentially accessible fiber resource.

Table 15. Medium Demand (base case): Net Traded Fiber in 1989 and Average Annual Fiber Demand for Ten Periods under Only Different Capital Investment Strategies (mill. cu. m, roundwood equivalent)[a]

Region/strategy	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
Baltic											
0 percent	3.7	-2.5	-2.0	-1.1	-0.3	0.6	1.7	2.8	4.1	5.5	7.1
10 percent	3.7	-2.5	-2.1	-1.3	-0.6	0.4	1.4	2.4	3.7	5.1	6.6
25 percent	3.7	-2.5	-2.2	-1.4	-0.7	0.2	1.2	2.3	3.6	5.0	6.6
50 percent	3.7	-2.5	-2.3	-1.5	-0.8	0.2	1.2	2.3	3.6	5.0	6.6
Transcaucasus											
0 percent	5.1	0.9	0.8	1.0	1.3	1.6	2.0	2.5	3.2	3.9	4.9
10 percent	5.1	0.9	0.7	1.0	1.2	1.6	2.0	2.4	3.1	3.8	4.7
25 percent	5.1	0.9	0.7	0.9	1.2	1.4	1.8	2.3	2.9	3.7	4.6
50 percent	5.1	0.9	0.7	0.8	1.0	1.4	1.8	2.3	2.9	3.7	4.6
Southwest											
0 percent	25.4	-0.4	-3.7	-0.2	2.5	5.7	8.8	11.7	15.4	19.1	22.6
10 percent	25.4	-0.4	-4.7	-1.5	1.2	4.3	7.3	10.2	13.9	17.5	20.9
25 percent	25.4	-0.4	-4.9	-1.7	0.9	4.1	7.2	10.2	13.9	17.5	20.7
50 percent	25.4	-0.4	-5.1	-1.7	0.9	4.1	7.2	10.2	13.9	17.5	20.8
Central Asian											
0 percent	8.4	1.9	1.7	2.0	2.5	3.0	3.7	4.5	5.2	6.0	7.0
10 percent	8.4	1.9	1.7	2.0	2.5	3.0	3.7	4.5	5.2	6.0	7.0
25 percent	8.4	1.9	1.7	2.0	2.5	3.0	3.7	4.5	5.2	6.0	6.9
50 percent	8.4	1.9	1.7	2.0	2.5	3.0	3.7	4.5	5.2	6.0	6.9
Kazakhstan											
0 percent	4.5	0.7	0.3	0.8	1.2	1.8	2.4	3.1	4.0	5.0	6.3
10 percent	4.5	0.7	0.3	0.8	1.2	1.7	2.3	3.1	3.9	5.0	6.3
25 percent	4.5	0.7	0.3	0.8	1.2	1.7	2.3	3.1	3.9	5.0	6.3
50 percent	4.5	0.7	0.3	0.8	1.2	1.7	2.3	3.1	3.9	5.0	6.3
Russia West											
0 percent	-52.8	-18.0	-18.1	0.3	16.9	36.7	60.2	88.4	122.0	157.7	185.5
10 percent	-52.8	-18.0	-25.4	-14.9	-6.6	4.1	17.8	36.9	70.5	106.2	134.0
25 percent	-52.8	-18.0	-36.3	-39.6	-34.6	-14.8	8.8	36.9	70.5	106.2	134.0
50 percent	-52.8	-18.0	-54.5	-51.2	-34.6	-14.8	8.8	36.9	70.5	106.2	134.0
Russia East											
0 percent	-37.4	-26.2	-26.8	-23.6	-20.5	-16.9	-12.7	-7.8	-1.9	4.4	9.8
10 percent	-37.4	-26.2	-30.0	-30.3	-31.0	-31.5	-31.6	-31.4	-30.5	-29.7	-30.1
25 percent	-37.4	-26.2	-34.9	-41.3	-49.8	-58.8	-55.6	-50.7	-44.8	-38.5	-33.1
50 percent	-37.4	-26.2	-43.0	-62.2	-63.4	-59.8	-55.6	-50.7	-44.8	-38.5	-33.1
Russia											
0 percent	-90.2	-44.3	-44.9	-23.3	-3.6	19.7	47.5	80.6	120.1	162.0	195.3
10 percent	-90.2	-44.3	-55.4	-45.2	-37.7	-27.4	-13.8	5.5	40.0	76.5	103.9
25 percent	-90.2	-44.3	-71.2	-81.0	-84.4	-73.6	-46.9	-13.8	25.7	67.7	100.9
50 percent	-90.2	-44.3	-97.5	-113.4	-98.0	-74.6	-46.9	-13.8	25.7	67.7	100.9

Table 15. Continued

Region/strategy	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
European[b]											
0 percent	34.2	-2.0	-4.9	-0.3	3.4	7.9	12.5	17.1	22.6	28.5	34.8
10 percent	34.2	-2.0	-6.1	-1.8	1.8	6.2	10.6	15.1	20.6	26.4	32.3
25 percent	34.2	-2.0	-6.4	-2.2	1.4	5.8	10.2	14.8	20.4	26.2	32.0
50 percent	34.2	-2.0	-6.7	-2.5	1.2	5.7	10.2	14.8	20.4	26.2	31.9
Central Asia and Kazakhstan											
0 percent	12.9	2.5	2.0	2.9	3.7	4.8	6.1	7.5	9.1	11.0	13.3
10 percent	12.9	2.5	2.0	2.8	3.7	4.8	6.1	7.5	9.1	11.0	13.3
25 percent	12.9	2.5	2.0	2.8	3.7	4.8	6.1	7.5	9.1	11.0	13.2
50 percent	12.9	2.5	2.0	2.8	3.7	4.8	6.1	7.5	9.1	11.0	13.2

[a]P(1) = Period 1, etc. Investment strategies relate to the degree to which average capacity in the previous period can be increased. For example, a "25 percent" strategy denotes one in which financial resources are available to increase the output of all forest products, including the output of roundwood, subject to the availability of either unused roundwood currently being exported or the availability of unused fiber supply not presently being harvested. It does not mean that capacity is automatically increased every period. It simply means that, at a maximum, the previous period's productive capacity can be increased by 25 percent. For example, for Russia West, harvesting capacity is increased by the full amount for the first two periods; in the third period, less than half of the maximum increase is taken, while after that none of the maximum increase is taken.
[b]The European region consists of the Baltic, Transcaucasus, and Southwest regions.

and ninth periods because of a lack of capital. By the tenth period (P10)), because of the development of fiber reserves tied up in the potential resource, Russia once again is able to generate sufficient forest products to satisfy both internal domestic demand and possibly meet demands in the other regions of the former USSR, although in so doing great pressure is placed on the transportation network in an east-west direction. Should growth continue at the very high-growth scenario, the limits to fiber supply in the former USSR will be encountered much sooner and Russia will be unable even to satisfy its own domestic requirements.

It is the development of the potential forest resource, becoming available between Periods 5 and 8 that provides the base needed to satisfy rising demands in the more populated regions, particularly Russia West and the Southwest regions, although the urgency of such development is dependent on the likely level of growth and concomitant demand. The Baltic and Southwest regions remain largely self-sufficient independent of events transpiring within Russia until well into the second and third periods. The Transcaucasus, Central Asian republics, and Kazakhstan, faced with a small resource base relative to demand, must rely on imported products in large measure to meet projected demand levels, which by the fifth (five-year) period account for between three-fifths and nearly 100 percent of total consumption in the modified high-growth scenario. The share rapidly increases in the second 25-year period, as additions in demand must be met by imports rather than utilization of new fiber sources. In the absence of fiber reserves materializing through increasing real prices for wood fiber, better forest management, improved utilization of the forest resource, and higher utilization of post-consumer paper and paperboard, the development of the resource tied up in the potential fiber flow looms significant in meeting future demand, and underscores the degree to which the transportation infrastructure must be relied upon to carry forest products from the timber-surplus to timber-deficit regions.

Table 16. Distribution of Net Exports for High-Growth Scenario (base case) with 25 Percent Investment Strategy and Increase in Waste Paper Consumption (mill. cu. m, roundwood equivalent)[a]

Region/strategy	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
Baltic											
High growth—25 base (mill. cu. m, r.e.)	3.72	-2.46	-1.53	0.60	3.05	6.15	9.48	13.18	17.55	22.57	28.06
High growth—25 waste paper (mill. cu. m, r.e.)	3.72	-2.46	-1.60	0.41	2.61	5.37	8.57	12.14	16.34	21.15	26.41
Pulp imports—base (mill. metric tons)	0.16	0.14	0.11	0.09	0.07	0.06	0.03	0.01	0.02	0.05	0.07
Pulp imports—waste paper (mill. metric tons)	0.16	0.14	0.10	0.05	-0.02	-0.06	-0.03	0.02	0.08	0.16	0.25
Transcaucasus											
High growth—25 base (mill. cu. m, r.e.)	5.08	0.89	0.87	1.44	2.23	3.41	5.19	7.62	10.95	15.75	22.75
High growth—25 waste paper (mill. cu. m, r.e.)	5.08	0.89	0.87	1.43	2.22	3.38	5.15	7.62	10.93	16.73	22.72
Pulp imports—base (mill. metric tons)	0.02	0.04	0.04	0.04	0.03	0.03	0.02	0.01	0.02	0.02	0.03
Pulp imports—waste paper (mill. metric tons)	0.02	0.04	0.04	0.04	0.03	0.03	0.02	0.01	0.02	0.03	0.03
Southwest											
High growth—25 base (mill. cu. m, r.e.)	25.43	-0.40	-1.83	7.10	14.81	22.15	30.73	42.99	60.10	84.16	116.83
High growth—25 waste paper (mill. cu. m, r.e.)	25.43	-0.40	-1.90	6.84	14.56	22.00	30.48	42.68	59.73	83.70	116.27
Pulp imports—base (mill. metric tons)	0.44	0.56	0.55	0.37	0.26	0.26	0.30	0.40	0.53	0.70	0.90
Pulp imports—waste paper (mill. metric tons)	0.44	0.56	0.54	0.31	0.22	0.26	0.34	0.45	0.59	0.77	0.99
Central Asian											
High growth—25 base (mill. cu. m, r.e.)	8.42	1.87	1.87	2.74	4.08	6.06	8.44	11.27	15.23	20.07	26.30
High growth—25 waste paper (mill. cu. m, r.e.)	8.42	1.87	1.87	2.74	4.08	6.07	8.45	11.28	15.24	20.07	26.31
Pulp imports—base (mill. metric tons)	0.04	0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.05	0.07	0.08
Pulp imports—waste paper (mill. metric tons)	0.04	0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.05	0.07	0.08
Kazakhstan											
High growth—25 base (mill. cu. m, r.e.)	4.51	0.66	0.70	1.90	3.24	5.15	7.97	12.10	18.21	25.27	33.27
High growth—25 waste paper (mill. cu. m, r.e.)	4.51	0.66	0.68	1.87	3.15	5.06	7.87	11.98	18.06	25.09	33.05
Pulp imports—base (mill. metric tons)	0.01	0.05	0.05	0.04	0.03	0.01	0.01	0.03	0.04	0.06	0.08
Pulp imports—waste paper (mill. metric tons)	0.01	0.05	0.05	0.03	0.01	0.02	0.03	0.04	0.06	0.09	0.11

Russia West											
High growth—25 base (mill. cu. m, r.e.)	-52.79	-18.03	-22.63	1.52	41.29	113.79	179.66	225.86	285.63	370.48	468.93
High growth—25 waste paper (mill. cu. m, r.e.)	-52.79	-18.03	-23.48	-1.11	35.46	102.29	162.65	202.89	263.22	351.45	447.53
Pulp imports—base (mill. metric tons)	-1.97	-0.52	-0.40	-0.68	-0.90	0.00	0.00	0.00	0.00	0.00	0.93
Pulp imports—waste paper (mill. metric tons)	-1.97	-0.52	-0.57	-1.21	-2.07	-1.92	-1.62	-1.36	0.17	2.03	4.30
Russia East											
High growth—25 base (mill. cu. m, r.e.)	-37.37	-26.23	-32.65	-34.45	-36.95	-37.13	-26.07	-14.65	-3.56	7.63	20.00
High growth—25 waste paper (mill. cu. m, r.e.)	-37.37	-26.23	-32.76	-34.79	-37.71	-38.64	-28.31	-17.97	-7.52	3.90	16.31
Pulp imports—base (mill. metric tons)	-1.69	-1.13	-1.37	-1.70	-2.10	-2.61	-3.25	-3.15	-2.90	-2.66	-2.33
Pulp imports—waste paper (mill. metric tons)	-1.69	-1.13	-1.40	-1.77	-2.26	-2.91	-3.69	-3.81	-3.69	-3.41	-3.07
Russia											
High growth—25 base (mill. cu. m, r.e.)	-90.16	-44.25	-55.28	-32.93	4.35	76.66	153.59	211.21	282.07	378.12	488.93
High growth—25 waste paper (mill. cu. m, r.e.)	-90.16	-44.25	-56.24	-35.90	-2.25	63.65	134.33	184.92	255.70	355.35	463.83
Pulp imports—base (mill. metric tons)	-3.67	-1.65	-1.77	-2.38	-3.00	-2.61	-3.25	-3.15	-2.90	-2.66	-1.40
Pulp imports—waste paper (mill. metric tons)	-3.67	-1.65	-1.96	-2.98	-4.32	-4.83	-5.32	-5.17	-3.52	-1.38	1.23
European[b]											
High growth—25 base (mill. cu. m, r.e.)	34.23	-1.98	-2.49	9.14	20.09	31.70	45.40	63.79	88.60	122.48	167.64
High growth—25 waste paper (mill. cu. m, r.e.)	34.23	-1.98	-2.63	8.67	19.39	30.76	44.20	62.45	86.99	120.58	165.40
Pulp imports—base (mill. metric tons)	0.62	0.74	0.71	0.49	0.36	0.35	0.36	0.42	0.57	0.77	1.00
Pulp imports—waste paper (mill. metric tons)	0.62	0.74	0.68	0.40	0.23	0.23	0.33	0.48	0.69	0.95	1.27
Central Asia and Kazakhstan											
High growth—25 base (mill. cu. m, r.e.)	12.93	2.53	2.56	4.65	7.32	11.21	16.41	22.37	33.44	45.34	59.57
High growth—25 waste paper (mill. cu. m, r.e.)	12.93	2.53	2.55	4.61	7.24	11.13	16.31	23.26	33.30	45.16	59.36
Pulp imports—base (mill. metric tons)	0.05	0.09	0.09	0.07	0.06	0.04	0.05	0.07	0.09	0.12	0.16
Pulp imports—waste paper (mill. metric tons)	0.05	0.09	0.09	0.06	0.04	0.05	0.07	0.09	0.12	0.15	0.19

[a]*Abbreviations*: r.e. = roundwood equivalent.
[b]The European region consists of the Baltic, Transcaucasus, and Southwest regions.

Table 17. Net Annual Trade of Fiber for 1989 and for Ten Periods Given High- and Modified High-Growth Scenario, All Sources of Fiber (mill. cu. m, roundwood equivalent)[a]

Region/scenario	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
Baltic											
High growth—25 base	3.72	-2.46	-1.29	0.92	3.46	6.61	9.97	13.72	18.21	23.41	29.24
High growth—all sources	3.72	-2.46	-1.60	-0.25	1.25	3.20	5.55	8.93	13.06	17.83	22.90
Modified high growth—all sources	3.72	-2.46	-1.60	-0.25	1.25	3.20	4.64	5.92	7.42	9.04	10.59
Modified high growth—excl. pot.	3.72	-2.46	-1.60	-0.25	1.25	3.20	4.66	5.94	7.41	9.00	10.55
Transcaucasus											
High growth—base	5.08	0.89	0.90	1.51	2.35	3.58	5.42	7.86	11.20	16.04	23.09
High growth—all sources	5.08	0.89	0.87	1.43	2.22	3.38	5.14	7.54	10.76	15.45	22.29
Modified high growth—all sources	5.08	0.89	0.87	1.43	2.22	3.38	4.55	5.59	6.77	8.04	9.55
Modified high growth—excl. pot.	5.08	0.89	0.87	1.43	2.22	3.38	4.55	5.59	6.77	8.04	9.57
Southwest											
High growth—base	25.43	-0.40	-0.55	8.57	16.35	24.03	33.07	46.03	64.01	89.12	123.07
High growth—all sources	25.43	-0.40	-1.90	4.92	10.35	15.24	20.78	32.11	48.37	71.54	103.35
Modified high growth—all sources	25.43	-0.40	-1.90	4.92	10.35	15.24	17.92	21.74	26.55	32.24	39.02
Modified high growth—excl. pot.	25.43	-0.40	-1.90	4.92	10.35	15.24	17.97	21.85	26.73	32.48	39.27
Central Asian											
High growth—base	8.42	1.87	1.87	2.74	4.09	6.09	8.51	11.40	15.41	20.33	26.65
High growth—all sources	8.42	1.87	1.87	2.74	4.08	6.07	8.45	11.28	15.24	20.07	26.31
Modified high growth—all sources	8.42	1.87	1.87	2.74	4.08	6.07	7.80	8.98	10.37	12.02	13.96
Modified high growth—excl. pot.	8.42	1.87	1.87	2.74	4.08	6.07	7.80	8.98	10.37	12.02	13.96
Kazakhstan											
High growth—base	4.51	0.66	0.72	1.93	3.26	5.17	8.03	12.24	18.44	25.61	33.74
High growth—all sources	4.51	0.66	0.68	1.66	2.70	4.32	6.78	10.52	16.39	23.20	31.12
Modified high growth—all sources	4.51	0.66	0.68	1.66	2.70	4.32	5.86	7.14	8.94	11.15	14.09
Modified high growth—excl. pot.	4.51	0.66	0.68	1.66	2.70	4.32	5.86	7.39	9.37	11.78	14.73

Russia West											
High growth—base	-52.79	-18.03	-4.43	41.40	92.78	165.27	232.08	285.23	355.28	455.35	565.86
High growth—all sources	-52.79	-18.03	-23.48	-1.11	21.26	57.85	82.29	79.89	105.32	174.03	267.04
Modified high growth—all sources	-52.79	-18.03	-23.48	-1.11	21.26	57.85	71.66	49.45	32.79	33.70	54.80
Modified high growth—excl. pot.	-52.79	-18.03	-23.48	-1.11	21.26	57.85	71.66	58.24	73.40	90.75	111.85
Russia East											
High growth—base	-37.37	-26.23	-24.54	-16.68	-7.68	4.72	16.82	29.03	41.47	54.67	69.25
High growth—all sources	-37.37	-26.23	-32.76	-34.79	-37.71	-39.74	-44.66	-53.71	-66.35	-82.43	-102.76
Modified high growth—all sources	-37.37	-26.23	-32.76	-34.79	-37.71	-39.74	-47.01	-61.88	-79.76	-101.25	-129.26
Modified high growth—excl. pot.	-37.37	-26.23	-32.76	-34.79	-37.71	-39.74	-47.01	-61.88	-68.07	-63.60	-60.43
Russia											
High growth—base	-90.16	-44.25	-28.97	24.72	85.09	170.00	248.90	314.26	396.76	510.02	635.11
High growth—all sources	-90.16	-44.25	-56.24	-35.90	-16.45	18.11	37.63	26.17	38.97	91.61	164.20
Modified high growth—all sources	-90.16	-44.25	-56.24	-35.90	-16.45	18.11	24.65	-12.43	-46.97	-67.55	-74.46
Modified high growth—excl. pot.	-90.16	-44.25	-56.24	-35.90	-16.45	18.11	24.65	-3.64	5.33	27.15	51.43
European[b]											
High growth—base	34.23	-1.98	-0.94	11.00	22.16	34.22	48.45	67.61	93.42	128.57	175.40
High growth—all sources	34.23	-1.98	-2.63	6.10	13.82	21.83	31.47	48.58	72.18	104.81	148.54
Modified high growth—all sources	34.23	-1.98	-2.63	6.10	12.82	21.83	27.12	33.26	40.74	49.32	59.17
Modified high growth—excl. pot.	34.23	-1.98	-2.63	6.10	13.82	21.83	27.19	33.38	40.91	49.52	59.39
Central Asia and Kazakhstan											
High growth—base	12.93	2.53	2.59	4.67	7.35	11.26	16.55	23.63	33.85	45.94	60.40
High growth—all sources	12.93	2.53	2.55	4.40	6.78	10.39	15.22	21.80	31.63	43.27	57.43
Modified high growth—all sources	12.93	2.53	2.55	4.40	6.78	10.39	13.66	16.13	19.31	23.16	28.05
Modified high growth—excl. pot.	12.93	2.53	2.55	4.40	6.78	10.39	13.66	16.38	19.74	23.80	28.69

[a]*Abbreviations*: Excl. pot. = excluding potential forest resource.
[b]The European region consists of the Baltic, Transcaucasus, and Southwest regions.

Capital Requirements

The capital requirements of the forest sector are enormous, not only to replenish the existing capital structure, but to add capacity to take advantage of export opportunities and meet future demand created by an expanding domestic economy. In order even to meet the demands brought on by a modified high-growth scenario, involving an increase in GDP of 5 percent per annum for the first 25 years, followed by a more gradual increase of 2.5 percent per year, would require enormous quantities of capital, amounting to more than 30 billion U.S. dollars in the first five-year period alone (Table 18). Most of this will be required within Russia, primarily Russia West. By the fifth period, between 13 and more than 60 billion dollars are needed, rising to an astounding 103 billion dollars per five-year period in the aggressive investment strategy by Period 10. Rising fiber availability in Russia East should attract an increasing share of the capital, so that by Period 10, under an aggressive investment strategy almost 60 percent of the funds required by Russia would be located there versus only roughly one-third in Period 1. Even within the European republics, capital requirements are not small, rising from between $2 billion and $3 billion in the first five-year period to between $2 billion and $5 billion in Period 5. By the tenth period, capital requirements amount to more than 7 billion dollars for the five-year interval (2039-2044).

Certainly, the timing of capital investments has an impact, creating imbalances that result in the need to import selective products until sufficient capital has been invested to utilize the rising fiber supply brought about by the utilization of the different fiber sources. As is evident in Table 19, the level of exportable wood-based material and the magnitude of imports is directly linked to the investment strategy chosen. An aggressive strategy linked to a maximum 50 percent increase in capacity over the previous five-year period, although it depends on the availability of sufficient fiber, generates sufficient fiber resources to meet demand in Russia and in the other regions in each of the ten periods (i.e., the exportable surplus in Russia exceeds the total demand for imports in all the FSU republics). A 25 percent strategy, however, provides only enough fiber to meet Russia's domestic needs. Although sufficient exportable material in Russia is available during the first half of the time horizon, insufficient capital to develop the additional fiber sources becoming available under the 25 percent strategy translates into an apparent gap in the non-Russian regions.[28] In the low investment strategy (10 percent) of the modified high-growth scenario, Russia East remains a marginal player, exporting a small share of its overall production, with demand in the non-Russian regions left unmet by Russia.

In regions such as Central Asia, which lack a domestic resource upon which to act, the different strategies to attract capital do not have a very large impact on the magnitude of imports required, whereas in the Baltic and Southwest regions, which have some surplus fiber potential in the initial periods, the different investment strategies can yield different results in the interim periods, although by the end of the time horizon (2044), the needs to supplement domestic production to meet local demand are similar. This phenomenon is clearly evident as well when examining Russia West. The two highest investment strategies deliver similar results by Period 10, although the most aggressive strategy produces larger export volume and reduces the overall fiber requirements in the

[28]Gaps between supply and demand, of course, never really take place. Rising prices depress demand, and bring forth additional supplies or lead to development of more efficient manufacturing technologies or even different products.

intervening periods. In Russia East, where large fiber reserves connected with the potential resource are located, and which become available beginning in Period 5, capital can be fully employed in developing this resource in such a way that by Period 10, exports are over 40 percent higher in the case of the aggressive policy than for to the next most favorable alternative.

CONCLUSIONS AND POLICY IMPLICATIONS

Clearly markets do exist for Russian producers in the non-Russian regions, with those in Central Asia and Kazakhstan being more important at present than those in the Southwest, Baltic, and Transcaucasus, which collectively are expected to be net exporters into the first decade of the 21st century. Rapid economic growth characterized by the very high- and high-growth scenarios is not an unlikely event, particularly if the different FSU countries are successful in political and economic restructuring of their societies; however, in the most likely scenario of modified high growth, annual increases in economic activity are expected to decline in the second 25-year period.[29] Meeting the demands placed on the forest resource by economies expanding at such rates, however, requires a commitment on the part of the respective governments to improve the capability of the capital system to manage and to attract the capital necessary to support forest-sector development. Although sufficient fiber reserves exist to meet the demand characterized by the modified high-growth assumption, their utilization depends on a financial infrastructure that can support massive transfers of capital and a perception by the domestic and international communities that the requisite political stability exists to support long-term investments. Even higher growth characterized by the very high-growth scenario would simply increase the urgency underlying the need to address the capabilities of the financial infrastructure, whereas a lower-growth scenario would simply postpone it and not eliminate it. The long-term balance of supply and demand within Russia and within the regions belonging to the former USSR rests upon the potential fiber supply, principally located in Russia East, in the absence of changing preferences for forest-products consumption.

The ability of the non-Russian regions to balance supply with projected demand in future periods is linked to developments in Russia, over which they have little if any control. Most of the surplus fiber reserves are located in Russia East, situated far from both Russia West—which becomes a deficit region in Periods 3 through 5, depending upon the success of the investment strategy in the modified high-growth scenario—and from the non-Russian European regions. Transformation of this resource from potential to current accessibility depends on a strategy at the Federation government level not only to promote extensive development of the frontier in Siberia but also the integration of east with west, despite the distances and costs of transportation involved. Furthermore, developing this potential may entail environmental costs that at present are not clearly understood. Furthermore, Russia East, located closer to the Pacific Rim than to

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[29]The 5 percent growth scenario is typical of the performance of developing countries, whereas the 2.5 percent rate reflects behavior of industrialized countries. Taking advantage of the accumulated social, political, and economic capital left over from the previous regime, Russia is expected to show strong economic growth. However, in the long run, this increase is not expected to be sustainable, thus the selection of the lower rate for the second 25-year period. Nonetheless, a precedent for relatively high, sustained economic growth over the recent past can be identified in the performance of economies such as India and China. Over the past 10 years, the economy of India has expanded in real terms by almost 65 percent (ca. 5 percent growth on an annualized basis), and China's economy has grown by 150 percent (almost 10 percent annualized) (Emerging, 1996, p. 116).

Table 18. Capital Requirements in Each Five-Year Period under the Modified High-Growth Scenario, All Fiber Sources, and Different Investment Strategies (mill. US$)[a]

Region/strategy	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
Baltic											
Modified high—base	n.a.	468	527	527	527	527	527	527	527	527	527
Investment—10	n.a.	550	635	665	719	768	810	870	928	1,000	1,074
Investment—25	n.a.	633	764	863	1,014	1,158	1,249	1,265	1,356	1,460	1,593
Investment—50	n.a.	738	914	1,016	1,148	1,193	1,262	1,251	1,319	1,406	1,497
Transcaucasus											
Modified high—base	n.a.	79	79	79	79	79	79	79	79	79	79
Investment—10	n.a.	80	81	82	83	83	84	85	94	99	104
Investment—25	n.a.	83	85	87	90	94	98	107	127	161	189
Investment—50	n.a.	86	92	99	119	147	158	195	180	179	187
Southwest											
Modified high—base	n.a.	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682	1,682
Investment—10	n.a.	1,848	1,946	2,033	2,207	2,394	2,639	2,754	2,814	2,954	3,109
Investment—25	n.a.	2,016	2,286	2,551	3,061	3,533	3,683	4,020	4,475	5,007	5,658
Investment—50	n.a.	2,278	2,740	2,938	3,692	4,016	4,363	4,365	4,740	5,164	5,662
Central Asian											
Modified high—base	n.a.	81	81	81	81	81	81	81	81	81	81
Investment—10	n.a.	82	82	83	83	96	100	104	109	114	119
Investment—25	n.a.	82	84	86	101	119	133	151	172	194	223
Investment—50	n.a.	83	86	92	110	139	153	167	190	219	253
Kazakhstan											
Modified high—base	n.a.	202	202	202	202	202	202	202	202	202	202
Investment—10	n.a.	207	214	219	242	254	266	280	295	311	329
Investment—25	n.a.	214	232	248	311	356	409	473	545	580	654
Investment—50	n.a.	225	257	289	376	411	487	493	546	549	590

Russia West											
Modified high—base	n.a.	8,862	8,862	8,862	8,862	8,862	8,862	8,862	8,862	8,862	8,862
Investment—10	n.a.	11,059	11,969	12,713	13,671	14,690	15,820	17,009	18,457	19,922	21,504
Investment—25	n.a.	14,338	17,274	20,839	24,798	29,744	35,682	40,347	44,055	45,850	50,943
Investment—50	n.a.	18,872	25,555	30,609	32,734	35,677	38,757	39,804	43,822	42,577	44,441
Russia East											
Modified high—base	n.a.	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634	4,634
Investment—10	n.a.	5,750	6,220	6,729	7,280	7,818	8,439	9,111	9,404	10,030	11,043
Investment—25	n.a.	7,423	8,946	10,783	12,999	15,671	18,895	22,785	27,477	33,140	39,974
Investment—50	n.a.	10,212	14,417	19,809	21,951	27,941	35,194	40,544	49,838	50,313	58,757
Russia											
Modified high—base	n.a.	13,496	13,496	13,496	13,496	13,496	13,496	13,496	13,496	13,496	13,469
Investment—10	n.a.	16,809	18,190	19,442	20,951	22,508	24,259	26,121	27,861	29,952	32,547
Investment—25	n.a.	21,761	26,220	31,622	37,797	45,415	54,577	63,131	71,533	78,990	90,917
Investment—50	n.a.	29,085	39,972	50,418	54,685	63,617	73,951	80,349	93,661	92,890	103,198
European[b]											
Modified high—base	n.a.	2,229	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288
Investment—10	n.a.	2,479	2,663	2,779	3,009	3,246	3,533	3,709	3,836	4,054	4,286
Investment—25	n.a.	2,732	3,134	3,501	4,165	4,784	5,029	5,392	5,959	6,628	7,440
Investment—50	n.a.	3,103	3,746	4,052	4,960	5,355	5,784	5,810	6,239	6,749	7,346
Central Asia and Kazakhstan											
Modified high—base	n.a.	283	283	283	283	283	283	283	283	283	283
Investment—10	n.a.	289	296	302	335	350	367	385	404	425	448
Investment—25	n.a.	296	316	334	412	474	542	624	717	774	877
Investment—50	n.a.	308	342	381	487	550	640	659	736	768	843

[a]*Abbreviations*: Investment—10 = sufficient capital available to support up to a 10 percent increase in average capacity over the previous period; investment—25 = sufficient capital available to support up to a 25 percent increase in average capacity over the previous period; investment—50 = sufficient capital available to support up to a 50 percent increase.

Table 19. Distribution of Annual Net Exports for Modified High-Growth Scenario and All Sources of Fiber for Different Investment Strategies (mill. cu. m, roundwood equivalent)[a]

Region/strategy	1989	P(1)	P(2)	P(3)	P(4)	P(5)	P(6)	P(7)	P(8)	P(9)	P(10)
Baltic											
Modified high—base	3.72	-2.46	-1.35	0.73	3.09	6.08	8.62	10.35	12.22	14.26	16.45
Investment—10	3.72	-2.46	-1.51	0.16	2.09	4.61	6.66	7.97	9.38	10.94	12.51
Investment—25	3.72	-2.46	-1.60	-0.25	1.25	3.20	4.64	5.92	7.42	9.04	10.59
Investment—50	3.72	-2.46	-1.66	-0.41	1.05	2.96	4.38	5.70	7.19	8.88	10.54
Transcaucasus											
Modified high—base	5.08	0.89	0.90	1.51	2.34	3.56	4.79	5.91	7.18	8.59	10.29
Investment—10	5.08	0.89	0.89	1.48	2.29	3.50	4.72	5.82	7.07	8.44	10.10
Investment—25	5.08	0.89	0.87	1.43	2.22	3.38	4.55	5.59	6.77	8.04	9.55
Investment—50	5.08	0.89	0.84	1.35	2.05	3.10	4.14	5.20	6.36	7.65	9.27
Southwest											
Modified high—base	25.43	-0.40	-0.62	8.30	16.12	23.96	30.21	35.66	42.20	49.82	58.74
Investment—10	25.43	-0.40	-1.66	6.13	12.71	19.09	23.67	27.21	32.30	38.76	46.44
Investment—25	25.43	-0.40	-1.90	4.92	10.35	15.24	17.92	21.74	26.55	32.24	39.02
Investment—50	25.43	-0.40	-2.05	4.65	10.09	14.50	16.83	20.49	25.32	31.02	37.82
Central Asian											
Modified high—base	8.42	1.87	1.87	2.74	4.09	6.09	7.86	9.10	10.55	12.27	14.31
Investment—10	8.42	1.87	1.87	2.74	4.08	6.08	7.83	9.05	10.49	12.18	14.20
Investment—25	8.42	1.87	1.87	2.74	4.08	6.07	7.80	8.98	10.37	12.02	13.96
Investment—50	8.42	1.87	1.87	2.74	4.08	6.06	7.76	8.94	10.32	11.95	13.88
Kazakhstan											
Modified high—base	4.51	0.66	0.71	1.89	3.18	5.15	7.12	8.86	10.98	13.56	16.71
Investment—10	4.51	0.66	0.68	1.78	2.98	4.83	6.67	8.27	10.24	12.66	15.63
Investment—25	4.51	0.66	0.68	1.66	2.70	4.32	5.86	7.14	8.94	11.15	14.09
Investment—50	4.51	0.66	0.68	1.61	2.61	4.22	5.65	7.11	8.94	11.18	14.16

Russia West											
Modified high—base	-52.79	-18.03	-5.27	38.77	86.95	161.52	218.17	244.84	270.69	300.41	335.94
Investment—10	-52.79	-18.03	-12.55	23.65	63.39	123.48	168.70	183.05	195.67	211.27	231.60
Investment—25	-52.79	-18.03	-23.48	-1.11	21.26	57.85	71.66	49.45	32.79	33.70	54.80
Investment—50	-52.79	-18.03	-41.68	-37.22	-15.70	22.27	28.80	32.62	32.79	33.70	54.80
Russia East											
Modified high—base	-37.37	-26.23	-24.65	-17.03	-8.45	3.98	13.91	19.26	25.47	32.71	38.92
Investment—10	-37.37	-26.23	-27.90	-23.76	-18.95	-11.33	-6.05	-5.65	-4.77	-3.28	-3.25
Investment—25	-37.37	-26.23	-32.76	-34.79	-37.71	-39.74	47.01	-61.88	-79.76	-101.25	-129.26
Investment—50	-37.37	-26.23	-40.87	-55.65	-71.75	-71.70	-101.18	-127.18	-155.03	-184.61	-181.43
Russia											
Modified high—base	-90.16	-44.25	-29.92	21.75	78.50	165.49	232.07	264.10	296.16	333.12	374.87
Investment—10	-90.16	-44.25	-40.45	-0.11	44.45	112.15	162.66	177.40	190.90	207.99	228.35
Investment—25	-90.16	-44.25	-56.24	-35.90	-16.45	18.11	24.65	-12.43	-46.97	-67.55	-74.46
Investment—50	-90.16	-44.25	-82.55	-92.87	-87.46	-49.43	-72.38	-94.56	-122.24	-150.91	-126.63
European[b]											
Modified high—base	34.23	-1.98	-1.07	10.53	21.55	33.60	43.62	51.93	61.60	72.68	85.48
Investment—10	34.23	-1.98	-2.27	7.77	17.09	27.20	35.04	41.00	48.75	58.14	69.06
Investment—25	34.23	-1.98	-2.63	6.10	13.82	21.83	27.12	33.26	40.74	49.32	59.17
Investment—50	34.23	-1.98	-2.88	5.59	13.19	20.56	25.36	31.39	38.86	47.54	57.63
Central Asia											
Modified high—base	12.93	2.53	2.58	4.63	7.26	11.24	14.98	17.96	21.54	25.83	31.02
Investment—10	12.93	2.53	2.55	4.53	7.07	10.91	14.50	17.33	20.73	24.84	29.83
Investment—25	12.93	2.53	2.55	4.40	6.78	10.39	13.66	16.13	19.31	23.16	28.05
Investment—50	12.93	2.53	2.55	4.35	6.69	10.28	13.42	16.05	19.25	23.13	28.04

[a]For explanation of investment strategies, see Table 18.
[b]The European region consists of the Baltic, Transcaucasus, and Southwest regions.

markets in Russia West, or to the other regions except for Central Asia and Kazakhstan, may see its future more closely linked to events taking place in the burgeoning Asian market. Thus, meeting emerging demands in the European regions from resources situated in Russia East may require an active policy on the part of the Russian government to grant preferential tariffs for the transport of goods from resource-rich to resource-poor areas in the western reaches of the former USSR. However, placing future reliance on the import of products that are directly linked to policy decisions at the governmental level exposes both final consumers and a manufacturing sector reliant on imported raw materials to the vagaries of a political system that must ration both its present financial resources and its future commitments.

While demands in the non-Russian European regions can be met in principle by their domestic forest sectors and that in Russia West well into Period 4 (2008-2013), alternatives will exist for Russia with respect to the marketing of surplus fiber. The non-Russian European regions, self-sufficient for the first two periods, will not necessarily be attractive markets for Russian producers, who will be searching for markets elsewhere. There is no guarantee that the non-Russian European regions will be able to compete for the available supply with other consumers located in Europe, where the demand of forest products also is expected to increase over at least the next two decades. Furthermore, there appears to be no nearer source of supply for this European market than Russia, which increases the urgency with which the forest industries in the non-Russian European republics in the FSU should be looking at developing domestic future fiber supplies.

Marginal increases in the productivity of the forest resource in the European region of Russia has been assumed to amount to only 10 percent of the maximum available fiber in Period One. Increases anticipated within other regions have been higher, with rises on the order of 20 to 25 percent in Latvia and Lithuania (the Baltic region) and of nearly 50 percent in the case of Belarus' (Southwest region) being projected. Higher increases in productivity of the Russian forests may in fact be possible, given additions of capital and labor, although the incremental increases should be examined more closely. Increasing the productivity of the forest resources in Russia West and the non-Russian European regions can have two effects. It will create a reserve of raw material that can be utilized to support higher domestic consumption within the regions and possibly create the opportunities to service export markets (both within and beyond FSU) that are likely to emerge within the next quarter century. Additionally, it can reduce the need to develop and bring to market in the west products supported by the potential fiber supply of Russia East, thereby decreasing the risk to the environment and economic losses connected with transportation subsidies.

Implementation of investment programs in the forest resource or even in infrastructure development will be difficult under present circumstances. The Baltic, Southwest, and Russia West regions are expected to be net exporters over the next decade, during a period in which financial resources from the public purse may be severely rationed. Given a current (albeit short-term) surplus of fiber and budgetary woes, it will be difficult to prioritize available funding to support more intensive forest management in the absence of other supporting factors, such as job creation for the presently unemployed or underemployed in the forest sectors or increasing the carbon sequestering potential of the forest resource through an active afforestation program designed to mitigate some of the impacts of global warming from increased industrial activity.

A successful transformation of the economies of the FSU countries, linked to robust export markets and an attractive environment for capital investment, could well provide

sufficient conditions not only for meeting rebounding domestic demand for forest products but also for satisfying growing demand in external markets beyond the boundaries of the former USSR for the next quarter century. The Southwest region, particularly Belarus', has the potential to become an exporter of forest products, provided an environment can be created to attract capital investment. The Baltic region, which was transformed from a net importer to a net exporter of forest products following the disintegration of the USSR, provides an indication of what could happen in the near term to the Southwest region. Over the long term, however, the former region still will need to rely on imported products to meet the rising demand produced by a rebounding economy. Furthermore, although the non-Russian states face a shortage of forest resources relative to market demand, necessitating imports over the longer term either from Russia or elsewhere, additions of capital to the forest resource, improvements in manufacturing and harvesting technology, and increased recycling of the paper and paperboard resource all can ease substantially the burden placed on imports or the domestic resource and reduce reliance on Russia as a potential source. Additionally, careful study of the uses of forest products inside the domestic economies of the former Soviet republics and the identification of alternative products may provide over the long term another method by which reliance on imported forest products can be reduced.

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