Working Paper

The Russian Forest Resource Physical Accessibility by Economic Region

Charles A. Backman

WP-94-126
December 1994

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FOREWORD

IIASA, the Russian Academy of Sciences and Russian governmental organizations initiated the Siberian Forest Study in 1992 with the overall objective of the Study to be:

- identification of possible future sustainable development options for the Siberian forest sector (assess the biospheric role of Siberian Forests, and identify suitable strategies for sustainable development of forest resources, the industry, the infrastructure and the society);

- identification of policies for the different options to be implemented by Russian and international agencies.

The first Phase of the Study was to build relevant and consistent databases for the upcoming analyses of the Siberian forest sector (Phase II). Nine cornerstone areas have been identified for the assessment analyses, namely further development of the databases, greenhouse gas balances, forest resources and forest utilization, biodiversity and landscapes, non-wood functions, environmental status, forest industry and markets, transportation infrastructure and socioeconomics.

This paper presents analyses of the physical accessibility of wood fibers in Russia based on 1988 forest inventory data.

SUMMARY OF FINDINGS AND RECOMMENDATIONS:

The Russian Forest Resource

Physical Accessibility by Economic Region

by

Dr. Charles A. BACKMAN

1. The estimated physically accessible fiber supply in the short and medium terms (next twenty years) amounts to 617 million cubic meters of solid wood fiber, 354 million cubic meters (almost 60 percent) of which originate from coniferous stands. Deciduous stands contribute an estimated 263 million cubic meters. The fiber supply consists of four components, the largest of which is the Allowable Annual Cut (AAC) from forest sector forests. This source accounts for 88 percent, or 540 million cubic meters of the total. The next two largest contributors, the AAC from the non-Forest Sector resource, and intermediate utilization, account for 5 percent each, or 30 million cubic meters and 28 million cubic meters respectively. Other utilization contributes 3 percent or 19 million cubic meters.

2. The total fiber supply can be divided into two components based on the degree of accessibility. Short term fiber supply is that for which the harvesting activity can support infrastructural development with the given level of technology. Medium term supply requires infrastructural investment not supported by the harvesting activity, or investment in technology, in order to bring it to reality.

   The short term fiber supply amounts to an estimated 417 million cubic meters, of which coniferous stands contribute 224 million cubic meters, or slightly more than 50 percent of the total. Deciduous stands contribute the balance of 193 million cubic meters. Short term fiber, accordingly, while amounting to two-thirds of the estimated short and medium term fiber, accounts for only five-eighths of the coniferous component and almost three-quarters of the deciduous component.

   The only source for the medium term fiber supply is believed to be the flow from the forest sector resource, excluding that classified as reserve. The medium term fiber supply amounts to 200 million cubic meters, 130 million of which are contributed by coniferous stands. Deciduous stands contribute the balance of 70 million cubic meters.

3. The major contributor to the short term fiber supply is the AAC supported by the forest sector forest. This components amounts to 340 million cubic meters, or 82 percent of the total. The share of the coniferous component contributed by the Forest Sector resource is slightly higher since the deciduous components of intermediate utilization, other utilization, and the AAC from the non-Forest Sector resource, account for such a

high share of the contributor specific totals. The deciduous component accounts for between 60 and 65 percent of their totals versus less than 45 percent in the Forest Sector AAC.

4. The European part of Russia accounts for 54 percent of the short term fiber supply, or 225 million cubic meters. The deciduous component represents 116 million cubic meters, or 52 percent of the European total. The coniferous component accounts for the remaining 109 million cubic meters. The principal forests supporting the coniferous component are pine and spruce/true fir, which account for one-third (36 million cubic meter) and two-thirds (73 million cubic meters) of the coniferous total respectively. The principal stands underlying the deciduous component are birch and what are believed to be aspen stands. Oak and beech stands comprise a small portion, amounting to only 6 million cubic meters.

   The medium term fiber supply is a minor sum, reaching to only 21 million cubic meters, of which coniferous and deciduous stands contribute equal shares. Of the coniferous component, pine stands account for 6 million cubic meters and spruce/true fir stands the remainder of 5 million cubic meters. Birch is still the principal component of the deciduous contribution, accounting for 60 percent, or 6 million cubic meters of the deciduous total. Aspen forest are believed to account for the remainder.

   Within the European part of Russia, two economic regions, the North Economic region and the Ural Economic region, account for three-fifths of its total. While the contribution by the AAC from the Forest Sector resource accounts for 80 percent of the short term fiber supply potential, among the economic regions of European Russia, the Forest Sector AAC share varies from 90 percent in the North Economic region to one-half in the Central Black Earth and North Caucuses Economic regions. Fiber shortages could be expected for those regions in which the components of the fiber supply other than the forest sector AAC account for a significant share. Intermediate utilization is generally not thought to be as economical as fiber produced from harvesting activities conducted against the AAC. Shortage of forest sector fiber potential thereby forcing a shift to more expensive harvesting methods.

   The coniferous resource dominates the short term fiber potential in the North region (71 percent or 55 million cubic meters), but diminishes in importance as one moves southwards. While accounting for 42 percent in the Ural region (24 million cubic meters), it accounts for less in the regions located in the central part of European Russia, reaching a nadir of less than 20 percent in the North Caucuses region.

5. The Asian economic regions of Russia, West Siberia, East Siberia, and the Far East, account for 46 percent (192 million cubic meters) of the short term fiber potential, but nearly all (90 percent or 179 million cubic meters) of the medium term fiber potential. While virtually absent from European Russia, larch forest are noticeable contributors to the West Siberia supply potential and a major factor to be considered in East Siberia and the Far East Economic regions where it accounts for almost one-quarter (15 million cubic meters) and almost three-fifths (18 million cubic meters) respectively of the short term coniferous potential fiber supply. While pine forests represent almost two-thirds (11 million cubic meters) of the West Siberian coniferous supply and slightly more than 50 percent of that in the East Siberia Economic region (34 million cubic meters), it

appears to contribute less than 5 percent of the coniferous supply in the Far East (one million cubic meters). Spruce/true fir stands account for 14 million cubic meters each in the Far East and East Siberia, and 6 million cubic meters in West Siberia. Birch is the dominant forest underlying the deciduous fiber potential in West and East Siberia where it accounts for two-thirds of the totals. Aspen is believed to account for most of the remainder. In the Far East, while birch and aspen account for three-fifths of the estimated deciduous fiber supply, specie such as oak and other hard wood deciduous trees account for a sizable share estimated to be 40 percent, or 4 million cubic meters of the deciduous total.

6. While it appears that the contributions from intermediate utilization have remained quite constant, and probably can be expected to continue at present levels, the contribution from other utilization is less certain. A large share has in the past located in Asian Russia, probably linked to developmental policies resident in the previous regime. Under present conditions existing in Russia, such levels may not be supportable as large scale projects, such as those characteristic of hydro electric development, may not continue in the near term. Although the flow potential from the non-Forest Sector forests will undoubtedly remain at levels identified in this report, the fiber potential from the Forest Sector forests cannot be taken for granted. The AAC figures were revised downwards in 1991, effectively leading to a 10 percent decline on 1990 levels. Future decreases cannot be eliminated as a re-evaluation process of the Russian resource continues. The medium term fiber supply in European Russia should therefore be considered suspect, and may prove illusionary in the longer term. Additionally, the less developed part of Russia, in which is concentrated the majority of the medium term fiber potential, lacks a developed transportation network similar to that existing in the European part of the country. The forest resource supporting the medium term fiber supply, and even part of the short term fiber supply, may not have been subjected to as rigorous a scrutiny as that possible in European Russia. Further reductions should not be completely discounted when contemplating future fiber flow for these regions of Russia.

7. Policies should be developed and implemented which support a reappraisal of the Russian forest resource. While Russia already possesses a system for classification of the forest resource, application of the criteria differentiating the resource may need to be re-visited in light of new paradigms defining valuation. Attention should be given to the degree to which future infrastructural developmental priorities of the central government will impact on the medium term fiber potential and the extent to which the pricing system in Russia will permit the forest sector to support the incremental development of the forest resource, central to the division between the short term and medium term fiber potential.

8. The larch resource accounts for a large share of the short term resource, and dominates the medium term potential supply, in the Asian part of Russia. However, larch reportedly suffers from physical and chemical characteristics which favours the use of the other coniferous species. Policies should be considered which either compensate for the inherent disadvantages surrounding larch utilization, or which support the development of new approaches in technology which can compensate for the physical and chemical properties which have hitherto worked against its utilization.

9. A deciduous resource exists in the European part of the country waiting for the appropriate conditions to foster its utilization. Developmental pressures favouring the coniferous resource in the past may have resulted in a coniferous stock, producing at less than it could do if managed in an intensive manner. While there is a need to maintain social infrastructure supported by the forest sector, some consideration should be given to policies shifting the raw material supply from coniferous species to deciduous species. This will allow the coniferous resource an opportunity to recover through less intensive use. While a deciduous resource does exist in Asian Russia, large transportation distances between supply and demand place priorities on utilization of species which can support higher transportation costs inherent in their location. Birch and aspen may not command a large enough economic surplus without additions of capital and technology to create value added products in order to accomplish this. Consequently, policies appropriate for Asian Russia may need to incorporate those which consider the role which transportation network plays in tying the Russian nation together, and the need to foster nodes of industrial activity as a resting place for human creativity.

10. Increasing additions of capital and labour to the forest resource in the European part of Russia at this juncture could lead to large dividends in the long-term. Developmental pressures have eased due to the collapse of the centrally planned economy. As economic activity rebounds with a successful introduction of a political, economic, and social contract among the different participants of the Russian system, investments now will lead to an expanded raw material base which can be used to fuel increasing welfare for the Russian peoples. In the short term, forest management activity will provide the opportunity for meaningful employment and a sense of contribution to the rebirth of the Russian nation. The risk of not providing an outlet for peoples' frustrations and sense that something is not right with the Russian house can be reduced. Solutions to problems the size which Russia is facing at this juncture in its existence can be met, but require a vehicle through which the collective energies and resolve of the Russian peoples can be focused so that the future of their nation is a sunrise and not a sunset.

Acknowledgments

This report would not have been possible without the help and patience of a number of people, not least of which is my wife, Peggy Pantel. She was extremely understanding and did not place undue demands on my time during the process of bringing this document to being. Dr. Anatoly Shvidenko provided access to statistical material and valuable insights which otherwise would not have been available. Without the financial resources provided by the Canadian Ministry of Industry, this document would not have appeared in its present form or at this particular juncture. And finally, IIASA provided the time during, and the environment within, which to complete this project.

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1. INTRODUCTION

Almost one-quarter of the global forest resources are located within Russia's borders, supporting an annual growth estimated to be 821 million cubic meters.[1] With such a large share of the global forest resources, Russian has forever captured the imagination of timber interests throughout the world. This is becoming even more apparent with the changing values which society is ascribing to Nature's endowment, and the emergence of an international consensus that greater weight must be placed on non-traditional uses of the forest resource.[2]

This forest resource until recently has supported a harvest accounting for some 10 percent of the world's production of roundwood.[3] The large difference between the apparent growth rate of the forest and the removals, amounting to more than 500 million cubic meters, has further widened under the present economic conditions, approaching 600 million cubic meters.[4] Looming fiber shortages brought on by the re-appraisal of the values flowing from the forest resource has sharpened the interest of many of its beneficiaries to regions of the world apparently rich in surplus fiber. In order to foster greater understanding of the role played by the Russian forest resources in the world environment, the Ministry of Industry and Science Canada commissioned the following study to peel back some of the veils which have shrouded the forest sector of the former USSR, and now Russia. In doing so, milestones can be introduced from which to develop more learned views concerning the role which Russia's forest resource plays and can expect to play in the global arena.

This report is divided into 5 chapters, beginning with chapter **1, Introduction**. Chapter **2, The Russian Fiber Flow Potential**, discusses at an aggregated level the degree to which forest resources of the Russian Federation can support a flow of roundwood. It is through this chapter that many of the concepts employed in the more detailed description following are introduced. In chapter **3, The Potential Fiber Flow from the Economic Regions of Russia**, the distribution of the Russian aggregated fiber flow among the different economic regions of Russia is reviewed in detail. Chapter **4** provides **Discussion and Observations** stemming from the preceding discussion. Chapter **5, Conclusions and Recommendations**, captures the major findings of the study and presents some recommendations which flow from the analysis.

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[1] Vorob'ev, G.I. *et alia, Ekonomicheskaya geografiya lesnikh resursov sssr* (Economic Geography of the Forest Resources of the USSR), p.81

[2] In the context of this report, the term, "traditional uses", is employed to define the role fulfilled when providing a flow of roundwood for the forest industry.

[3] In 1990, global production of roundwood amounted to 3,506 million cubic meters (Food and Agricultural Organization, Forest Products Annual YearBook for 1990, p. 2) During the same year, the share contributed by Russia was 304 million cubic meters, or almost 9 percent. *(Goskomstat Rossii, Narodnoye Khozyaustvo Rossiyskoy Federatsii v 1991* {National Statistics of the Russian Federation for 1991}, p. 381)

[4] The harvest levels in 1991 amounted to 269 million cubic meters, producing an apparent surplus of 552 million cubic meters (Goskomstat Rossii, *Narodnoye Khozyaystvo Rossiyskoy Federatsii v 1991* {National Statistics of the Russian Federation for 1991}, p. 381). The decline in harvest evident between 1990 and 1991 has continued, with harvest for 1992 amounting to 238 million cubic meters (Goskomstat Rossii, *Narodnoye Khozyaystvo Rossiyskoy Federatsii v 1992* {National Statistics of the Russian Federation for 1992}, p. 400). The resulting inferred surplus, accordingly, amounted to 583 million cubic meters.

2. THE RUSSIAN FIBER FLOW POTENTIAL

The forest resources of Russia can support a stream of solid wood fiber in the short to medium term from the exploitable forest resource.[5,6,7] This fiber flow originates from four sources.[8] First, the forest sector resource supports an AAC, from which flows harvest classified as the "principal utilization". The second source is called "intermediate utilization", while the third component to the fiber flow from the Russian forests is classified as "other utilization". The final component of the fiber supply is contributed by forest belonging to either agricultural or other sectoral interests.

Table 2.1 presents currently accessible (short term fiber) and potentially accessible (medium term) fiber available on an annual basis from the Russian forest resource.[9,10,11] The sum of the currently and potentially accessible fiber amounts to an estimated 617 million cubic meters, of which the presently accessible share amounts to two-thirds, or 417 million cubic meters. The potentially available fiber accordingly consists of 200 million cubic meters.

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[5]While other products, such as nuts, berries, and recreational experiences, are important sources of revenue and utility to the population, this report focuses on the flow of roundwood which could be sustainable in the near and medium terms. Consequently, benefits from non-traditional products, while potentially significant, are not discussed in the context of sustainable levels.

[6]In the context of this report, the short to medium term is employed for a period up to 20 years. This length of time corresponds to the period during which the forest establishment in the former Soviet Union based their estimates of AAC flowing from what were perceived to be the current and potentially accessible (exploitable) stands. Thus, long-term sustainability may in fact be quite different than the numbers presented in this analysis as more of the forest resource is subjected to rigorous scrutiny employing a paradigm which places greater emphasis on the non-traditional values provided by the forest resource.

[7]The forest resource of Russia is divided into two components depending on the degree to which it is considered available in the short to medium term for development. The fiber flow in the short to medium term is supported by the exploitable forest resource which accounts for almost three-fifths of the stocked forest land (446 million hectares) and two-thirds of the growing stock (55 billion cubic meters).

[8]As Backman (1993) noted, there are four components to the solid wood supply of Russia. The components are: (1) the principal utilization; (2) the intermediate utilization; (3) other utilization; and (4) non-forest sector utilization. The principal utilization is directly offset against the AAC available from the forest sector land. The harvest from non forest sector lands is also directly accounted against AAC from the non-forest sector lands. Intermediate utilization, not directly linked to the AAC, translates into volume available through such operations as thinning, or sanitation felling for purposes of stand improvement, for example. It is not clear precisely what constitutes other utilization, although the volume linked to it is not directly connected to the AAC. One of the components included with other utilization is thought to be that stemming from industrial development, notably that from land clearing for hydro-electric development.

[9]The AAC presented for Russia does not include that contributed by the Kaliningrad *Oblast'*.

[10]In addition to the roundwood available from the exploitable forest resource, roundwood supply is possible from the reserve stands, although it cannot be realistically included in with an estimate of available fiber due to its location far from existing transportation systems and/or inherent conflict with uses by the forest industry. The reserve AAC has been estimated to be in the neighbourhood of 264 million cubic meters per year.

[11]Short term fiber supply is defined by what can be expected to be accessible with the current generation of technology, and infrastructural development which can be supported by the harvesting activity. Medium term fiber supply is linked to infrastructural development which cannot be supported solely by the forest sector. Consequently, realization of the medium term fiber supply depends on additions of technology, and capital investment for infrastructural development.

The realization of the short term fiber potential depends on capital investment as well, but the capital investment is directed at supporting the production of roundwood with the given technology. In addition, capital allocated for large scale infrastructural development, such as the construction of the BAM railway, would not be considered a use of the capital in the context of short term fiber potential.

2.1 THE CURRENTLY ACCESSIBLE FIBER FLOW

The presently available fiber, amounting to 417 million cubic meters, has the four components identified above. The largest share of the presently available fiber supply, evident from **Table 2.2**, is contributed by the flow connected with the AAC in the forest sector stands (four-fifths of the total). Intermediate utilization and fiber from the non-forest sector resource each account for 7 percent of the total. The remaining 5 percent of the total is contributed through the activity of other utilization.

2.1.1 The Current Allowable Annual Cut

The presently accessible AAC amounts to an estimated 340 million cubic meters, three-fifths of which (196 million cubic meters) flow from coniferous stands. The major share from within the coniferous component is provided by spruce/true fir forest stands, which amounts to nearly one half of the coniferous total, or 94 million cubic meters. Pine stands account for slightly more than one-third (71 million cubic meters) with the balance consisting of fiber from larch stands (31 million cubic meters). The deciduous component, amounting to 40 percent of the total presently accessible AAC, contains 144 million cubic meters. The major contributors to the deciduous AAC are birch stands (86 million cubic meters) and aspen stands.[12] Minor contributions flow from the oak and beech stands which together account for less than 5 million cubic meters.

2.1.2 The Intermediate Utilization

In addition to the stream of solid wood fiber which is directly linked to the AAC in forest sector forests, the forest resource of Russia can support a flow of wood fiber through intermediate utilization. Intermediate utilization does not directly count against the AAC potential of the forests, and does provide some relief in timber deficit regions which support immature forest resource.[13,14]

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[12]The contribution from birch forest is specifically identified in (oak and beech forests are also identified), *Glavnoye upravleniye lesnikh resursov i lesopol'zovaniya za 1990 g.* (Principal Management of the Forest Resources and Utilization for 1990). It is believed that aspen stands contribute the largest share of the remainder since aspen stands account for 53 percent of the unidentified deciduous stocked forest land and 61 percent of the growing stock within the forest inventory of Russia.

[13]Isaev (1991) estimates that annually during the last decade of the twentieth century, in Russia, nearly 150 million cubic meters of wood fiber could be produced from stands in need of such activity. However, in recent years, the level of harvest has been far less than this. According to the economic conditions of the late 1980s and early 1990s, actual volume amounted to less than 30 million cubic meters per year, one-fifth of the level which the conditions of the forest resource reportedly demands (Isaev, A.S., ed., *Prognoz ispol'zovaniya i vosproizvodstva lesnikh resursov po ekonomicheskim rayonam sssr do 2010 goda v dvukh tomakh* (Prognosis of Forest Utilization and Management of the Forest Resources by Economic Region of the USSR until 2010 in two volumes), p. 273

While there appears to be a large potential supply of wood fiber available from intermediate harvesting, even under the previous regime, less than twenty percent were actually considered "economically" accessible. Accordingly, while it is difficult to provide an indication of future levels, it would seem reasonable that there would be no more than 28 million cubic meters available annually. Consequently, it is believed that a similar volume can be considered as physically accessible over the short to medium term.

[14]The 28 million cubic meter figure is based on the average value of intermediate utilization for the period 1985 to 1989 (*Lesnoye khozyaystvo RSFSR*, p. 20-22; *Ekonomika vosproizvodstva lesnikh resursov*, p. 61). The period of 1985 until 1989 inclusive was chosen to account for production variations not directly linked to the onset of economic decline of the then Soviet economy, first evident in 1990.

The average intermediate utilization produced between 1985 and 1989 amounted to 28 million cubic meters.[15,16] The coniferous share, amounting to almost 11 million cubic meters, is dominated by fiber from the pine and spruce stands which account for almost 95 percent of the coniferous total (more than 10 million cubic meters).[17] The deciduous component, amounting to almost two-thirds of the total (18 million cubic meters), derives most of its volume from birch stands (9 million cubic meters). Minor volumes appear linked to activity in oak stands (one million cubic meters) with most of the remainder thought to be due to intermediate utilization in aspen forest.

2.1.3 Other Utilization

The wood supply originating from other utilization is not part of the AAC, or flows from forests which are expected to remain part of the resource supporting long-term industrial utilization. While it is difficult to provide an estimate of the contribution of this category of harvest to the short term fiber supply, a proxy can be developed based on the level experienced under the former regime. This level of harvest amounted to an estimated 19 million cubic meters.[18]

The deciduous component of other utilization amounted to almost two-thirds of this total (12 million cubic meters), the principal specie association of which being birch, which accounts for slightly over one-half of the deciduous volume.[19] The coniferous component (7 million cubic meters) consists of nearly equal shares derived from pine and spruce/true fir stands, which together contributed 6 million cubic meters. The remaining one million cubic meters are derived through activity in larch stands.

2.1.4 The Wood Supply from the Non-Forest Sector Forest

The non-forest sector resource contributes an estimated 30 million cubic meters to the currently accessible fiber supply, 10 million cubic meters of which flow from coniferous stands. The balance, amounting to some 20 million cubic meters, consists of contributions from deciduous forest.

The coniferous component is dominated by activity in the pine and spruce stands, accounting for nearly all of the 11 million cubic meters. Larch accounts for slightly more than 7 percent of the coniferous total, or greater than three-quarters of a million cubic meters. Birch stands provide the major source of the deciduous fiber, amounting

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[15]In order to develop a proxy for physical accessibility of the intermediate utilization, it was assumed that the level of activity for the 5 years immediately preceding the year in which the decline in industrial output is first detectable, reflects the physical accessible fiber flow.

[16]The distribution of the intermediate utilization among the different species groups is not available for recent harvest. However, Backman (1993) provided an estimate based on figures available for the early 1970s. He showed that almost two-thirds of the intermediate harvest consisted of deciduous species while one-third consisted of coniferous species. It is this ratio which has been employed to derive an estimate of the coniferous volume and deciduous volume derivable through intermediate utilization.

[17]Distribution of the intermediate harvest into the specie components within the coniferous and deciduous specie groups is based on the distribution experienced in the principal harvest in 1990. Data presenting the distribution for the intermediate utilization are not available. Consequently, caution should be exercised when interpreting the volume attributed to the specie specific forests derived from intermediate utilization.

[18] While distribution of the harvest among specie associations is not available, Backman (1993) employed the distribution evident in the intermediate utilization to develop an estimate segregated by specie groups. It is this ratio which has been utilized here.

[19]Distribution of the coniferous and deciduous components of other utilization into the specie components is based on that experienced in the principal utilization in 1990. Consequently, caution should be exercised when interpreting the distribution of the volume flowing from other utilization disaggregated to the specie association level of detail.

to slightly more than one-half of the deciduous volume, or 10 million cubic meters. It is believed that aspen accounts for most of the remainder, with minor contributions from oak and beech stands.

2.2 THE POTENTIALLY ACCESSIBLE FIBER FLOW

The sole contributor to the potential fiber flow, shown in **Table 2.3**, originates from the AAC supported by the forest sector resource.[20]

2.2.1 The Potential Allowable Annual Cut

The potentially available AAC amounts to 200 million cubic meters, two-thirds of which are contributed from coniferous stands.[21] The share from larch stands accounts for slightly more than one-half of the coniferous total, or 66 million cubic meters. The balance in the coniferous component is made up of by nearly equal shares from the pine and spruce stands, which together amount to 64 million cubic meters.

The deciduous component, which reaches 70 million cubic meters, derives nearly two-thirds of its total from birch stands. While fiber potential from oak and beech stands do contribute, the majority of the remainder is thought to come from aspen forest.[22]

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[20]The potentially available AAC is the sole contributor to the potential fiber flow because of the expected higher cost of harvesting stands in more remote parts of the country. The expected cost is thought to be sufficiently high to discourage economic activity in the forest harvesting sector other than the principal utilization. Fiber from agriculture forest and the other sectors forest is not expected to contribute to the potential fiber supply since by definition all of the agricultural and other sectors forests should be accessible at the present time. While it is reasonable to expect a contribution from other utilization, the unclear nature of this harvest lead the authour to discount this as a potential source for the currently inaccessible fiber base.

[21]The potential AAC is a derived result based on the Russian estimate of AAC in the current and potentially accessible resource less the estimated currently accessible component.

[22]The distribution of the deciduous potentially available AAC into the specie association specific components beyond that linked with birch stands is not clearly identified. Consequently, the allocation of the "major part" of the balance to aspen is connected with the distribution of the forest resource among specie specific stand associations. Care should therefore be exercised when utilizing ratios derived for specie associations not specifically presented in **Tables 2.1** through **2.3**.

3. THE FIBER FLOW OF THE ECONOMIC REGIONS OF RUSSIA

Variety of climate and terrain mask a wide variation which exists among the economic regions of Russia. In order to capture the variation existing at the present time, it is necessary to review the fiber flow at a finer level of geographic detail. Chapter 3 examines fiber flow segregated by the economic regions of Russia, which are presented in **Map A**.

3.1 NORTH ECONOMIC REGION

The flow of fiber from the currently and potentially accessible stands, shown in **Table 2.1** as an estimated 84 million cubic meters, can be differentiated by the degree of access. The share which is considered currently accessible, amounting to 77 million cubic meters, accounts for more than 90 percent of the total. The potential fiber flow amounts to only 7 million cubic meters.[23]

3.1.1 The Currently Accessible Fiber Flow

The fiber flow which is currently accessible (77 million cubic meters), consisting of the four components, is dominated by the share derivable from the forest sector AAC (**Table 2.2**). This component accounts for more than 90 percent of the total, or 70 million cubic meters. Intermediate utilization and other utilization each account for two percent, with the balance of 4 percent contributed by the fiber flow from the non-forest sector forest resource.

3.1.1.1 The Allowable Annual Cut

The currently accessible AAC, amounting to 70 million cubic meters, is dominated by contributions from coniferous forest which account for more than 70 percent of the total, or 51 million cubic meters. The principal source of the coniferous volume consists of spruce and true fir stands, which account for some two-thirds of the coniferous total (37 million cubic meters). The balance flows almost entirely from pine stands (14 million cubic meters). The deciduous component, amounting to 19 million cubic meters, is dominated by contributions from birch forest, accounting for two-thirds of the deciduous total (13 million cubic meters). The remaining 6 million cubic meters are supported by fiber available from aspen stands.

3.1.1.2 The Intermediate Utilization

Intermediate utilization is expected to contribute nearly two million cubic meters annually to the current physically available fiber supply, accounting for two percent of volume. The coniferous component, which accounts for one-third, or 702 thousand cubic meters, originates to a large extent from the spruce/true fir stands (505 thousand cubic meters). The remaining coniferous volume is contributed by pine forest (197 thousand cubic meters). The deciduous component, amounting to almost two-thirds of the total (1.2 million cubic meters), receives nearly 60 percent of its volume from birch stands (665 thousand cubic meters) with the balance stemming from aspen stands.

[23] In addition to both the current and potentially available fiber, the reserve forests of the Northern Economic region are believed to support an AAC of some 13 million cubic meters, up considerable from the 5 million identified during the 1970s. The fiber represented by the AAC in the reserve stands is not considered to be realistically available in the short to medium term, and accordingly, is not considered further.

3.1.1.3 Other Utilization

The wood supply contributed by other utilization is expected to amount to 2 million cubic meters as well, or 2 percent of the total currently accessible fiber. Coniferous component of the other utilization accounts for one-third of the total (704 thousand cubic meters) with deciduous forest resource contributing the remaining two-thirds (1.2 million cubic meters). The spruce/true fir stand association dominates the coniferous component, accounting for more than 70 percent of the coniferous total (506 thousand cubic meters). The balance, amounting to 198 thousand cubic meters, flows from pine stands. Within the deciduous component of other utilization, birch stands contribute almost 60 percent of the volume with the remainder flowing primarily from what aspen forest.

3.1.1.4 The Wood Supply from the Non Forest Sector Forest

The fiber supply contributed from the non-forest sector resource amounts to an estimated 3.4 million cubic meters, of which three-fifths are believed to flow from coniferous forest (1.3 million cubic meters). More than 70 percent of the coniferous component of the non-forest sector AAC is contributed by the spruce/true fir stands (1.5 million cubic meters) with the balance originating from the pine stands (588 thousand cubic meters). Birch stands contribute the largest share of the deciduous AAC, amounting to nearly 60 percent of the deciduous total with aspen providing the remainder.

3.1.2 The Potentially Accessible Fiber Flow

The potentially accessible AAC amounts to 7 million cubic meters, almost three-quarters of which consists of coniferous species (**Table 2.3**). The major stand association in the coniferous component is pine which represents almost 55 percent of the coniferous total. While spruce/true fir stands make up most of the remainder, a small volume is available from larch stands which amounts to one percent of the coniferous volume. In the deciduous component, amounting to 2 million cubic meters, two-thirds flow from birch stands with the balance contributed by aspen stands.

3.2 NORTH-WEST ECONOMIC REGION

The forest resources of the North-West Economic region appear able to support an estimated fiber flow of 19 million cubic in the short to medium term, of which 15 million are believed to be currently accessible with minimal infrastructural development (**Table 2.1 and 2.2**). The potential fiber flow, which depends on infrastructural development or the introduction of new technology in the harvesting process, contributes 4 million cubic meters (**Table 2.3**).[24]

3.2.1 The Currently Accessible Fiber Flow

Fiber available through the AAC on forest sector forests contributes 70 percent (nearly 11 million cubic meters) of the total current accessible fiber of 15 million cubic meters. Fiber from the non-forest sector forests account for slightly more than 15 percent, or 2.6 million cubic meters, while intermediate utilization contributes another one-eighth (1.8 million cubic meters) of the total. Fiber from other utilization is a minor contributor to the overall currently accessible fiber flow.

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[24]Even though the Northwest Economic region contains reserve forest, it has been assumed to be of sufficiently low site not to contribute to the AAC.

3.2.1.1 The Allowable Annual Cut

Nearly 45 percent of the currently accessible AAC (11 million cubic meters) consists of coniferous species, or 4.7 million cubic meters. The principal species association within the coniferous AAC is spruce-true fir, which accounts for 3.2 million cubic meters. Pine makes up most of the remaining 1.5 million cubic meters. Deciduous stands account for 55 percent of the AAC, or 6 million cubic meters, with the largest share concentrated in birch forests (3.5 million cubic meters). The balance of 2.5 million cubic meters are thought to be mainly contributed by aspen stands.

3.2.1.2 The Intermediate Utilization

Intermediate utilization is expected to contribute 1.8 million cubic meters to the annual fiber flow, comprising 700 thousand cubic meters from coniferous forest and 1.1 million cubic meters from deciduous forest. The coniferous component consists mainly of fiber flowing from spruce/true fir stands which account for two-thirds of the conifer total. The balance is derived from pine stands. Birch forest still contributes a significant share to the deciduous component of intermediate utilization, but the share is less than 50 percent, or 513 thousand cubic meters. The balance is believed to come from aspen stands.

3.2.1.3 The Other Utilization

Other utilization is not a major contributor to the fiber potential of the North-West economic region, comprising only one percent of the current total, or 211 thousand cubic meters. The coniferous component, amounting to 83 thousand cubic meters, consists mainly of fiber originating from spruce/true fir stands, which account for two-thirds of the coniferous total. Pine stands contribute the remainder. Birch stands are a major source of the deciduous fiber flow, forming 45 percent of the 143 thousand cubic meter deciduous total. Aspen stands are expected to account for the remaining deciduous total.

3.2.1.4 The Wood Supply from the Non Forest Sector Forest

The non-forest sector resource is estimated to contribute 2.6 million cubic meters to the currently accessible fiber, 70 percent of which flows from deciduous forests (1.8 million cubic meters). Birch stands contribute the major component of the volume, comprising 45 percent of the deciduous total. The coniferous component, which amounts to almost 800 thousand cubic meters, flows mainly from spruce/true fir association (two-thirds) and pine associations (one-third).

3.2.2 The Potentially Accessible Fiber Flow

The potential fiber flow, which depends on infrastructural development or the introduction of new technology in the harvesting process, contributes 4 million cubic meters. The coniferous component, amounting to 1.7 million cubic meters, consists of nearly equal shares from pine stands and spruce/true fir stands. More than 55 present of this total, or greater than 2 million cubic meters, is contributed by deciduous stands, the major specie association being birch.

3.3 CENTRAL ECONOMIC REGION

Table 2.1 shows the current and potential fiber flow supportable from the forest resources of the Central Economic region reaching almost 37 million cubic meters, of

which the current share amounts to some 34 million cubic meters. The potentially accessible AAC is only 3 million cubic meters.[25]

3.3.1 The Currently Accessible Fiber Flow

The currently accessible fiber, shown in **Table 2.2**, reaches 34 million cubic meters, of which the largest contributor is the forest sector AAC (71 percent). Intermediate utilization and the flow due to the non-forest sector AAC each contribute 14 percent, or 4.7 million cubic meters. The balance of some one percent is provided by other utilization (511 thousand cubic meters).

3.3.1.1 The Allowable Annual Cut

The forests of the Central Economic region support a currently accessible AAC estimated to be 24 million cubic meters. Deciduous stands account for two-thirds of the currently accessible total (16 million cubic meters), with the principal source consisting of birch stands (8.4 million cubic meters). The balance is believed to primarily flow from aspen stands. The coniferous component, amounting to almost 9 million cubic meters, comes mainly from spruce/true fir stands which account for almost three-fifths of the coniferous total (4.5 million cubic meters) with pine stands comprising the remainder (3.4 million cubic meters).

3.3.1.2 The Intermediate Utilization

The contribution of Intermediate utilization amounts to more than 4.6 million cubic meters, nearly two-thirds of which flow from deciduous stands (2.9 million cubic meters). The coniferous component originating from spruce/true fir stands (one million cubic meters) amounts to nearly 60 percent of the coniferous total of 1.8 million cubic meters. Pine comprises the balance. Birch accounts for one-half of the deciduous component with the remainder originating primarily from what are believed to be aspen stands.

3.3.1.3 The Other Utilization

Contributing some one to two percent of the fiber flow, other utilization is expected to account for no more than 511 thousand cubic meters annually. As with the intermediate utilization, deciduous component contributes almost two-thirds of the total, or 322 thousand cubic meters. The principal deciduous specie association is birch which accounts for one-half of the deciduous total, or 1.6 million cubic meters. The remaining one-half flows mainly from aspen stands. Spruce/true fir stands account for the majority of the coniferous component, amounting to more than 55 percent of the 189 thousand cubic meters. The balance consists of contributions from the pine stands.

3.3.1.4 The Wood Supply from the Non Forest Sector Forest

The contribution from the non-forest sector forests amounts to an estimated 4.6 million cubic meters, almost 70 percent of which originates from deciduous stands. Of the 3.2 million cubic meters flowing from deciduous forest, one-half, or 1.6 million cubic meters, comes from birch stands. Except for minor amounts contributed by the oak resource, the balance flows from what are believed to be aspen stands. The coniferous component, which amounts to 1.4 million cubic meters, is dominated by contributions from the spruce/true fir stand associations, which account for 814 thousand cubic meters. The balance comes from the pine stands.

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[25]Reserve AAC, absent from this region even though the Central Economic region contains reserve forest, does not exist due to, it is believed, the low site class characterizing these reserve forests.

3.3.2 The Potentially Accessible Fiber Flow

The potentially accessible fiber, flowing completely from the potentially accessible AAC, amounts to 3 million cubic meters. Two-thirds of the potential fiber flow originates from deciduous stands (1.9 million cubic meters), with birch contributing the largest share, amounting to nearly 50 percent of the total. In the coniferous component (935 thousand cubic meters), spruce/true fir stands contribute three-fifths of the total with pine stands making up the remainder.

3.4 VOLGO-VYATSKIY ECONOMIC REGION

The estimated fiber flow from the Volgo-Vyatskiy Economic region, presented in **Table 2.1**, amounts to 28 million cubic meters, 95 percent of which is considered to be currently accessible. The potential fiber flow amounts to only 1.7 million cubic meters.[26]

3.4.1 The Currently Accessible Fiber Flow

The currently accessible fiber flow (26 million cubic meters), presented in **Table 2.2**, is dominated by the fiber from the AAC provided by the forest sector forest. This component accounts for four-fifths of the total, or 21 million cubic meters. Intermediate utilization accounts for another 13 percent (3.3 million cubic meters) with fiber from the non-forest sector forests accounting for 7 percent (1.7 million cubic meters). The fiber from the other utilization is not significance at 327 thousand cubic meters.

3.4.1.1 The Allowable Annual Cut

More than one-third of the AAC of 21 million cubic meters flows from coniferous stands, amounting to almost 8 million cubic meters. The principal species association from which the coniferous AAC originates is spruce-true fir, accounting for 4.6 million cubic meters, or almost 60 percent of the coniferous total. Pine stands make-up the remaining 3.3 million cubic meters. Deciduous stands contribute 13 million cubic meters, or two-thirds of the total of 21 million cubic meters. The largest specie group, birch, accounts for nearly 8 million cubic meters. The balance of 5 million cubic meters flows mainly from what are believed to be aspen stands.

3.4.1.2 The Intermediate Utilization

Intermediate utilization contributes 3.3 million cubic meters annually to the fiber potential in the currently accessible forests. Deciduous stands, accounting for 2 million cubic meters, consist primarily of fiber contributed by birch stands (1.2 million). The balance, amounting to some 800 thousand cubic meters, consists mainly of fiber contributed from aspen forest. The coniferous component, amounting to 1.2 million cubic meters, flows mainly from spruce/true fir stands (725 thousand cubic meters) with the balance from pine stands (519 thousand cubic meters).

3.4.1.3 The Other Utilization

The wood supply contributed by other utilization is not a major component to the fiber potential of the Volgo-Vyatskiy region, contributing 327 thousand cubic meters annually. Deciduous stands contribute three-fifths of this (206 thousand cubic meters), the principal component of which being contributed by birch stands (124 thousand cubic meters). Aspen forest are thought to contribute the balance, except for minor

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[26] In addition to the current and potential fiber flow, the reserve forests are thought to support an AAC of more than 2 million cubic meters. However, this volume is not expected to become available for at least twenty years, and accordingly, has not been factored into the fiber flow figures.

volumes from oak stands (80 thousand cubic meters). The coniferous component, amounting to 121 thousand cubic meters, is dominated by spruce/true fir stands which represent almost three-fifths of the coniferous total. Pine stands contribute the balance.

3.4.1.4 The Wood Supply from the Non Forest Sector Forest

The wood flowing from the non-forest sector resource is expected to amount to 1.7 million cubic meters, of which coniferous stands contribute slightly more than one-half, or 886 thousand cubic meters. Spruce stands account for three-fifths (516 thousand cubic meters) of the coniferous total with pine accounting for the remaining 370 thousand cubic meters. The deciduous component (826 thousand cubic meters) is dominated by birch stands which account for 60 percent (496 thousand cubic meters) of the deciduous total. The balance flows primarily from aspen stands.

3.4.2 The Potentially Accessible Fiber Flow

The potential AAC, shown in **Table 2.3** amounting to 1.7 million cubic meters, consists of a deciduous component representing some 60 percent of the total, and a coniferous component representing the remainder. Fiber from birch stands dominates the deciduous component, accounting for three-fifths of the deciduous total of 1.1 million cubic meters, while spruce/true fir accounts for 80 percent (502 thousand cubic meters) of the coniferous total of 631 thousand cubic meters. Pine accounts for the remaining 129 thousand cubic meters within the coniferous component of the AAC.

3.5 Black Earth Economic Region

Evident from **Table 2.1**, the forest resource of the Black Earth Economic region appears to support a fiber flow of more than 2 million cubic meters annually, virtually all of which are considered to be currently accessible.[27]

3.5.1 The Currently Accessible Fiber Flow

While the largest share is contributed by the fiber flow connected with the AAC in the forest sector forests (1.1 million cubic meters), intermediate utilization contributes more than 40 percent, or 875 thousand cubic meters (**Table 2.2**). The remaining 10 percent is made-up of contributions from other utilization and from the resource under non-forest sector control.

3.5.1.1 The Allowable Annual Cut

The forests of the Black Earth Economic region supports an AAC estimated to be in the vacinity of 1.1 million cubic meters. Nearly four-fifths of the AAC flows from deciduous stands (840 thousand cubic meters), the principal species association of which being oak (329 thousand cubic meters). The coniferous component, amounting to 240 thousand cubic meters, consists entirely of fiber emanating from pine stands.

3.5.1.2 The Intermediate Utilization

Intermediate utilization is expected to contribute 875 thousand cubic meters to the fiber flow of the Black Earth region, nearly two-thirds of which come from deciduous stands. The principal specie association is thought to be oak, accounting for 215 thousand cubic meters of the 543 thousand cubic meters total. The coniferous

[27] In addition to the accessible fiber supply, some 250 thousand cubic meters of AAC are believed to be contributed by the reserve stands. This volume, however, is not expected to be available within the next twenty years, and so is not discussed further.

component, amounting to 332 thousand cubic meters, is believed to flow solely from pine stands.

3.5.1.3 The Other Utilization

The wood supply originating under this category is not a major contributor to the fiber flow, amounting to only 41 thousand cubic meters. The deciduous component, accounting for almost two-thirds of the total, is dominated by oak stands. The coniferous component consists entirely of fiber flowing from pine stands.

3.5.1.4 The Wood Supply from the Non Forest Sector Forest

The wood flowing from this resource contributes 7 percent of the currently available fiber, or 152 thousand cubic meters. Deciduous species contribute nearly four-fifths of the total (119 thousand cubic meters), the principal stand contributor being oak (47 thousand cubic meters). The coniferous share amounts to one-fifth, or 32 thousand cubic meters, the principal stand component being pine.

3.5.2 The Potentially Accessible Fiber Flow

There does not appear to be any potentially accessible fiber available in the Black Earth economic region (**Table 2.3**).

3.6 POVOLZHSKIY ECONOMIC REGION

Evident from **Table 2.1**, the total fiber flow available from the Povolzhskiy Economic Region amounts to an estimated 10 million cubic meters. All of the total fiber potential is located in what is considered to be the currently accessible resource.[28]

3.6.1 The Currently Accessible Fiber Flow

All of the current and potentially accessible fiber is considered to be presently accessible. The largest share of the 10 million cubic meter volume of currently accessible fiber is supported by the forest sector forest resource, which amounts to almost 7 million cubic meters (**Table 2.2**). Intermediate utilization contributes almost one-quarter (2.6 million cubic meters) of the fiber with the balance consisting of minor amounts from other utilization and forests not under control of the forest authorities.

3.6.1.1 The Allowable Annual Cut

The forest sector forests of the Povolzhskiy Economic region support an AAC estimated to be almost 7 million cubic meters. Nearly seven-eighths of the AAC (5.9 million cubic meters) is supported by deciduous stands. The principal species associations within the deciduous AAC are oak and birch which contribute 1.5 million and one million cubic meters respectively. Aspen stands are also a major contributor to the deciduous fiber supply, thought to contribute most of the remainder. The coniferous component, amounting to almost one million cubic meters, flows almost completely from the pine stands.

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[28] In addition to the 10 million cubic meters of fiber, identified above, reserve forests appear to support an allowable cut of some 250 thousand cubic meters. However, this fiber is located within stands which are believed to be sensitive to development by the forest industry posing intractable impediments to exploitation in the short and medium term. Consequently, the reserve AAC is not considered when developing an estimate of the currently and potentially accessible fiber available in the Povolzhskiy region.

3.6.1.2 The Intermediate Utilization

Intermediate utilization has been estimated to be 2.6 million cubic meters, or 27 percent of the fiber potential. The coniferous component, accounting for almost one-third, or one million cubic meters, flows primarily from pine stands. Trace volume is believed to originate from the spruce/true fir forest resource. The deciduous component of the intermediate volume, accounting for almost 65 percent of the total volume, or 1.6 million cubic meters, consists of oak (324 thousand cubic meters), birch (302 thousand cubic meters) and an unknown volume from what are believed to be aspen stands.

3.6.1.3 The Other Utilization

The wood supply originating under this category does not contribute a significant share of the fiber available from the currently accessible stands. Amounting to only 100 thousand cubic meters, almost two-thirds are contributed by deciduous forest (64 thousand cubic meters). The principal specie associations consist of oak, aspen and birch. The coniferous component, accounting for one-third of the total, flows almost completely from pine stands.

3.6.1.4 The Wood Supply from the Non Forest Sector Forest

The contribution from the non-forest sector resource amounts to an estimated 400 thousand cubic meters, three-quarters of which are contributed from deciduous stands. The deciduous component (296 thousand cubic meters) depends on aspen, oak and birch stands, which collectively account for virtually all of the deciduous volume. The coniferous component of almost 100 thousand cubic meters flows almost completely from pine stands with trace amounts originating from spruce/true fir forest.

3.6.2 The Potentially Accessible Fiber Flow

Evident from **Table 2.3**, there does not appear to the any potentially accessible fiber in the Povolzhskiy region.

3.7 North Caucuses Economic Region

The forest resources of the North Caucuses Economic region can support an estimated fiber flow of only three million cubic meters, more than 80 percent of which flows from deciduous stands (**Table 2.1**). The currently accessible component accounts for virtually all of the identified volume.[29]

3.7.1 The Currently Accessible Fiber Flow

The share of the currently accessible fiber, shown in **Table 2.2** to amount to 3.1 million cubic meters, which is contributed by the forest sector forest resource amounts to 1.6 million cubic meters, or approximately one-half of the total currently accessible. The flow from intermediate utilization accounts for another 35 percent, or 1.1 million cubic meters. The non-forest sector AAC contributes approximately 10 percent (276 thousand cubic meters) of the fiber flow with trace amounts provided through other utilization.

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[29] In addition to this volume, the forest resource in reserve stands supports an AAC of some 675 thousand cubic meters per year. However, for the same reasons presented previously, this volume is not expected to contribute in a meaningful way to the fiber potential available in the short and medium terms.

3.7.1.1 The Allowable Annual Cut

The forests of the North Caucuses Economic region support an AAC estimated to be 1.6 million cubic meters. The share which is located in the forest resource currently accessible amounts to 1.6 million cubic meters. More than 95 percent of the AAC is contributed by deciduous stands, amounting to 1.5 million cubic meters. The principal species association from which the deciduous AAC flows are oak and beech, which contributed 0.7 million and almost 0.4 million cubic meters respectively. The small share of coniferous AAC is contributed completely from spruce/true fir stands.

3.7.1.2 The Intermediate Utilization

Intermediate utilization contributes a significant share of the fiber flow, amounting to one million cubic meters. Nearly two-thirds of the volume is contributed from deciduous stands, in which the major species are oak and beech. The balance, originating from coniferous stands, is dominated by spruce/true fir.

3.7.1.3 The Other Utilization

The wood supply originating from other utilization is not a large part of the fiber potential, contributing almost 140 thousand cubic meters. Nearly two-thirds (86 thousand cubic meters) are believed to consist of deciduous stands, the principal species being oak and beech. The balance of 50 thousand cubic meters is contributed by coniferous stands, concentrated in spruce/true-fir specie associations.

3.7.1.4 The Wood Supply from the Non Forest Sector Forest

The total volume of wood expected from the non-forest sector resource amounts to some 275 thousand cubic meters, nearly all of which consists of deciduous species (261 thousand cubic meters). The principal species consist of oak and beech.

3.7.2 The Potentially Accessible Fiber Flow

Evident from **Table 2.3**, there does not appear to be any potentially available AAC at the present time.

3.8 URAL ECONOMIC REGION

The forest resources of the Ural Economic Region are believed capable of supporting 62 million cubic meters of fiber, 57 million of which are thought to be currently accessible (**Table 2.1**). The potentially accessible forest resource contributes nearly 6 million cubic meters.[30]

3.8.1 The Currently Accessible Fiber Flow

Of the 57 million cubic meters of currently available fiber (**Table 2.2**), that from the forest sector forests accounts for four-fifths, or 46 million cubic meters. Intermediate utilization provides another 9 percent (5.2 million cubic meters) with non forest sector forests providing 6 percent (3.6 million cubic meters). Fiber derived through other utilization amounts to only 3 percent of the total (2 million cubic meters).

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[30] In addition to the fiber flow, another 9 million cubic meters of fiber are supported in the reserve forests. Since this resource is not expected to be available in the short and medium terms, and accordingly is not considered available for development, it is not considered part of the fiber potential.

3.8.1.1 The Allowable Annual Cut

The forests of the Ural Economic region supports an AAC estimated to be 46 million cubic meters. Nearly 60 percent of the AAC is contributed by deciduous stands (27 million cubic meters), the principal specie association being birch and aspen. The 40 percent accounted for by the coniferous forests (20 million cubic meters) consists of more than two-thirds of spruce/true fir stands and one-third of pine stands.

3.8.1.2 The Intermediate Utilization

Intermediate utilization contributes slightly more than 5 million cubic meters of fiber, almost two-thirds of which consist of deciduous stands. Birch forest account for two-thirds (2.2 million cubic meters) of the deciduous component of 3.2 million cubic meters) with aspen thought to represent most of the remainder. The coniferous component, amount to more than one-third (2 million cubic meters) of the total, obtains some three-fifths of its total from spruce/true fir stands (1.4 million cubic meters) with the balance flowing from pine stands.

3.8.1.3 The Other Utilization

The wood supply contributed by other utilization is not large, amounting to 2 million cubic meters, or 3 percent of the total. Deciduous stands contribute more than 60 percent, or 1.2 million cubic meters, the principal specie association being birch (842 thousand cubic meters). Coniferous stands, accounting for one-third of the total, receive fiber primarily from spruce/true fir stands (510 thousand cubic meters) and pine stands (220 thousand cubic meters).

3.8.1.4 The Wood Supply from the Non Forest Sector Forest

The forest resource not under control by the forest authorities contributes 3.5 million cubic meters to the currently accessible total, nearly three-fifths of which consist of deciduous species (2.2 million cubic meters). Birch dominates the deciduous component accounting for two-thirds, or 1.5 million cubic meters). Spruce/fir dominate the coniferous total, contributing almost one million cubic meters of the 1.4 million coniferous total. The remainder flows from pine stands.

3.8.2 The Potentially Accessible Fiber Flow

The potentially accessible AAC, amounting to 6 million cubic meters, consists of a deciduous component (three-fifths) and a coniferous component (two-fifths) (**Table 2.3**). Two-thirds of the coniferous component are contributed by pine stands (1.4 million of a total 2.4 million) with the balance by spruce/true fir stands. In the deciduous component, birch stands account for two-thirds (2.1 million cubic meters) with the balance thought to consist of aspen (one million cubic meters).

3.9 WEST SIBERIA ECONOMIC REGION

The forest resources of West Siberia supports a fiber flow of estimated to be almost 100 million cubic meters (**Table 2.1**). The potentially accessible component of this total amount is 44 million cubic meters while the currently accessible share amounts to 55 million cubic meters.[31]

[31] In addition to this, the reserve stands are believed to support an AAC of almost 35 million cubic meters. The reserve AAC cannot be expected to contribute realistically in the short to medium term, and is not therefore discussed in this section.

3.9.1 The Currently Accessible Fiber Flow

The fiber from the forest sector forests accounts for 70 percent, or 39 million cubic meters of the currently accessible volume of 55 million cubic meters. Other utilization and fiber from the non-forest sector resource together account for one-quarter of the total (13.3 million cubic meters) with intermediate utilization providing the remaining 5 percent (2.6 million cubic meters)

3.9.1.1 The Allowable Annual Cut

The share of the AAC which is currently accessible amounts to 39 million cubic meters, nearly two-thirds of which flow from deciduous stands (25 million cubic meters). The principal species association from which the deciduous AAC originates is birch (17 million cubic meters). The balance is contributed by aspen stands. The coniferous AAC, amounting to 14 million cubic meters, consists of contributions from pine stands (63 percent) and spruce/true for (33 percent). Larch stands contribute almost 5 percent of the total AAC.

3.9.1.2 The Intermediate Utilization

Intermediate utilization is expected to contribute 2.6 million cubic meters towards the potential fiber supply of West Siberia, or 5 percent of the current total. Approximately two-thirds of the volume consists of deciduous species, the principal specie association being birch (903 thousand cubic meters) followed by aspen 700 thousand cubic meters). In the coniferous component, pine stands (615 thousand cubic meters) contribute some 60 percent with the balance accounted for by spruce/true for stands (325 thousand cubic meters) and larch stands (39 thousand cubic meters).

3.9.1.3 The Other Utilization

The wood supply contributed by other utilization accounts for 12 percent of the fiber supply in the short term, or 6.6 million cubic meters. Deciduous stands contribute nearly two-thirds of the total volume, or 4.2 million cubic meters, the primarily specie association of which being birch (2.3 million cubic meters). Aspen accounts for the remaining share. The coniferous component, amounting to 2.4 million cubic meters, consists mainly of pine stands (1.5 million cubic meters) followed by spruce/true fir stands (808 thousand cubic meters). Larch stands contribute a minor amount of almost 100 thousand cubic meters to the coniferous total.

3.9.1.4 The Wood Supply from the Non Forest Sector Forest

The non-forest sector resource is expected to contribute 12 percent of the fiber supply, or 6.7 million cubic meters. Deciduous stands account for five-sixths of the total (5.6 million cubic meters), the major species being birch (3.1 million cubic meters), followed by aspen. The coniferous component, accounting for one million cubic meters, consists of contributions from pine stands (60 percent) and from spruce/true fir stands (40 percent). Trace amounts are contributed from the larch stands.

3.9.2 The Potentially Accessible Fiber Flow

The potentially accessible AAC, shown in **Table 2.3** amounting to 44 million cubic meters, comes mainly from deciduous stands, which account of two-thirds of the total (29 million cubic meters). Birch forest is the principal contributor, accounting for two-thirds of the deciduous potential AAC, or 19 million cubic meters, with aspen accounting for the remainder. In the coniferous component, contributions from pine stands account for some 60 percent (9.6 million cubic meters) with spruce/true

accounting for most of the remainder (5 million cubic meters) save 6 percent coming from the larch stands (944 thousand cubic meters).

3.10 East Siberia Economic Region

The forest resources of East Siberia are able to support fiber flow of 167 million cubic meters. Of the 167 million cubic meters in the current and potentially accessible forests, 73 million cubic meters are considered to be accessible at the present time. The share which is currently accessible amounts to 94 million cubic meters (see **Table 2.1**).[32]

3.10.1 The Currently Accessible Fiber Flow

The fiber available from the forest sector forests as AAC amounts to more than 85 percent of the 94 million cubic meters, or 81 million cubic meters (**Table 2.2**). The contribution from other utilization and fiber from the non-forest sector resource contribute together another 10 percent of the total (10.3 million cubic meters). Intermediate utilization contributes the balance of three percent (2.9 million cubic meters).

3.10.1.1 The Allowable Annual Cut

The forest sector forests of East Siberia support an AAC estimated to be 81 million cubic meters. Nearly three-quarters of the AAC flow from coniferous stands, amounting to 58 million cubic meters. The principal species association within the coniferous AAC is pine, which accounts for almost 55 percent, or 31 million cubic meters, of the total. Spruce/true fir and larch stands in equal shares contribute the balance of the coniferous AAC. Deciduous stands, accounting for the remainder, provide 23 million cubic meters of AAC. The largest share is concentrated in birch forests which represent 70 of the deciduous total. The balance comes from aspen stands.

3.10.1.2 The Intermediate Utilization

Intermediate utilization is expected to contribute nearly 3 million cubic meters of the current fiber flow, almost two-thirds of which consist of deciduous stands (1.8 million cubic meters). Birch stands account for slightly more than 55 percent of the volume (934 thousand cubic meters) with the balance flowing from aspen stands. The coniferous component consists of wood from pine stands (50 percent), larch stands (25 percent), and spruce/true fir stands (25 percent).

3.10.1.3 The Other Utilization

Other utilization is expected to contribute some 5 million cubic meters to the currently accessible wood supply. Two thirds is expected to consist of deciduous species (3.4 million cubic meters), the principal component of which flows from birch stands (1.8 million cubic meters). Coniferous forest, contributing one-third of the volume, consist mainly of flows from pine stands (1.1 million cubic meters), with equal volumes from spruce/true fir stands (454 thousand cubic meters) and larch stands (471 thousand cubic metros).

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[32] In addition to this fiber flow from the presently and potentially accessible resource, another 120 million cubic meters are located in the reserve forests which are not expected to contribute to the fiber flow within the next twenty years.

3.10.1.4 The Wood Supply from the Non Forest Sector Forest

The non-forest sector resource is expected to provide nearly 5 million cubic meters of wood, one-half of which consist of roundwood from deciduous stands. Both birch (1.3 million cubic meters) and aspen stands (1.2 million cubic meters) contribute equally to the deciduous component. The coniferous component receives its wood primarily from pine stands (1.3 million cubic meters) with equal shares coming from larch (580 thousand cubic meters) and spruce/true for stands (559 thousand cubic meters).

3.10.2 The Potentially Accessible Fiber Flow

The potentially available AAC, amounting to 73 million cubic meters, is dominated by the coniferous component, which accounts for 70 percent of the total, or 52 million cubic meters (**Table 2.3**). The dominant specie association in the coniferous component is larch which represent slightly more than 50 percent (27 million cubic meters). Spruce/true fir stands account for some 30 percent (14 million cubic meters) with pine stands comprising the balance (10 million cubic meters). Birch stands contribute the majority of the 21 million cubic meters of deciduous AAC (15 million cubic meters) with the balance contributed by aspen forest.

3.11 THE FAR EAST ECONOMIC REGION

The forest resource of the Far East Economic region appears to be able to support a fiber flow from the current and potentially accessible forest resource of 105 million cubic meters per year (**Table 2.1**).[33] Of the 105 million cubic meters of fiber available in the current and potentially available resource, 62 million cubic meters are considered to be potentially available subject to infrastructural investment or the introduction of new technology. The balance of 43 million cubic meters is what is believed to be currently accessible.

3.11.1 The Currently Accessible Fiber Flow

The presently available fiber flow arises primarily from the fiber available in forest sector forests, which account for nearly 90 percent of the 43 million cubic meters, or 38 million cubic meters (**Table 2.2**). The fiber flow from other utilization contributes some 5 percent of the total (2.2 million cubic meters) with intermediate utilization and fiber from the non-forest sector resource accounting for 3 percentage points apiece (in total 2.7 million cubic meters).

3.11.1.1 The Allowable Annual Cut

The forests of the Far Eastern Economic region supports an AAC of only 38 million cubic meters. Nearly 85 percent of the AAC, or 32 million cubic meters, comes from coniferous stands. The principal species association within the coniferous AAC is larch, which accounts for 17 million cubic meters, or almost two-thirds of the coniferous total. Spruce/true fir makes up most of the remainder. Deciduous stands contribute 6 million cubic meters of AAC. The largest share of the fiber supply is concentrated in birch forests which represent approximately one-half of the deciduous total. Oak stands and aspen stands contribute the largest share of the remainder.

[33]To this volume must be added the 90 million cubic meters of fiber flow available from the reserve forests which is not expected to be available for at least twenty years.

3.11.1.2 The Intermediate Utilization

Intermediate utilization is expected to contribute 1.4 million cubic meters of fiber, two-thirds of which flow from deciduous stands. The deciduous component is represented by birch stands, aspen stands and oak stands. The coniferous component is dominated by larch and spruce/true fir stands which together account for most of the fiber flow of intermediate utilization.

3.11.1.3 The Other Utilization

Other utilization is expected to contribute some 2 million cubic meters of wood flow annually, two-thirds of which are expected to flow from deciduous stands. The birch stands are believed to contribute the largest share of the deciduous wood fiber followed by both aspen stands and oak stands. Larch stands are the major contributor on the coniferous component of the wood supply from other utilization.

3.11.1.4 The Wood Supply from the Non Forest Sector Forest

The wood flowing from this resources expected to contribute slightly more than 1.3 million cubic meters, nearly 80 percent of which consists of coniferous species. Birch and aspen stands account for major components of the deciduous fiber flow.

3.11.2 The Potentially Accessible Fiber Flow

Shown in **Table 2.3**, the potential AAC amounts to 62 million cubic meters. Coniferous stands contribute almost 85 percent of the total (51 million cubic meters), with larch stands accounting for the largest share (38 million cubic meters). Birch, aspen and oak are major contributors to the deciduous component of the potential AAC.

4. OBSERVATIONS AND DISCUSSIONS

Observations and discussions are structured around two broad geographic units, Russia, and the Economic Regions. Within each of these broad categories, comments are organized about the following topics, numbered as 1) Accessibility; 2) Components of the Fiber Supply; and 3) Specie Associations. An additional category, numbered 4) Fiber Availability, is included in the section discussing detail at the Economic Region level.

4.1 RUSSIA

While the forest resources of Russia are enormous, accounting for one-quarter of the world's inventory, not all can be considered accessible in the near to medium terms. Of the 771 million hectares of stocked forest land and 82 billion cubic meters of growing stock, at most only 58 percent of the stocked forest land and 67 percent of the growing stock can be considered to be currently or potentially accessible within the next twenty years. This exploitable resource supports a fiber supply estimated to be 617 million cubic meters.

4.1.1 Accessibility

However, well important this figure may be, what is more important given the present unsettled economic, political and social conditions existing in Russia, is the share of the fiber flow which is accessible with the given level of technology, and which does not require infrastructural investment beyond that which can be supported by forest sector activity. The share of the currently and potentially accessible fiber flow contributed by

this component amounts to an estimated 417 million cubic meters, shown in **Figure 4.1**.

4.1.2 Components of Fiber Supply

The currently accessible fiber supply consists of four components, the largest being the fiber available from the forest sector forest resource (**Figure 4.2**). This category of fiber contributes four-fifths of the total, or 340 million cubic meters. Intermediate utilization accounts for 28 million cubic meters (7 percent), other utilization for 19 million cubic meters (5 percent), while the AAC from the non-forest sector resource contributes 30 million cubic meters (7 percent). The sole component of the potentially accessible fiber supply flows from the AAC in the potentially accessible forest sector forest resource, underscoring the difficulty attached to bringing to reality this component of the fiber supply.

The low share of coniferous species in the non-forest sector component emphasizes the nature of the forest resource supporting this fiber flow. Three-quarters of the forest resource is located in forests allocated to the agricultural sector. The agricultural lands have been subjected to development for a long period of time suggesting that a high degree of the forest land should support immature forest (four-fifths of the agricultural resource versus one-half in the forest sector exploitable resource). Agricultural land too tends to be located in the better sites and more hospitable parts of the country which would support conversion from coniferous forest to deciduous forest under conditions of extensive forest management. (Three-fifths of the forest resource in agricultural forests are deciduous versus one-quarter in forest sector forests). It is more difficult to explain the high share of deciduous species in the intermediate harvest, although this could indicate a high level of sanitation felling designed to restore previously damaged stands. The high deciduous component in the other utilization is assumed to be similar to the experience in the intermediate utilization.

4.1.3 Specie Components

The coniferous component of the fiber supply accounts for almost 55 percent of the currently accessible fiber and 65 percent of the potentially accessible fiber. However this ratio changes with the different components, varying from 36 percent in the non-forest sector component to nearly 60 percent in the component contributed from the currently accessible forest sector resource.

The principal specie association supporting the coniferous AAC (**Figure 4.3**) is spruce/true fir which accounts for nearly one-half of the 224 million cubic meters, or 108 million cubic meters. Pine stands contribute one-third of the coniferous total with the balance provided from larch stands (34 million cubic meters).

However, when the potential fiber supply is examined, it is from larch stands which the majority of the fiber flows, contributing 66 million of the 130 million coniferous component. While spruce/true-fir stands still provide a greater supply than pine stands, the difference narrows considerably with pine stands providing 29 million cubic meters and spruce/true-fir providing 34 million cubic meters.

The differences between the shares of the coniferous resource contributed by each of the coniferous components in the currently accessible fiber and those evident in the potentially accessible fiber are linked to an historical preference for pine and spruce/true fir interacting with the general location of larch stands. Larch stands tend to be located in the lesser developed reaches of the country. Since larch has been under represented in the past, it stands that it should be over represented in the potential fiber supply. Correspondingly, since pine and spruce/true fir stands have been preferred in the past

coupled with the extensive nature of the larch resource, it is to be expected that pine and spruce/true fir should be under represented in the potential stands.

Birch stands are the principal component of the currently accessible deciduous fiber with aspen stands providing the largest share of the balance. However, Russia does contain a significant volume of forest resource in oak and beech stands which contribute nearly 7 million cubic meters of currently available fiber which should not be overlooked when considering the forest of Russia as a purveyor of wood fiber. These last two species can support a higher value added industry including the manufacture of furniture.

4.2 ECONOMIC REGIONS

However important Russia's forest resource and the indicators describing it, the aggregated numbers mask a wide diversity evident when examining the resource distributed among the economic regions of Russia.

4.2.1 Accessibility

The potential fiber supply is a major component of the overall supply in all regions of Asian Russia where it represents between 45 percent and 60 percent of the total currently and potentially accessible fiber supply (**Figure 4.1**). However, caution should be exercised when interpreting the long-term availability of the fiber represented by the potential fiber supply. Virtually all is located in the Asian Russia which is predominantly overlain with permafrost. Climate conditions can be severe, compounding the distance from domestic markets and the preponderance of a lower value specie (larch). Shifting priorities of the Russian government may effectively preclude the allocation of large sums for the type of infrastructural development necessary to bring this resource to the currently accessible stage, necessitating a large investment from non Russian government sources. Consequently, when developing an estimate for the physically accessible fiber supply of Asian Russia, the share contributed by the potentially accessible resource should be discounted accordingly.

Furthermore, when examining the potentially accessible fiber located in the European part of the Russia, the potential component should also be discounted heavily. European Russia has been subjected to the longest period of development. However, these stands were not developed over preference of the resource in Siberia and The Far East. Consequently, it is believed that the potentially accessible resource in the European part of the country may suffer from environmental constraints that effectively preclude development. Therefore, fiber availability in the short to medium term should be considered in the context of the currently accessible component only.

4.2.2 Components of Fiber Supply

The contribution of the non-forest sector and components of intermediate utilization and other utilization are more critical to the fiber supply of European Russia than in Asian Russia where more than 90 percent of the fiber is contributed by the forest sector AAC (**Figure 4.2**). In European Russia, the aggregated percent amounts to slightly more than 80 percent, but varies dramatically among the Economic regions comprising European Russia. The low value is reached in the North Caucuses Region and Black Earth Region where forest sector AAC contributes one-half of the total and reaches a high of more than 90 percent in the North Economic region. Thus, when contemplating investment in the forest sector of Russia, care should be exercised over the degree to which the fiber supply is supported by an underlying forest resource. Reliance on fiber contributed from intermediate utilization and other utilization may suggest that long-term fiber deficits loom as the economy in Russia recovers. Additionally, relying on the fiber supply from non-forest sector lands may be unwise. The resource was originally

allocated to the other sectors to support internal use by them. While fiber may be available in the short term due to the decline in economic activity, recovery may effectively preclude uses other than by the organization which was granted the resource in the first place.

4.2.3 Specie Components

Excluding the North Economic region from the European total shows that the forest resource over much of the area is dominated by that flowing from the deciduous stands. In fact, the deciduous component exceeds fifty percent of the fiber supply in all cases except for the North Economic region, East Siberia regions, and The Far East region (**Figure 4.4**).

European Russia is characterized by a lack of larch fiber, present only in trace amounts in the Ural and North economic regions (**Figure 4.5**). Spruce/true fir dominates the coniferous component in the North region, while forming a more balanced share with pine stands in the other economic regions of Russia. Contrarily, fiber from the larch stands dominates the fiber supply of the Far East economic region where it represents more than 50 percent of the coniferous volume. In the East Siberian economic region, larch is a major component, but contributes slightly less than 40 percent of the coniferous total. West Siberia has a minor component of larch which is lost between the pine and the spruce/true fir components.

Hardwood deciduous species are a minor component of the overall timber supply, but are more prevalent in regions of the central part of European Russia where it accounts for between 23 and 45 percent of the deciduous fiber supply. A hardwood deciduous supply also is present in the Far East economic region which could support the establishment of a furniture industry.

4.2.4 Fiber Supply

The current fiber supply is concentrated in five regions which collectively account for 78 percent of the total. These regions are the North, Ural, West Siberia, East Siberia, and the Far East. The other regions, all of which are located in European Russia, are minor players thought to be located in regions which are believed to have suffered from a timber shortage under the previous regime. Consequently, while timber surpluses undoubtedly exist at the present time throughout Russia given the sharp decline in the industrial output, care should be exercised when entertaining investment to examine the historic demand and supply within each region to develop a better understanding of the long-term surplus to the installed capacity. The high share of deciduous resource evident in European Russia and West Siberia are in all probability more available than a comparable volume of coniferous species. An historic preference for coniferous species has left a large supply of deciduous resource accessible but lacking an appropriate use. Consequently, long-term fiber availability may be more secure for those operations which can use either coniferous or deciduous species. If the domestic industry cannot utilize the deciduous resource, there is less likely to be political pressures to curtail its use by foreign enterprises to ensure that domestic industry can continue to operate.

5. CONCLUSIONS and RECOMMENDATIONS

Conclusions and recommendations flowing from the study are presented in point form. This section is repeated as the summary of the report.

1. The estimated physically accessible fiber supply in the short and medium terms (next twenty years) amounts to 617 million cubic meters of solid wood fiber, 354 million cubic meters (almost 60 percent) of which originate from coniferous stands. Deciduous stands contribute an estimated 263 million cubic meters. The

fiber supply consists of four components, the largest of which is the Allowable Annual Cut (AAC) from forest sector forests. This source accounts for 88 percent, or 540 million cubic meters of the total. The next two largest contributors, the AAC from the non-Forest Sector resource, and intermediate utilization, account for 5 percent each, or 30 million cubic meters and 28 million cubic meters respectively. Other utilization contributes 3 percent or 19 million cubic meters.

2. The total fiber supply can be divided into two components based on the degree of accessibility. Short term fiber supply is that for which the harvesting activity can support infrastructural development with the given level of technology. Medium term supply requires infrastructural investment not supported by the harvesting activity, or investment in technology, in order to bring it to reality.

   The short term fiber supply amounts to an estimated 417 million cubic meters, of which coniferous stands contribute 224 million cubic meters, or slightly more than 50 percent of the total. Deciduous stands contribute the balance of 193 million cubic meters. Short term fiber, accordingly, while amounting to two-thirds of the estimated short and medium term fiber, accounts for only five-eighths of the coniferous component and almost three-quarters of the deciduous component.

   The only source for the medium term fiber supply is believed to be the flow from the forest sector resource, excluding that classified as reserve. The medium term fiber supply amounts to 200 million cubic meters, 130 million of which are contributed by coniferous stands. Deciduous stands contribute the balance of 70 million cubic meters.

3. The major contributor to the short term fiber supply is the AAC supported by the forest sector forest. This components amounts to 340 million cubic meters, or 82 percent of the total. The share of the coniferous component contributed by the Forest Sector resource is slightly higher since the deciduous components of intermediate utilization, other utilization, and the AAC from the non-Forest Sector resource, account for such a high share of the contributor specific totals. The deciduous component accounts for between 60 and 65 percent of their totals versus less than 45 percent in the Forest Sector AAC.

4. The European part of Russia accounts for 54 percent of the short term fiber supply, or 225 million cubic meters. The deciduous component represents 116 million cubic meters, or 52 percent of the European total. The coniferous component accounts for the remaining 109 million cubic meters. The principal forests supporting the coniferous component are pine and spruce/true fir, which account for one-third (36 million cubic meter) and two-thirds (73 million cubic meters) of the coniferous total respectively. The principal stands underlying the deciduous component are birch and what are believed to be aspen stands. Oak and beech stands comprise a small portion, amounting to only 6 million cubic meters.

   The medium term fiber supply is a minor sum, reaching to only 21 million cubic meters, of which coniferous and deciduous stands contribute equal shares. Of the coniferous component, pine stands account for 6 million cubic meters and spruce/true fir stands the remainder of 5 million cubic meters. Birch is still the principal component of the deciduous contribution, accounting for 60 percent, or 6 million cubic meters of the deciduous total. Aspen forest are believed to account for the remainder.

   Within the European part of Russia, two economic regions, the North Economic region and the Ural Economic region, account for three-fifths of its total. While

the contribution by the AAC from the Forest Sector resource accounts for 80 percent of the short term fiber supply potential, among the economic regions of European Russia, the Forest Sector AAC share varies from 90 percent in the North Economic region to one-half in the Central Black Earth and North Caucuses Economic regions. Fiber shortages could be expected for those regions in which the components of the fiber supply other than the forest sector AAC account for a significant share. Intermediate utilization is generally not thought to be as economical as fiber produced from harvesting activities conducted against the AAC. Shortage of forest sector fiber potential thereby forcing a shift to more expensive harvesting methods.

The coniferous resource dominates the short term fiber potential in the North region (71 percent or 55 million cubic meters), but diminishes in importance as one moves southwards. While accounting for 42 percent in the Ural region (24 million cubic meters), it accounts for less in the regions located in the central part of European Russia, reaching a nadir of less than 20 percent in the North Caucuses region.

5. The Asian economic regions of Russia, West Siberia, East Siberia, and the Far East, account for 46 percent (192 million cubic meters) of the short term fiber potential, but nearly all (90 percent or 179 million cubic meters) of the medium term fiber potential. While virtually absent from European Russia, larch forest are noticeable contributors to the West Siberia supply potential and a major factor to be considered in East Siberia and the Far East Economic regions where it accounts for almost one-quarter (15 million cubic meters) and almost three-fifths (18 million cubic meters) respectively of the short term coniferous potential fiber supply. While pine forests represent almost two-thirds (11 million cubic meters) of the West Siberian coniferous supply and slightly more than 50 percent of that in the East Siberia Economic region (34 million cubic meters), it appears to contribute less than 5 percent of the coniferous supply in the Far East (one million cubic meters). Spruce/true fir stands account for 14 million cubic meters each in the Far East and East Siberia, and 6 million cubic meters in West Siberia. Birch is the dominant forest underlying the deciduous fiber potential in West and East Siberia where it accounts for two-thirds of the totals. Aspen is believed to account for most of the remainder. In the Far East, while birch and aspen account for three-fifths of the estimated deciduous fiber supply, specie such as oak and other hard wood deciduous trees account for a sizable share estimated to be 40 percent, or 4 million cubic meters of the deciduous total.

6. While it appears that the contributions from intermediate utilization have remained quite constant, and probably can be expected to continue at present levels, the contribution from other utilization is less certain. A large share has in the past located in Asian Russia, probably linked to developmental policies resident in the previous regime. Under present conditions existing in Russia, such levels may not be supportable as large scale projects, such as those characteristic of hydro electric development, may not continue in the near term. Although the flow potential from the non-Forest Sector forests will undoubtedly remain at levels identified in this report, the fiber potential from the Forest Sector forests cannot be taken for granted. The AAC figures were revised downwards in 1991, effectively leading to a 10 percent decline on 1990 levels. Future decreases cannot be eliminated as a re-evaluation process of the Russian resource continues. The medium term fiber supply in European Russia should therefore be considered suspect, and may prove illusionary in the longer term. Additionally, the less developed part of Russia, in which is concentrated the majority of the medium term fiber potential, lacks a developed transportation network similar to that existing in the European part of the country. The forest resource supporting the medium term fiber supply, and even part of the short term fiber supply, may not

have been subjected to as rigorous a scrutiny as that possible in European Russia. Further reductions should not be completely discounted when contemplating future fiber flow for these regions of Russia.

7. Policies should be developed and implemented which support a reappraisal of the Russian forest resource. While Russia already possesses a system for classification of the forest resource, application of the criteria differentiating the resource may need to be re-visited in light of new paradigms defining valuation. Attention should be given to the degree to which future infrastructural developmental priorities of the central government will impact on the medium term fiber potential and the extent to which the pricing system in Russia will permit the forest sector to support the incremental development of the forest resource, central to the division between the short term and medium term fiber potential.

8. The larch resource accounts for a large share of the short term resource, and dominates the medium term potential supply, in the Asian part of Russia. However, larch reportedly suffers from physical and chemical characteristics which favours the use of the other coniferous species. Policies should be considered which either compensate for the inherent disadvantages surrounding larch utilization, or which support the development of new approaches in technology which can compensate for the physical and chemical properties which have hitherto worked against its utilization.

9. A deciduous resource exists in the European part of the country waiting for the appropriate conditions to foster its utilization. Developmental pressures favouring the coniferous resource in the past may have resulted in a coniferous stock, producing at less than it could do if managed in an intensive manner. While there is a need to maintain social infrastructure supported by the forest sector, some consideration should be given to policies shifting the raw material supply from coniferous species to deciduous species. This will allow the coniferous resource an opportunity to recover through less intensive use. While a deciduous resource does exist in Asian Russia, large transportation distances between supply and demand place priorities on utilization of species which can support higher transportation costs inherent in their location. Birch and aspen may not command a large enough economic surplus without additions of capital and technology to create value added products in order to accomplish this. Consequently, policies appropriate for Asian Russia may need to incorporate those which consider the role which transportation network plays in tying the Russian nation together, and the need to foster nodes of industrial activity as a resting place for human creativity.

10. Increasing additions of capital and labour to the forest resource in the European part of Russia at this juncture could lead to large dividends in the long-term. Developmental pressures have eased due to the collapse of the centrally planned economy. As economic activity rebounds with a successful introduction of a political, economic, and social contract among the different participants of the Russian system, investments now will lead to an expanded raw material base which can be used to fuel increasing welfare for the Russian peoples. In the short term, forest management activity will provide the opportunity for meaningful employment and a sense of contribution to the rebirth of the Russian nation. The risk of not providing an outlet for peoples' frustrations and sense that something is not right with the Russian house can be reduced. Solutions to problems the size which Russia is facing at this juncture in its existence can be met, but require a vehicle through which the collective energies and resolve of the Russian peoples can be focused so that the future of their nation is a sunrise and not a sunset.

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FIGURE 4.1: Russia and Regions - Currently and Potentially Accessible Fiber Flow

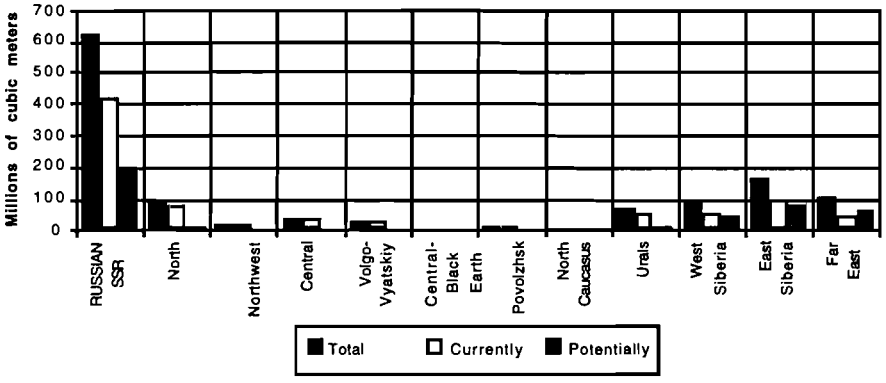


FIGURE 4.2: Russia and Regions - Components of the Currently Accessible Fiber Flow

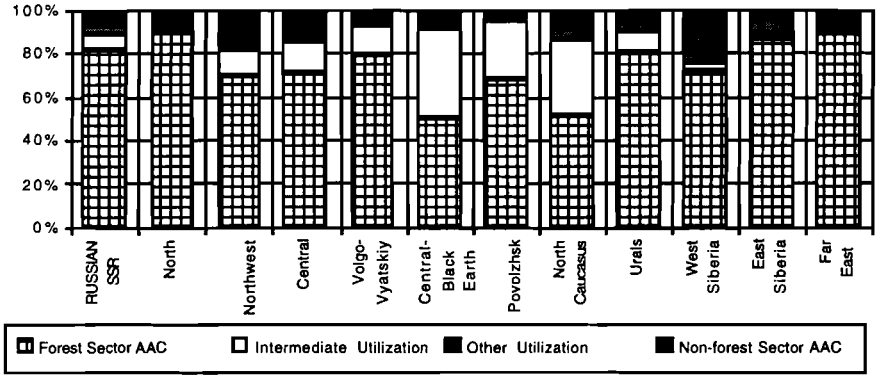


FIGURE 4.3: Russia - Specie Associations of Currently Accessible Fiber Flow

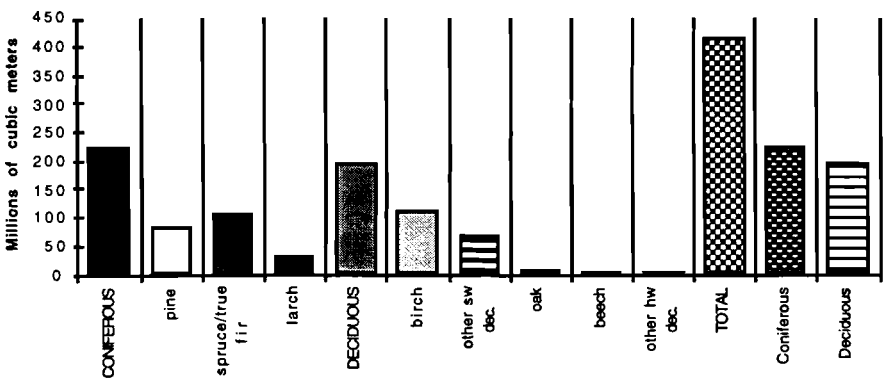


FIGURE 4.4: Russia - Specie Groups of Currently Accessible Fiber Flow

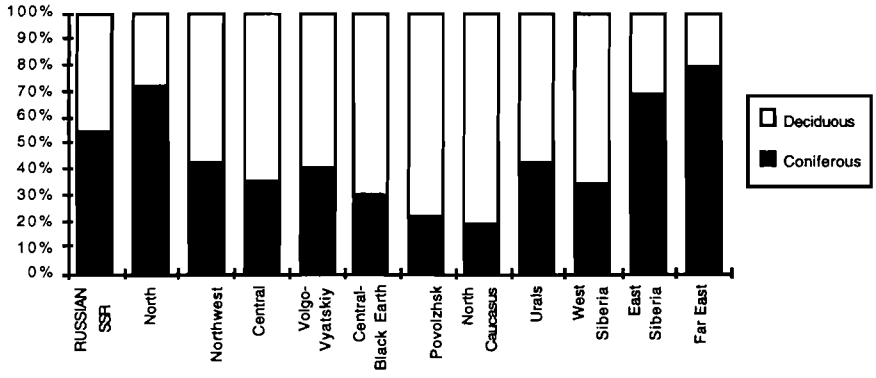


FIGURE 4.5: Russia and Regions - Specie Groups of Currently Accessible Fiber Flow

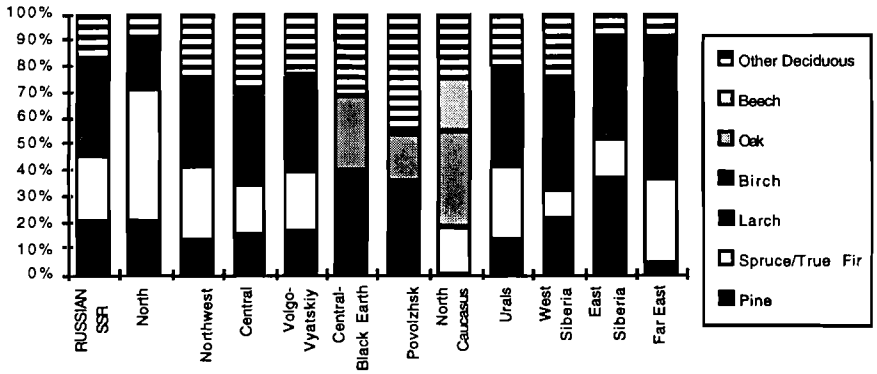


Table 2.1: RUSSIA and REGIONS: Estimated Maximum Fiber Flow in the Short and Medium Terms (million cubic meters)

	Coniferous	of which: pine	spruce-true fir	larch
Currently and Potentially Accessible Forest AAC				
RUSSIAN SSR (excl. Kaliningrad)	326	100	128	98
European Russia of which:	103	36	67	0
North	56	17	39	0
Northwest	6	3	3	0
Central	9	4	5	0
Volgo-Vyatskiy	8	3	5	0
Central-Black Earth	0	0	0	0
Povolzhsk	1	1	0	0
North Caucasus	0	0	0	0
Urals	22	7	15	0
Asian Russia of which:	223	64	61	98
West Siberia	29	18	10	1
East Siberia	110	42	27	41
Far East	83	4	24	55
Intermediate Utilization				
RUSSIAN SSR (excl. Kaliningrad)	11	5	5	1
European Russia of which:	8	4	5	0
North	1	0	1	0
Northwest	1	0	0	0
Central	2	1	1	0
Volgo-Vyatskiy	1	1	1	0
Central-Black Earth	0	0	0	0
Povolzhsk	1	1	0	0
North Caucasus	0	0	0	0
Urals	2	1	1	0
Asian Russia of which:	3	1	1	1
West Siberia	1	1	0	0
East Siberia	1	1	0	0
Far East	1	0	0	0

Source: CAB/IIASA

Table 2.1 (continued)

	Coniferous	of which: pine	spruce-true fir	larch
Other Utilization				
RUSSIAN SSR (excl. Kaliningrad)	7	3	3	1
European Russia of which:	2	1	1	0
North	1	0	1	0
Northwest	0	0	0	0
Central	0	0	0	0
Volgo-Vyatskiy	0	0	0	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	1	0	1	0
Asian Russia of which:	5	3	2	1
West Siberia	2	2	1	0
East Siberia	2	1	0	0
Far East	1	0	0	0
Non Forest Sector AAC				
RUSSIAN SSR (excl. Kaliningrad)	11	4	5	1
European Russia of which:	7	2	4	0
North	2	1	2	0
Northwest	1	0	1	0
Central	1	1	1	0
Volgo-Vyatskiy	1	0	1	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	1	0	1	0
Asian Russia of which:	4	2	1	1
West Siberia	1	1	0	0
East Siberia	2	1	1	1
Far East	0	0	0	0

Source: CAB/IIASA

Table 2.1 (continued)

Total	Coniferous	of which: pine	spruce-true fir	larch
RUSSIAN SSR (excl. Kaliningrad)	354	113	142	100
European Russia of which:	120	43	77	0
North	60	18	42	0
Northwest	8	4	4	0
Central	12	5	7	0
Volgo-Vyatskiy	11	4	6	0
Central-Black Earth	1	1	0	0
Povolzhsk	2	2	0	0
North Caucasus	1	0	1	0
Urals	26	9	17	0
Asian Russia of which:	234	70	64	100
West Siberia	34	21	11	2
East Siberia	116	45	29	42
Far East	85	4	24	56

Source: CAB/IIASA

Table 2.1 (continued)

	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
Cur. and Pot. Acc. Forest AAC						
RUSSIAN SSR (excl. Kaliningrad)	214	131	71	6	0	5
European Russia of which:	99	56	37	4	0	2
North	21	14	7	0	0	0
Northwest	8	5	3	0	0	0
Central	18	9	8	0	0	0
Volgo-Vyatskiy	14	8	5	0	0	0
Central-Black Earth	1	0	0	0	0	0
Povolzhsk	6	1	3	1	0	0
North Caucasus	2	0	0	1	0	0
Urals	30	19	9	1	0	1
Asian Russia of which:	115	75	34	2	0	4
West Siberia	54	36	18	0	0	0
East Siberia	44	31	13	0	0	0
Far East	17	8	3	2	0	4
Interm. Utilization						
RUSSIAN SSR (excl. Kaliningrad)	18	9	7	1	0	0
European Russia of which:	13	6	6	1	0	0
North	1	1	0	0	0	0
Northwest	1	1	1	0	0	0
Central	3	1	1	0	0	0
Volgo-Vyatskiy	2	1	1	0	0	0
Central-Black Earth	1	0	0	0	0	0
Povolzhsk	2	0	1	0	0	0
North Caucasus	1	0	0	0	0	0
Urals	3	2	1	0	0	0
Asian Russia of which:	4	2	2	0	0	0
West Siberia	2	1	1	0	0	0
East Siberia	2	1	1	0	0	0
Far East	1	0	0	0	0	0

Source: CAB/IIASA

Table 2.1 (continued)

	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
Other Utilization						
RUSSIAN SSR (excl. Kaliningrad)	12	7	5	0	0	0
European Russia of which:	3	2	1	0	0	0
North	1	1	1	0	0	0
Northwest	0	0	0	0	0	0
Central	0	0	0	0	0	0
Volgo-Vyatskiy	0	0	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	1	1	0	0	0	0
Asian Russia of which:	9	5	4	0	0	0
West Siberia	4	2	2	0	0	0
East Siberia	3	2	2	0	0	0
Far East	1	1	0	0	0	0
Non For. Sector AAC						
RUSSIAN SSR (excl. Kaliningrad)	19	10	8	0	0	0
European Russia of which:	10	5	4	0	0	0
North	1	1	1	0	0	0
Northwest	2	1	1	0	0	0
Central	3	2	2	0	0	0
Volgo-Vyatskiy	1	0	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	2	1	1	0	0	0
Asian Russia of which:	9	5	4	0	0	0
West Siberia	6	3	2	0	0	0
East Siberia	2	1	1	0	0	0
Far East	1	0	0	0	0	0

Source: CAB/IIASA

Table 2.1 (continued)

Total	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
RUSSIAN SSR (excl. Kaliningrad)	263	157	91	7	1	7
European Russia of which:	126	70	48	5	1	2
North	24	16	8	0	0	0
Northwest	11	6	5	0	0	0
Central	24	13	11	1	0	0
Volgo-Vyatskiy	17	10	7	0	0	0
Central-Black Earth	2	0	1	1	0	0
Povolzhsk	8	1	5	2	0	0
North Caucasus	3	0	0	1	1	0
Urals	37	23	12	1	0	2
Asian Russia of which:	137	87	43	2	0	5
West Siberia	65	42	23	0	0	0
East Siberia	51	35	16	0	0	0
Far East	20	9	4	2	0	5

Source: CAB/IIASA

Table 2.1 (continued)

	Coniferous	Deciduous	TOTAL
Currently and Potentially Accessible Forest AAC			
RUSSIAN SSR (excl. Kaliningrad)	326	214	540
European Russia of which:	103	99	203
North	56	21	77
Northwest	6	8	15
Central	9	18	27
Volgo-Vyatskiy	8	14	23
Central-Black Earth	0	1	1
Povolzhsk	1	6	7
North Caucasus	0	2	2
Urals	22	30	52
Asian Russia of which:	223	115	337
West Siberia	29	54	83
East Siberia	110	44	154
Far East	83	17	100
Intermediate Utilization			
RUSSIAN SSR (excl. Kaliningrad)	11	18	28
European Russia of which:	8	13	21
North	1	1	2
Northwest	1	1	2
Central	2	3	5
Volgo-Vyatskiy	1	2	3
Central-Black Earth	0	1	1
Povolzhsk	1	2	3
North Caucasus	0	1	1
Urals	2	3	5
Asian Russia of which:	3	4	7
West Siberia	1	2	3
East Siberia	1	2	3
Far East	1	1	1

Source: CAB/IIASA

Table 2.1 (continued)

	Coniferous	Deciduous	TOTAL
Other Utilization			
RUSSIAN SSR (excl. Kaliningrad)	7	12	19
European Russia	2	3	5
of which:			
North	1	1	2
Northwest	0	0	0
Central	0	0	1
Volgo-Vyatskiy	0	0	0
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	1	1	2
Asian Russia	5	9	14
of which:			
West Siberia	2	4	7
East Siberia	2	3	5
Far East	1	1	2
Non Forest Sector AAC			
RUSSIAN SSR (excl. Kaliningrad)	11	19	30
European Russia	7	10	17
of which:			
North	2	1	3
Northwest	1	2	3
Central	1	3	5
Volgo-Vyatskiy	1	1	2
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	1	2	4
Asian Russia	4	9	13
of which:			
West Siberia	1	6	7
East Siberia	2	2	5
Far East	0	1	1

Source: CAB/IIASA

Table 2.1 (continued)

	Coniferous	Deciduous	TOTAL
Total			
RUSSIAN SSR (excl. Kaliningrad)	354	263	617
European Russia	120	126	246
of which:			
North	60	24	84
Northwest	8	11	19
Central	12	24	37
Volgo-Vyatskiy	11	17	28
Central-Black Earth	1	2	2
Povolzhsk	2	8	10
North Caucasus	1	3	3
Urals	26	37	63
Asian Russia	234	137	371
of which:			
West Siberia	34	65	99
East Siberia	116	51	167
Far East	85	20	105

Source: CAB/IIASA

Table 2.2: RUSSIA and REGIONS: Estimated Maximum Fiber Flow in the Short Term (million cubic meters)

	Coniferous	of which: pine	spruce-true fir	larch
Cur. Access. AAC				
RUSSIAN SSR (excl. Kaliningrad)	196	71	94	31
European Russia	92	30	63	0
of which:				
North	51	14	37	0
Northwest	5	1	3	0
Central	8	3	5	0
Volgo-Vyatskiy	8	3	5	0
Central-Black Earth	0	0	0	0
Povolzhsk	1	1	0	0
North Caucasus	0	0	0	0
Urals	20	6	14	0
Asian Russia	104	41	31	31
of which:				
West Siberia	14	9	5	1
East Siberia	58	31	13	14
Far East	32	1	14	17
Interm. Utilization				
RUSSIAN SSR (excl. Kaliningrad)	11	5	5	1
European Russia	8	4	5	0
of which:				
North	1	0	1	0
Northwest	1	0	0	0
Central	2	1	1	0
Volgo-Vyatskiy	1	1	1	0
Central-Black Earth	0	0	0	0
Povolzhsk	1	1	0	0
North Caucasus	0	0	0	0
Urals	2	1	1	0
Asian Russia	3	1	1	1
of which:				
West Siberia	1	1	0	0
East Siberia	1	1	0	0
Far East	1	0	0	0

Source: CAB/IIASA

Table 2.2 (continued)

	Coniferous	of which: pine	spruce-true fir	larch
Other Utilization				
RUSSIAN SSR (excl. Kaliningrad)	7	3	3	1
European Russia of which:	2	1	1	0
North	1	0	1	0
Northwest	0	0	0	0
Central	0	0	0	0
Volgo-Vyatskiy	0	0	0	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	1	0	1	0
Asian Russia of which:	5	3	2	1
West Siberia	2	2	1	0
East Siberia	2	1	0	0
Far East	1	0	0	0
Non For. Sec. AAC				
RUSSIAN SSR (excl. Kaliningrad)	11	4	5	1
European Russia of which:	7	2	4	0
North	2	1	2	0
Northwest	1	0	1	0
Central	1	1	1	0
Volgo-Vyatskiy	1	0	1	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	1	0	1	0
Asian Russia of which:	4	2	1	1
West Siberia	1	1	0	0
East Siberia	2	1	1	1
Far East	0	0	0	0

Source: CAB/IIASA

Table 2.2 (continued)

Total	Coniferous	of which: pine	spruce-true fir	larch
RUSSIAN SSR (excl. Kaliningrad)	224	83	108	34
European Russia of which:	109	36	73	0
North	55	15	39	0
Northwest	6	2	4	0
Central	11	5	6	0
Volgo-Vyatskiy	10	4	6	0
Central-Black Earth	1	1	0	0
Povolzhsk	2	2	0	0
North Caucasus	1	0	1	0
Urals	24	7	17	0
Asian Russia of which:	115	47	35	34
West Siberia	18	11	6	1
East Siberia	64	34	14	15
Far East	33	1	14	18

Source: CAB/IIASA

Table 2.2 (continued)

	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
Cur. Access. AAC						
RUSSIAN SSR (excl. Kaliningrad)	144	86	50	4	0	3
European Russia of which:	89	50	33	4	0	2
North	19	13	6	0	0	0
Northwest	6	4	2	0	0	0
Central	16	8	7	0	0	0
Volgo-Vyatskiy	13	8	5	0	0	0
Central-Black Earth	1	0	0	0	0	0
Povolzhsk	6	1	3	1	0	0
North Caucasus	2	0	0	1	0	0
Urals	27	17	8	1	0	1
Asian Russia of which:	55	36	16	1	0	1
West Siberia	25	17	8	0	0	0
East Siberia	23	16	7	0	0	0
Far East	6	3	1	1	0	1
Interm. Utilization						
RUSSIAN SSR (excl. Kaliningrad)	18	9	7	1	0	0
European Russia of which:	13	6	6	1	0	0
North	1	1	0	0	0	0
Northwest	1	1	1	0	0	0
Central	3	1	1	0	0	0
Volgo-Vyatskiy	2	1	1	0	0	0
Central-Black Earth	1	0	0	0	0	0
Povolzhsk	2	0	1	0	0	0
North Caucasus	1	0	0	0	0	0
Urals	3	2	1	0	0	0
Asian Russia of which:	4	2	2	0	0	0
West Siberia	2	1	1	0	0	0
East Siberia	2	1	1	0	0	0
Far East	1	0	0	0	0	0

Source: CAB/IIASA

Table 2.2 (continued)

	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
Other Utilization						
RUSSIAN SSR (excl. Kaliningrad)	12	7	5	0	0	0
European Russia of which:	3	2	1	0	0	0
North	1	1	1	0	0	0
Northwest	0	0	0	0	0	0
Central	0	0	0	0	0	0
Volgo-Vyatskiy	0	0	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	1	1	0	0	0	0
Asian Russia of which:	9	5	4	0	0	0
West Siberia	4	2	2	0	0	0
East Siberia	3	2	2	0	0	0
Far East	1	1	0	0	0	0
Non For. Sec. AAC						
RUSSIAN SSR (excl. Kaliningrad)	19	10	8	0	0	0
European Russia of which:	10	5	4	0	0	0
North	1	1	1	0	0	0
Northwest	2	1	1	0	0	0
Central	3	2	2	0	0	0
Volgo-Vyatskiy	1	0	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	2	1	1	0	0	0
Asian Russia of which:	9	5	4	0	0	0
West Siberia	6	3	2	0	0	0
East Siberia	2	1	1	0	0	0
Far East	1	0	0	0	0	0

Source: CAB/IIASA

Table 2.2 (continued)

Total	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
RUSSIAN SSR (excl. Kaliningrad)	193	111	70	6	1	4
European Russia of which:	116	64	45	5	1	2
North	22	15	8	0	0	0
Northwest	9	5	4	0	0	0
Central	22	12	10	0	0	0
Volgo-Vyatskiy	16	10	6	0	0	0
Central-Black Earth	2	0	1	1	0	0
Povolzhsk	8	1	5	2	0	0
North Caucasus	3	0	0	1	1	0
Urals	34	21	11	1	0	1
Asian Russia of which:	77	48	26	1	0	3
West Siberia	37	23	13	0	0	0
East Siberia	31	20	10	0	0	0
Far East	10	4	2	1	0	3

Source: CAB/IIASA

Table 2.2 (continued)

	Coniferous	Deciduous	TOTAL
Cur. Access. AAC			
RUSSIAN SSR (excl. Kaliningrad)	196	144	340
European Russia	92	89	181
of which:			
North	51	19	70
Northwest	5	6	11
Central	8	16	24
Volgo-Vyatskiy	8	13	21
Central-Black Earth	0	1	1
Povolzhsk	1	6	7
North Caucasus	0	2	2
Urals	20	27	46
Asian Russia	104	55	158
of which:			
West Siberia	14	25	39
East Siberia	58	23	81
Far East	32	6	38
Interm. Utilization			
RUSSIAN SSR (excl. Kaliningrad)	11	18	28
European Russia	8	13	21
of which:			
North	1	1	2
Northwest	1	1	2
Central	2	3	5
Volgo-Vyatskiy	1	2	3
Central-Black Earth	0	1	1
Povolzhsk	1	2	3
North Caucasus	0	1	1
Urals	2	3	5
Asian Russia	3	4	7
of which:			
West Siberia	1	2	3
East Siberia	1	2	3
Far East	1	1	1

Source: CAB/IIASA

Table 2.2 (continued)

	Coniferous	Deciduous	TOTAL
Other Utilization			
RUSSIAN SSR (excl. Kaliningrad)	7	12	19
European Russia of which:	2	3	5
North	1	1	2
Northwest	0	0	0
Central	0	0	1
Volgo-Vyatskiy	0	0	0
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	1	1	2
Asian Russia of which:	5	9	14
West Siberia	2	4	7
East Siberia	2	3	5
Far East	1	1	2
Non For. Sec. AAC			
RUSSIAN SSR (excl. Kaliningrad)	11	19	30
European Russia of which:	7	10	17
North	2	1	3
Northwest	1	2	3
Central	1	3	5
Volgo-Vyatskiy	1	1	2
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	1	2	4
Asian Russia of which:	4	9	13
West Siberia	1	6	7
East Siberia	2	2	5
Far East	0	1	1

Source: CAB/IIASA

Table 2.2 (continued)

	Coniferous	Deciduous	TOTAL
Total			
RUSSIAN SSR (excl. Kaliningrad)	224	193	417
European Russia	109	116	225
of which:			
North	55	22	77
Northwest	6	9	15
Central	11	22	34
Volgo-Vyatskiy	10	16	26
Central-Black Earth	1	2	2
Povolzhsk	2	8	10
North Caucasus	1	3	3
Urals	24	34	57
Asian Russia	115	77	192
of which:			
West Siberia	18	37	55
East Siberia	64	31	94
Far East	33	10	43

Source: CAB/IIASA

Table 2.3: RUSSIA and REGIONS: Estimated Maximum Fiber Flow in the Medium Term (million cubic meters)

	Coniferous	of which: pine	spruce-true fir	larch
Potent. Accessible Forest AAC				
RUSSIAN SSR (excl. Kaliningrad)	130	29	34	66
European Russia of which:	11	6	5	0
North	5	3	2	0
Northwest	2	2	0	0
Central	1	0	1	0
Volgo-Vyatskiy	1	0	1	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	2	1	1	0
Asian Russia of which:	119	23	30	66
West Siberia	16	10	5	1
East Siberia	52	10	14	27
Far East	51	3	10	38
Interm. Utilization				
RUSSIAN SSR (excl. Kaliningrad)	0	0	0	0
European Russia of which:	0	0	0	0
North	0	0	0	0
Northwest	0	0	0	0
Central	0	0	0	0
Volgo-Vyatskiy	0	0	0	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	0	0	0	0
Asian Russia of which:	0	0	0	0
West Siberia	0	0	0	0
East Siberia	0	0	0	0
Far East	0	0	0	0

Source: CAB/IIASA

Table 2.3 (continued)

	Coniferous	of which: pine	spruce-true fir	larch
Other Utilization				
RUSSIAN SSR (excl. Kaliningrad)	0	0	0	0
European Russia	0	0	0	0
of which:				
North	0	0	0	0
Northwest	0	0	0	0
Central	0	0	0	0
Volgo-Vyatskiy	0	0	0	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	0	0	0	0
Asian Russia	0	0	0	0
of which:				
West Siberia	0	0	0	0
East Siberia	0	0	0	0
Far East	0	0	0	0
Non For. Sec. AAC				
RUSSIAN SSR (excl. Kaliningrad)	0	0	0	0
European Russia	0	0	0	0
of which:				
North	0	0	0	0
Northwest	0	0	0	0
Central	0	0	0	0
Volgo-Vyatskiy	0	0	0	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	0	0	0	0
Asian Russia	0	0.	0	0
of which:				
West Siberia	0	0	0	0
East Siberia	0	0	0	0
Far East	0	0	0	0

Source: CAB/IIASA

Table 2.3 (continued)

Total	Coniferous	of which: pine	spruce-true fir	larch
RUSSIAN SSR (excl. Kaliningrad)	130	29	34	66
European Russia	11	6	5	0
of which:				
North	5	3	2	0
Northwest	2	2	0	0
Central	1	0	1	0
Volgo-Vyatskiy	1	0	1	0
Central-Black Earth	0	0	0	0
Povolzhsk	0	0	0	0
North Caucasus	0	0	0	0
Urals	2	1	1	0
Asian Russia	119	23	30	66
of which:				
West Siberia	16	10	5	1
East Siberia	52	10	14	27
Far East	51	3	10	38

Source: CAB/IIASA

Table 2.3 (continued)

	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
Potent. Accessible Forest AAC						
RUSSIAN SSR (excl. Kaliningrad)	70	45	21	1	0	2
European Russia of which:	10	6	4	0	0	0
North	2	1	1	0	0	0
Northwest	2	1	1	0	0	0
Central	2	1	1	0	0	0
Volgo-Vyatskiy	1	1	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	3	2	1	0	0	0
Asian Russia of which:	60	39	17	1	0	2
West Siberia	29	19	10	0	0	0
East Siberia	21	15	6	0	0	0
Far East	10	5	2	1	0	2
Interm. Utilization						
RUSSIAN SSR (excl. Kaliningrad)	0	0	0	0	0	0
European Russia of which:	0	0	0	0	0	0
North	0	0	0	0	0	0
Northwest	0	0	0	0	0	0
Central	0	0	0	0	0	0
Volgo-Vyatskiy	0	0	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	0	0	0	0	0	0
Asian Russia of which:	0	0	0	0	0	0
West Siberia	0	0	0	0	0	0
East Siberia	0	0	0	0	0	0
Far East	0	0	0	0	0	0

Source: CAB/IIASA

Table 2.3 (continued)

	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
Other Utilization						
RUSSIAN SSR (excl. Kaliningrad)	0	0	0	0	0	0
European Russia	0	0	0	0	0	0
of which:						
North	0	0	0	0	0	0
Northwest	0	0	0	0	0	0
Central	0	0	0	0	0	0
Volgo-Vyatskiy	0	0	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	0	0	0	0	0	0
Asian Russia	0	0	0	0	0	0
of which:						
West Siberia	0	0	0	0	0	0
East Siberia	0	0	0	0	0	0
Far East	0	0	0	0	0	0
Non For. Sec. AAC						
RUSSIAN SSR (excl. Kaliningrad)	0	0	0	0	0	0
European Russia	0	0	0	0	0	0
of which:						
North	0	0	0	0	0	0
Northwest	0	0	0	0	0	0
Central	0	0	0	0	0	0
Volgo-Vyatskiy	0	0	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	0	0	0	0	0	0
Asian Russia	0	0	0	0	0	0
of which:						
West Siberia	0	0	0	0	0	0
East Siberia	0	0	0	0	0	0
Far East	0	0	0	0	0	0

Source: CAB/IIASA

Table 2.3 (continued)

Total	Deciduous	of which: birch	other soft wood dec.	oak	beech	other hard wood dec.
RUSSIAN SSR (excl. Kaliningrad)	70	45	21	1	0	2
European Russia of which:	10	6	4	0	0	0
North	2	1	1	0	0	0
Northwest	2	1	1	0	0	0
Central	2	1	1	0	0	0
Volgo-Vyatskiy	1	1	0	0	0	0
Central-Black Earth	0	0	0	0	0	0
Povolzhsk	0	0	0	0	0	0
North Caucasus	0	0	0	0	0	0
Urals	3	2	1	0	0	0
Asian Russia of which:	60	39	17	1	0	2
West Siberia	29	19	10	0	0	0
East Siberia	21	15	6	0	0	0
Far East	10	5	2	1	0	2

Source: CAB/IIASA

Table 2.3 (continued)

	Coniferous	Deciduous	TOTAL
Potent. Accessible Forest AAC			
RUSSIAN SSR (excl. Kaliningrad)	130	70	200
European Russia of which:	11	10	21
North	5	2	7
Northwest	2	2	4
Central	1	2	3
Volgo-Vyatskiy	1	1	2
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	2	3	6
Asian Russia of which:	119	60	179
West Siberia	16	29	44
East Siberia	52	21	73
Far East	51	10	62
Interm. Utilization			
RUSSIAN SSR (excl. Kaliningrad)	0	0	0
European Russia of which:	0	0	0
North	0	0	0
Northwest	0	0	0
Central	0	0	0
Volgo-Vyatskiy	0	0	0
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	0	0	0
Asian Russia of which:	0	0	0
West Siberia	0	0	0
East Siberia	0	0	0
Far East	0	0	0

Source: CAB/IIASA

Table 2.3 (continued)

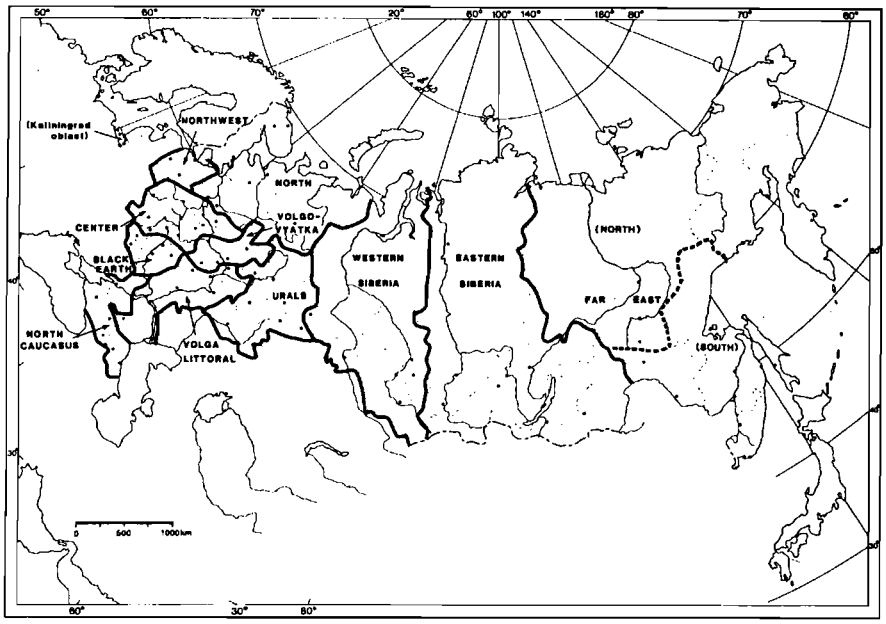
	Coniferous	Deciduous	TOTAL
Other Utilization			
RUSSIAN SSR (excl. Kaliningrad)	0	0	0
European Russia	0	0	0
of which:			
North	0	0	0
Northwest	0	0	0
Central	0	0	0
Volgo-Vyatskiy	0	0	0
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	0	0	0
Asian Russia	0	0	0
of which:			
West Siberia	0	0	0
East Siberia	0	0	0
Far East	0	0	0
Non For. Sec. AAC			
RUSSIAN SSR (excl. Kaliningrad)	0	0	0
European Russia	0	0	0
of which:			
North	0	0	0
Northwest	0	0	0
Central	0	0	0
Volgo-Vyatskiy	0	0	0
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	0	0	0
Asian Russia	0	0	0
of which:			
West Siberia	0	0	0
East Siberia	0	0	0
Far East	0	0	0

Source: CAB/IIASA

Table 2.3 (continued)

	Coniferous	Deciduous	TOTAL
Total			
RUSSIAN SSR (excl. Kaliningrad)	130	70	200
European Russia	11	10	21
of which:			
North	5	2	7
Northwest	2	2	4
Central	1	2	3
Volgo-Vyatskiy	1	1	2
Central-Black Earth	0	0	0
Povolzhsk	0	0	0
North Caucasus	0	0	0
Urals	2	3	6
Asian Russia	119	60	179
of which:			
West Siberia	16	29	44
East Siberia	52	21	73
Far East	51	10	62

Source: CAB/IIASA



Map A: Economic regions of Russia

Source: The disappearing Russian forest, p. 12