



**United Nations  
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**Food and Agriculture Organization  
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## **GENEVA TIMBER AND FOREST DISCUSSION PAPER 27**

### **RUSSIAN FEDERATION FOREST SECTOR OUTLOOK STUDY**

*by*

*the Research and Design Institute on Economics, Production Management and  
Information for the Forest, Pulp and Paper and Woodworking Industries  
(OAO "NIPIEllesprom")*



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United Nations Economic Commission for Europe/  
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UNECE



Timber Branch, Geneva, Switzerland

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## **Note**

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## **Abstract**

This study analyses the national and international demand and provides forecasts for consumption, trade and production of major forest products in the Russian Federation. The authors elaborate conclusions for the forest sector stakeholders, which could be useful for further discussion about the forecasts and possible conclusions for policy makers. It starts from a historical analysis of major developments in the Russian forestry and forest industry sector, focusing on the collapse of the planned economy in the Russian Federation after 1990 and the current indicators for recovery. It uses macroeconomic assumptions, partly approved by the government, as a background to elaborate three forest sector scenarios.

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## Preface

The forest sector of the Russian Federation is characterized by its huge potential: huge natural resources, unique biodiversity, skilled workers and close access to Western and Asian markets. The sector could play a remarkable role for Russia during the transition period, as the resource-based sectors can contribute significantly to overall economic development. Whether or not this potential is developed is of the greatest importance not only for Russia but also for other countries. A policy analysis carried out by the UNECE Timber Branch has indicated that greater policy attention should be paid to the Russian forest sector.

The present study recognizes the dynamic development of the forest sector of the Russian Federation over the last decade. After the collapse of the planned economy and the crisis of the forest sector, production and, in particular, exports of the forest sector have recovered and are increasing rapidly. Traditional trade flows are changing, as Russia appears as a new competitor on western European and Asian roundwood and timber markets. The duration and intensity of these developments will depend on investments in the Russian forest sector, especially in the paper and panel industries. Such investments would foster roundwood consumption and contribute to economic growth in general.

The current study starts from the assumption of stabilisation of a democratic policy framework and further progress towards a market economy in Russia. Specific forest sector policy and market scenarios are analysed. The study provides a broad overview of the long-term development of the forest sector, in terms of forest resources and forest products markets, labour resources and employment.

The European Forest Sector Outlook Study (EFSOS) programme is a joint programme of the UNECE Timber Committee and the FAO European Forestry Commission, and provides an input to the global forest sector outlook study activities of FAO. EFSOS represents a contribution of the two organizations to the sustainable development of the forest sector in Europe.



Mrs. Brigita Schmögnerová  
Executive Secretary  
UN Economic Commission for Europe

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The current report was drafted by N.A. Burdin – general methodological guidance and preparation of Introduction and chapters 1, 2, 3.1, 5, 8.2, 9, 10, 11; A.P. Petrov – chapters 3.2, 3.3, 8.1; and V.M. Shlykov – chapters 4, 6, 7. Prof. Korobov V.V. (OAO TSNIIME), the Institute VNIILM, also participated in the study. Collection and processing of technical and economic information was carried out with the participation of V.V. Sakhanov, L.V. Grebenev, N.M. Kachalova, N.D. Uriasieva, V.S. Sukhanov, and O.F. Subota.

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## Summary

### Background

In the early 1990s the Russian planned economy suffered a total collapse. Following years of economic and social dislocation, Russia is now on a course to establish a functioning market economy. Further progress requires stability and reliability in state policy, which is a prerequisite for further sustainable development of the country and the region in general. The forest sector plays an important role for the recovery of the economy.

The forest sector of the Russian Federation has a staggering potential for further development. Located between developed Western European and Asian (Japan) economies and the fast growing market in China, the Russian forest sector has excellent opportunities for rapidly increasing exports of forest products.

The growing stock amounts to 81.9 billion m<sup>3</sup> with an annual increment exceeding 900 million m<sup>3</sup>. These resources represent over 20 % of the global total and the single largest national forest resource. Removals decreased during the mid 90s crisis to the current level of about 100 million m<sup>3</sup>. The potential for increasing fellings in the framework of sustainable forest management is clear. Further, Russia disposes of rather well-educated, low-cost, labour resources. Both factors could attract investments into the Russian forest sector.

Aside from the potentials, there are also threats to be considered. One of the most important ones is that profits are not sufficiently reinvested into expanding forest sector capacities. The continuing uncertainties in the policy framework also do not provide the trust required for foreign investments. The structure of the forest industry of the Russian Federation is inefficiently oriented towards resources rather than on processed products which need more investment than simple resource extraction. As a result, such countries as the USA, Canada, Finland, and Sweden surpass Russia in per capita production of highly processed timber products. For example, despite the availability of the richest forest resources, Russia's share of global paper and paperboard production is only 1.4%.

### Study Approach

The main goal of the study is to describe the possible outcomes of various strategic directions for sustainable development of the forest sector in Russia. Sustainable development of the forest as a renewable resource is its use on the principles of sustainability with the purpose of preserving and developing forests for future generations. Sustainable development in forest industry production implies dynamic growth of the basic economic and production indices, output of competitive products, social security and environmental protection.

The official strategies of the government of the Russian Federation for the short- and long-term socioeconomic development of the country form the basis for the current study. The main forest sector stakeholders as well as the scientific community have been involved in the elaboration of the study. Several long-term macroeconomic forecasts (including NOBE, 2002) were also taken into account. The study integrates global forest sector development data and information.

The study starts with a detailed historical analysis of development trends of the forest and forest industry sector and forestry covering the last years of the planned economy, the collapse, and the recovery since the mid 1990s. The forecast reflects the assumption that development of the forest sector is largely dependent on development of the entire economy of the Russian Federation. Three scenarios are considered in the study, including both optimistic (radical) and inertial (no change) options for policy and markets for the period up to 2015.

Domestic and foreign demand in forest products is forecast based on national information as well as international forecasts, and on calculations of the balance between demand and supply. The study assumes that the immediate policy objective of forest sector development is to overcome the economic and social crises. This needs improvement of the forest industry production structure in the direction of increasing the volumes of highly processed wood products and enhancement of the efficiency of production and trade in the forest and forest products sector. This restructuring requires the creation of favourable economic conditions for forest users and measures at the federal and regional levels for attracting investments for development of highly-processed wood products, improvement of foreign trade activity, standardization and certification as well as actions in the field of tariff policy.

### Key Outcomes

The chapter dealing with the estimate of demand for forest products represents the key outcome of the study. Estimates are given for production and consumption of major types of forest products (roundwood, sawnwood, wood-based panels, paper and paperboard). Depending on the scenarios, the volume of forest industry production will increase by 30-200% between 2000 and 2015. The highest growth rates are forecast for highly processed wood products (paper, paperboard, wood-based panels).

Scenario I (medium growth), provides the most probable outcomes. The scenario assumes policies that would foster investments for the enlargement of paper and paperboard production. By the year 2015 this scenario envisages an increase in industrial roundwood production and fellings to 206 and 255 million m<sup>3</sup> respectively, double removals in 2000. It should be noted that this level of removals would still be only 2/3 of the production in the mid 80s. Just ¼ of the annual increment would be used in this scenario. The pulp and paper industry is forecasted to grow to 15 million tons in 2015, nearly 3 times higher than in 2000, but only double the level of the mid 80s. Exports of most forest products are forecast to increase steadily, e.g. more than 5 million tons of paper and paperboard are envisaged to be exported in 2015, with a significant share going to other CIS countries. At the same time roundwood exports are forecast first to increase and then to decrease to 20 million m<sup>3</sup> due to increasing domestic demand.

Growth in the volumes of forest industry production will result in the growth of per capita consumption of forest products, as shown in the table below (scenario I).

**Per capita consumption of forest products in Russia**  
(figures according to Scenario I)

	2000	2010	2015
Sawnwood (m <sup>3</sup> per 1,000 capita)	85.0	195.0	266.0
Plywood (m <sup>3</sup> per 1,000 capita)	3.8	7.4	9.5
Particle board (m <sup>3</sup> per 1,000 capita)	16.8	33.0	44.0
Fibreboard m <sup>3</sup> per (1,000 capita)	4.8	11.0	18.0
Paper and paperboard (kg per caput)	24.1	55.0	84.0

According to this scenario, Russia would increase its consumption of forest products but would still remain below the level of per capita consumption of most of the developed western countries.

### Current use of the study

The study outcomes were used during strategic policy discussion among the forest sector stakeholders under the leadership of the government. The basic results of the study were reflected in the "Main Directions of Forest Industry Development" and in the "Concept of Development of Forestry of the Russian Federation", which were presented by the Ministry of Industry, Science and Technologies and the Ministry of Natural Resources and were considered at an extended meeting of the government of the Russian Federation on 18 June, 2002. The goal of sustainable forest management was considered as preserving the ecological and resource potential of forests, satisfying the needs of society for forest resources on the basis of scientifically substantiated analysis, fostering sustainable multiple-purpose forest use, conservation, protection and biological diversity. The main assumptions as well as the major outcomes of the current study were endorsed during this strategic discussion, whereas the development goals in the mentioned government documents are defined much higher. In the government documents, the volume of forest industry production is foreseen to increase 4 times by the year 2015 assuming about securing competitiveness of products and increasing productivity of labour.

## 1 Introduction

The forest sector of the Russian Federation includes forestry, logging, sawmilling, plywood, panel, furniture, pulp and paper and wood-chemical industries. Over 30,000 large, medium and small enterprises, located throughout the Russian Federation are engaged in extended regeneration of forests, increasing their productivity, protection from fire and insects, logging and all types of processing of wood. All branches of the forest sector are technologically interrelated on the basis of production and utilization of the natural resource – wood raw material. There is practically no branch where wood and products of its processing are not used. The products of the forest sector are widely used in industry, construction, agriculture, the printing industry, trade, and medicine. The volumes of production and consumption of furniture, paper and paperboard determine to a great extent the social and cultural level of society.

In 2001 the share of the forest sector in Gross Domestic Product was over 3%, in total industrial output 4.3%, in the total number of industrial workforce 8%, and in production of non-food products 11%. The forest sector is one of the leading and stable exporters of the Russian Federation. All branches of the forest sector have great potential for development, the basis of which is a natural resource which, in contrast to oil, gas, coal, ore and other minerals, is renewable. According to the latest state forest resources inventory, the total growing stock of Russia is 81.9 billion m<sup>3</sup>. The annual increment amounts to 970 million m<sup>3</sup> and the scientifically estimated annual cut (annual allowable cut) to 551 million m<sup>3</sup>.

At present market relations are in force in the forest industry: over 97% of enterprises have been privatized or been converted to joint stock companies, free prices are ruling on the domestic market, external trade in forest and paper products is liberalized, while the former rigid system of management of forest enterprises at federal and regional levels no longer exists. Up to now the forests in the Russian Federation have been predominantly state-owned. All enterprises and organizations engaged in wood harvesting carry out their activities mainly through leasing forest compartments or through auctions

However, the results of the activities of forest industry branches over recent years show that the process of transition towards a market economy is progressing with difficulty. Despite the positive tendencies in 1999-2000 in the development of the country's economy in general and of the forest sector in particular, the situation of many forest enterprises remains tense: unstable financial position, large share of outdated equipment, insolvency. In 2000 the output of the basic types of forest product was considerably lower than in 1990: removals 69% lower, production of sawnwood 73%, plywood 9%, particle board 58%, fibreboard 41%, and paper and paperboard –38%. In 2000 tree planting areas amounted to 263,000 ha against 566,000 ha in 1990.

Almost 50% of all forest industry enterprises are unprofitable. Domestic consumption of forest products, which has fallen several times in recent years, remains low. Actual forest exploitation figures do not in the least comply with the requirements of efficient forest management and forest industry production. The annual allowable cut utilization rate for Russia as a whole is only 23.6% and for the basic forest regions of Siberia and the "Far East" only 7–19 %. The index of wood cut per 1 ha of forested area, adopted in world practice, was 0.22 m<sup>3</sup> in Russia in 2000 whereas in the countries with developed forest industries it was 2.5-3.5 m<sup>3</sup>/ha.

Despite the availability of the richest forest resources, the share of Russia in the world forest sector is not considerable: 3.2% for removals, 4.4% for sawnwood production, 2.4% for wood-based panel production, and 1.4% for paper and paperboard production. While in the late 1980s Russia ranked second in the world after the USA in wood removals, production of sawnwood and wood-based panels, now this lag has increased considerably, not only as compared with the USA but also with many other countries. Russia is far behind the leading countries of the world in per capita consumption of sawnwood, plywood, particle board and fibreboard, paper and paperboard.

The structure of the forest industry production is not optimal. The share of the pulp and paper industry in the total output of products is low. Further, the distribution of forest industry branches over the territory of the country cannot be considered normal. The most obvious example in this respect is Central Federal Okrug, which is the major consumer of forest and paper products. Here 19% of the total volume of sawnwood produced in the country is consumed as well as 38% of plywood, 35% of paper and paperboard and 43% of wood-based panels. Most of these products are brought in from other regions. At the same time the resources of wood available in the Okrug, accounting for 3.7 billion m<sup>3</sup>, are obviously underused. In Central Federal Okrug there is not a single pulp and paper mill; plywood, sawmilling and wood-based panel industries are underdeveloped.

Owing to the unsatisfactory structure of forest industry production and insufficient output of competitive products, raw materials are the predominant Russian forest products exports, which sharply reduces its currency efficiency. The forest sector of the Russian Federation, with its huge forest resources, has great potential for contributing significantly to the development of the economy of Russia in general.

## 2 Premises and methodological principles of the study

Forecasting the forest sector outlook is a part of the Russian Federation's social and economic development strategy. In this connection, the methodological basis for preparing the Russian Federation Forest Sector Outlook Study is official documents of the Government of the Russian Federation, the State Duma, the State Council, the Ministry of Economic Development and other federal bodies, namely:

- Strategy of the Russian Federation development up to 2010, elaborated by the fund "Centre of strategic projects".
- Strategy of State development for the period up to 2010, prepared by the State Council of the Russian Federation.
- Main directions of social and economic development of the Russian Federation for the long-term period, prepared by the Government of the country;
- Forest Code of the Russian Federation adopted by the State Duma;
- Strategy for the development of the forest, pulp and paper and woodworking industries of the Russian Federation for the period up to 2010 (approved by the Collegium of the Ministry of Industry, Science and Technologies);
- Programme of restructuring of the Russian Federation forest sector for the period up to 2005 (approved by the Collegium of the Ministry of Economy of Russia).

The goal of the long-term social and economic policy of the Government of the Russian Federation is to raise steadily the living standards of the population on the basis of self-realisation of every citizen, reduction of social disparity, preservation of the independence and cultural values of Russia, and restoration of economic and political role of the country in the global community. Achievement of this goal is impossible without the liberation of society, making it possible to engage its inner development sources. An optimistic attitude should prevail in the society, and confidence between citizens and the State, citizens and business, business and power, which has been nearly completely lost, must be restored.

The Programme of restructuring proceeds from the fact that the development of society depends to a large extent on the system of values which are the basis of activities of the State, economic actors and public organizations and which form the basis of everyday life of every person. Our society needs a renewed system of values, which is in compliance with the traditions of Russia and meets the requirements of the present time: freedom, responsibility, confidence, and high value of individuals. People should achieve goals through their own efforts.

In the strategy of State development for the period up to 2010, elaborated by the State Council of the Russian Federation, the following strategic goal was adopted to turn Russia into a dynamically developing power, securing average European living standards on the basis of intensive labour and business initiative, sound and consistent economic policy under specifically Russian natural, climatic and geographical conditions.

The primary sector of Russia's economy – extractive industry and export-oriented industries in particular – represents a major material resource for economic growth and maintaining the level and growth of export earnings. A positive future for Russia can only be based on priority development of processing branches of industry. It is their dynamics that determine the level of investment activity and technological renovation of production on the one hand and of final consumption by the population on the other hand.

The State must organize and stimulate in order to achieve the country's economic and social objectives. Under market economy conditions the State acts simultaneously as:

- Organizer of an economic order, responsible for establishment of general "rules of the game", securing their stability and observance.
- Entrepreneur, performing economic activities within the limits of established norms and rules.
- Exponent of social goals and interests.

Under the circumstances of transition, the functions of the State are mainly:

- Keeping of macroeconomic and structural equilibrium, where the market mechanism fails to do so.
- Formation and securing of economic order through elaboration and ensuring realization of norms and rules of behaviour with respect to economic agents.
- Elaboration of the development strategy, creation of a favourable investment and business climate as well as favourable social conditions for creation of a functioning market economy.
- Support of national enterprises in the external world, co-ordination of activities of national business with the purpose of support and growth of competitiveness of the national economy under the conditions of globalization of the world economy.
- Securing economic safety, counteracting against threats and factors of instability.

The following macroeconomic indices, adopted in the programme documents of the Government of Russia are the basis for estimating the demand for forest products and substantiating forest industry output: growth rate of Gross Domestic Product, industrial production, investment in fixed capital, volume of trade, income of population, commissioning of new basic production facilities, industrial and residential construction and others.

The following basic methodological principles of the Russian Federation Forest Sector Outlook Study were used for the current study:

- System approach, including economic, production, scientific and technical, social and ecological problems.
- Integrated approach, taking account of the interests of the State and subjects of the Federation as well as of all branches of the forest sector.
- Market orientation and consideration of demand for basic types of forest and paper products manufactured within the country and abroad.
- Orientation of innovation and technical re-equipment of enterprises on the basis of highly efficient machines and advanced resource-saving technologies for manufacturing of competitive products.
- Priority of social and ecological factors.

Proceeding from the present situation in the forest sector and taking account of the basic programme directions of the social and economic development of the Russian Federation for the long term as well as of forecasts of global forest sector development, the main goal of our outlook study is to describe the strategic directions for sustainable forest sector development with allowances for utilization of its potentialities and sustainable development of the entire economy of the country. By sustainable development with respect to forest, as a renewable resource, we mean its exploitation on the principles of inexhaustibility and extended regeneration with the purpose of preserving forests for future generations. With respect to forest industry production, sustainable development implies dynamic growth of the basic economic and production indices, output of competitive products, social protection of workers and ecological safety.

The immediate objective of forest sector development is to overcome the economic, social and technical crisis, and securing the profitable operation and stable financial position of all forest branches on the basis of improving the forest industry production structure by increasing added value chemical and chemical-and-mechanical wood processing and manufacturing of a wide range of competitive products.

The goals of the study also include solving the following specific problems:

- Give an objective assessment of the forest sector development trends in the preceding period.
- Describe scenarios of forest sector development for the outlook period.
- Forecast demand for final forest products in the perspective of domestic and foreign markets.
- Estimate production volumes of basic types of forest products on the basis of balance calculations.
- Determine volumes of domestic consumption and export of forest products.
- Determine potential volumes of forest resources in the outlook period.
- Directions for forestry reform.
- Identify measures for social protection of forest sector workers and creation of new jobs.
- Identify main directions to reduce the environmental impact of forest industry enterprises to an ecologically safe level.
- Calculate potential directions of wood utilization as a source of energy generation.

There are important positive factors which should be taken into account in the study and which can be the basis for achieving the strategic goals of sustainable development of all forest branches:

- Vast renewable high quality forest resources, making it possible to increase considerably the rate of forest utilization, taking due account of all statutory silvicultural requirements.
- Forest resources in all regions of the country and possibilities to conduct final and intermediate fellings there without detriment to sustainable forest management.
- Labour resources and enough experienced specialists and workers.
- Sufficient capacities for wood harvesting, production of basic types of forest products, making it possible to increase their output already at the first stage of realization of the strategy.
- Scientific and technical potential to solve at relatively short notice the problems of developing new advanced technologies and efficient machines and equipment, their production and introduction.
- Real consumer timber market within Russia, in the countries of Europe, Asia, Africa, and America.

At the same time negative factors should also be taken into account, which will undoubtedly have a detrimental effect on economic and social aspects of the forest sector in the outlook period. These factors are as follows:

- Low technical level of domestic production in the majority of forest sector branches and high level of wear and tear of basic production facilities.
- Imperfect structure of forest industry production and, as a result, ineffective structure of exports.
- Continual increase in prices and tariffs for fuel and energy resources.
- Disproportions in territorial location of forest industry enterprises, entailing high costs of forest products transport from producer to consumer.
- Tough tax and credit policy, taking no account of specific features of individual forest branches (seasonal work type, necessity of continual construction of forest roads, etc.).
- Critical social situation in many forest regions.
- Impact of globalization on forest and paper products output and their competitiveness on foreign markets.
- Low investments in forest sector development.
- Low level of innovation activity related to creation and introduction of new machines, equipment and technologies.
- Increase in the share of forests transferred to different protection categories and withdrawn from exploitation.

The methods and structure of the study make use of the projects on European timber trends and prospects (ETTS –IV and ETTS-V), elaborated earlier by the UNECE Timber Committee, as well as recommendations of the meeting of Team of Specialists (Geneva, March 2001).

In connection with the importance and necessity of State regulation and support of the forest sector, the study also considers possible directions of specific measures on the part of the State, such as:

- Development of forms of forest ownership and improvement of mechanism of interaction between forest users and forest owners as applied to market relations.
- Financing forest conservation, protection and regeneration activities.
- Improvement of forest sector management on the basis of development of corporate forms.
- Promotion of innovation and investment activities.
- Perfection of export and import activities.
- Regulation of tariff policy of natural monopolies (railway transport, fuel and power industries: Gazprom, RAO UES).
- Social protection of forest sector workers.
- Environmental conservation.

The official data of the Central Statistics Board (TsSU) of the former USSR and the State Statistics Committee of the Russian Federation, as well as reports of scientific and research institutes are the basis for the analysis of forest sector development trends for the period 1980-2000. The official data of State forest resources inventories, conducted every 5 years for the Russian Federation as a whole, and by region, is the basis for the analysis of forest resources and the level of their utilization.



The forecasts for wood supply are based on available scientific reports on projection of forestry development for the outlook period as well as on the data on age structure of stands, rotation period, annual increment, allowable cut, possible negative factors affecting growing stock (fires, windstorms, insects, illegal fellings, contamination, climate change, etc.).

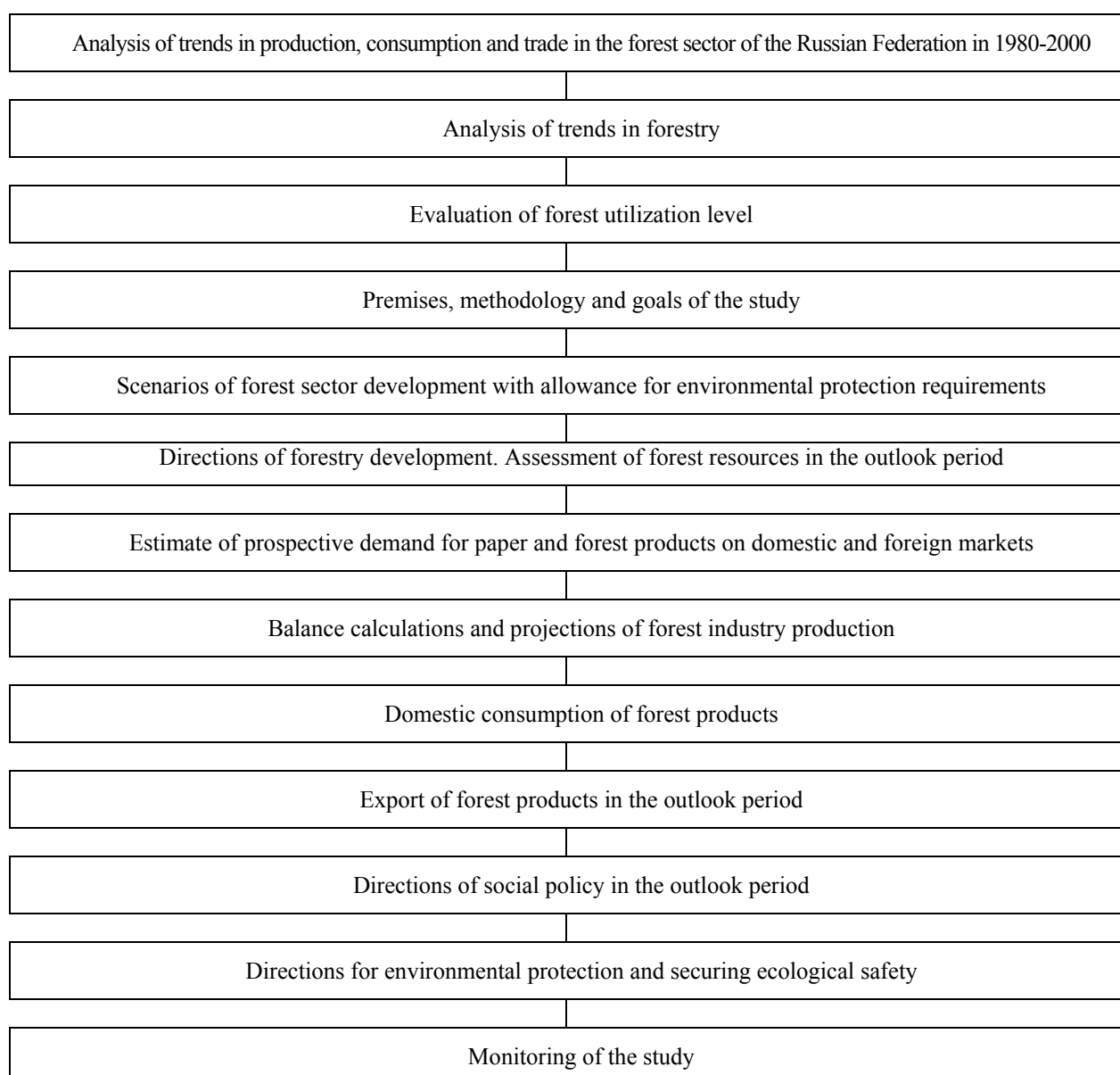
The demand for forest products in the domestic market, the markets of the CIS and “overseas” countries is estimated separately for each type of forest product: roundwood, sawnwood, plywood, particle board, fibreboard, pulp, paper and paperboard and for major spheres of consumption: construction and civil engineering, housing construction, repair of buildings and installations, containers and packaging, the mining industry, machine building, furniture production, sales to the population, etc.

Separate calculations are made to determine the demand for roundwood, fuelwood and chips in the branches of woodworking: sawmilling, production of plywood, production of wood-based panels and pulp and paper production. On the basis of estimates of the demand in domestic and foreign markets, calculations are made of the balance between demand and supply.

The structure and process of the Russian Federation Forest Sector Long Term Outlook Study is given in figure 1.

Figure 1

### Structure and process of the Russian Federation Forest Sector Long Term Outlook Study



### 3 Development trends of Russian Federation forestry 1980-2000

#### 3.1 Basic indices of the forest resources

"Forestry", as a constituent part of the Russia's economy, includes forest inventory, forest conservation and protection from fires, insects and diseases, regulation of forest utilization, extended forest regeneration, improvement of forest species mix, and productivity, strengthening of protective, sanitary and other functions of forest, control over forest resources utilization. Russia is the richest forest country in the world. The basic indices of the forest resources of the Russian Federation as of early 2000 are given in table 1.

Table 1  
General indices of forest resources of the Russian Federation<sup>1</sup>

	Russian Federation total		of which			
			European part		Asian part	
		%		%		%
Forest land area (million ha)	882.0	100	173.7	19.6	708.3	80.4
Stocked area (million ha)	774.2	100	168.7	21.8	605.5	78.2
Growing stock, total (billion m <sup>3</sup> )	81.9	100	22.1	27.0	59.8	73.0
Mature and over-mature (billion m <sup>3</sup> ) of which:	44.1	100	9.7	22.0	34.4	78.0
Coniferous	34.6	100	6.4	18.5	28.2	81.5
Non-coniferous	9.5	100	3.3	34.7	6.2	65.3
Forest cover (%)		45.3		39.1		47.4
Total average annual increment (million m <sup>3</sup> )	970.4	100	359.4	37.0	611.0	63.0
Annual allowable cut (million m <sup>3</sup> )	551.0		213.0		338.0	

According to the data of the latest forest resources inventory (1998), the stocked area in Russia accounts for 774.2 million ha with total growing stock amounting to 81.9 billion m<sup>3</sup>, which makes 20% of total world forest resources. Mature and over-mature stands account for 44.1 billion m<sup>3</sup> or 53.8% of the total growing stock. Coniferous species prevail (larch, spruce, pine, cedar), their share is 78% of the growing stock of mature and over-mature stands. The major share of forests is concentrated in the Asian part of Russia – 78.2% of stocked area and 73% of the growing stock. The basic trends of forest resources of the Russian Federation as a whole and of regions for the last twenty years are presented in tables 2 and 3.

Table 2  
Forest resources of the Russian Federation, 1978-1998  
(by years of forest resources inventory)

Item	1978	1983	1988	1993	1998	Change 1978 to 1998
Stocked area (million ha)	749.5	766.6	771.1	763.5 <sup>2</sup>	774.3	+24.8
Total growing stock (billion m <sup>3</sup> ) including:	80.7	81.9	81.6	80.7	81.9	+1.2
Mature and over mature (billion m <sup>3</sup> ) of which:	53.1	50.6	47.7	41.5	44.1	-9.0
Coniferous species (billion m <sup>3</sup> )	45.3	43.0	40.0	34.2	34.6	-10.7
Non-coniferous species (billion m <sup>3</sup> )	7.8	7.6	7.7	7.3	9.5	+1.7
Annual average increment (million m <sup>3</sup> )	824	839	822	822	970	+146

<sup>1</sup>All indices of forest resources for the Russian Federation and for regions given in this and succeeding tables are based on official reference books and data of state inventory.

<sup>2</sup>This "dip" in official stocked area is likely a result of changed procedures in inventory methodology that took place during the transition of administration from the former Soviet Union to administration by Russia.

Table 3  
**Growing stock by regions of the Russian Federation for 1978 – 1998**  
*(billion m<sup>3</sup>)*

	1978	1983	1988	1993	1998
North-Western	1.37	1.46	1.63	1.60	1.78
Northern	7.58	7.41	7.60	7.80	8.08
Volgo-Viatskiy	1.63	1.65	1.79	1.83	1.99
Central	2.50	2.70	3.04	3.20	3.48
Central- Black Earth	0.15	0.17	0.18	0.20	0.21
North-Caucasian	0.58	0.59	0.58	0.60	0.67
Povolzhskiy	0.51	0.55	0.57	0.60	0.66
Urals	4.39	4.75	4.85	4.90	5.18
West-Siberian	10.62	10.93	10.79	10.80	10.96
East-Siberian	29.09	29.62	29.31	28.90	27.90
Far-Eastern	22.22	22.05	21.26	21.10	20.90
<b>Russian Federation, total</b>	<b>80.64</b>	<b>81.88</b>	<b>81.60</b>	<b>81.53</b>	<b>81.81</b>

The 1998 stocked area in Russia was 24.8 million ha greater compared to 1978 and growing stock 1.2 billion m<sup>3</sup> greater. Stocked area and growing stock increased in all regions except East-Siberia and the Far-East. The main reasons for decreasing growing stock in the above-mentioned regions were intensive fellings in the 1980s as well as fires and insects. The greatest increase of growing stock was in the central region because of the reduction in volume of fellings and more intensive regeneration. The growth of the stocked area over the period under consideration is attributed primarily to the fact that in recent years the scope of reforestation has steadily exceeded the scope of fellings (table 4). Whereas in 1990-2000 2.6 million ha of forest areas were cut, the area of reforestation for the same period amounted to 2.8 million ha, or 200,000 ha more. Over the preceding 10-year period (1979-1989), the situation was approximately the same; reforested areas exceeded felled areas by 290,000 ha.

Table 4  
**Reforestation and fellings in the Russian Federation, 1990-2000**  
*(1,000 ha)*

	<i>Reforestation</i>	<i>Of which tree planting</i>	<i>Felled area</i>
1990	1 831	566	1 810
1991	1 562	521	1 608
1992	1 402	447	1 415
1993	1 461	428	1 047
1994	1 562	391	815
1995	1 454	367	762
1996	1 110	305	612
1997	1 092	267	623
1998	1 019	260	574
1999	964	254	707
2000	973	263	781
<b>Total for 1990-2000</b>	<b>17 234</b>	<b>4 898</b>	<b>13 345</b>

As regards the increase in total growing stock, the excess of net annual increment over volume of felling was a decisive factor. In the period under analysis the annual average increment accounted for more than 800 million m<sup>3</sup>, and the volume of fellings did not exceed 310 million m<sup>3</sup>. Growing stock of mature and over mature stands was reduced by 9 billion m<sup>3</sup>: conifer stands account for all of this reduction. Growing stock of deciduous forests increased by 1.7 billion m<sup>3</sup>, which is attributed to the structure of forest industry production, mainly oriented to the processing and consumption of softwood. The increase in growing stock and stocked areas is to a great extent accounted for by the low level of forest utilization (table 5).

Table 5  
Forest resource utilization for the Russian Federation and regions

	<i>Annual allowable cut utilization rate</i> (%)	<i>Annual increment utilization rate</i> (%)	<i>Volume of wood cut per 1 ha of stocked area</i> (m <sup>3</sup> /ha)
Russian Federation, including regions:	23.6	17.3	0.22
North-Western	42.9	39.2	1.17
Northern	41.4	36.5	1.47
Central	36.3	26.4	0.83
Volgo-Viatskiy	47.4	31.2	0.98
Central Black Earth	64.3	26.1	0.78
North Caucasian	15.7	12.0	0.29
Povolzhskiy	40.3	23.9	0.67
Urals	31.0	22.6	0.60
West-Siberian	7.2	10.6	0.11
East-Siberian	19.0	12.0	0.15
Far-Eastern	13.0	7.0	0.05

The annual allowable cut, which determines, on a scientifically established basis, the volume of fellings, taking into account all silvicultural and other factors, is 551.5 million m<sup>3</sup> for Russia as a whole (actual utilization of annual allowable cut accounts for 23.6%). The annual increment utilization rate is still lower and accounts for 17.3% for the Russian Federation, and from 7% to 39% for regions. The volume of wood cut per hectare of stocked area is 0.22 m<sup>3</sup> on the average for the Russian Federation, in the West-Siberian region 0.11 m<sup>3</sup>, in the East-Siberian region 0.15 m<sup>3</sup> and in the Far-Eastern region only 0.05 m<sup>3</sup>. For comparison, in countries with developed forest industries, this index exceeds 2.5 m<sup>3</sup>/ha.

### **3.2 Forest management and forestry practice under the centrally planned economy**

Under the centrally planned economy of the former USSR, forest management entities had undergone numerous administrative changes. This affected primarily only the top administrative levels (i.e. the All-Union, Republican and Regional forest authorities), and included either merging forest management with timber industries or its singling out into a separate sector. Timber industries, in any case, dominated forest management, though those two sectors were managed by two separate central agencies: the Ministry of Forest Industries and the State Committee for Forestry.

Timber industries were always regarded as a higher priority for the State since:

- Timber industries supplied the country with products essential for industrialization, post-war recovery of the economy, and satisfaction of the population's needs;
- Forest products were an important source of foreign currency revenues;
- Forest industries were a pioneer in the development of non-populated areas in the European North, Siberia and the Far East.

The main mission of forest management, with enormous timber resources at its disposal, was confined to catering for the interests of forest industries through making available the required cutting areas for them on a centralized basis. At the same time, the entire responsibility for the state of the forestland, forest protection and renewal rested with forest management bodies. Since the 1930s, at the lower level, forests had been managed by monopolistic State entities called '*leskhoz*' (similar to *kolkhoz* and *sovkh* in agriculture). Politically,

both *kolkhozes* and *sovkhozes* in agriculture and *leskhoz*es in forestry were “products” of land nationalization and public forest tenure underlying the so-called socialist land relations. Forest management and its practices as performed by *leskhoz*es funded from the budget were monopolistic arrangements of forest resource use and renewal, precluding any competition in the area of practical forestry. Both pre- and post-war *leskhoz*es were enterprises owned and managed by the State to function at the lower level of the sector’s management and administration.

The State exercised its monopolistic rights of forestland administration and management through *leskhoz*es. At the start-up stage of *leskhoz*es’ development (i.e. before and after the Second World War), they were vested primarily with functions of control and did not have either a developed physical infrastructure or sufficient financial resources to implement industrial forest logging and forest management activities. During that period, forests were harvested by temporary forest logging enterprises designated to supply the national economy with forest products through intensive cutting. That involved two approaches depending upon the forest cover in a given area. In forest-sparse areas, forests were managed on an integrated basis to include final cutting by enterprises subordinated to the Russian Ministry of Forestry (in the case of forests located in Russia) and to the USSR State Committee for Forestry (at the All-Union level). These enterprises were called either *leskhoz*es (forest management units), or *lespromkhoz*es (forest logging enterprises) or *lesokombinat*s (wood processing enterprises) depending on their prevailing activities. In forest-rich areas, forest logging and wood processing were the functions of enterprises of forest industries subordinated to the USSR Ministry responsible for industrial policy implementation. *Leskhoz*es were also preserved in those areas to take care of forest renewal and protection as well as to control and inspect forest loggers.

Areas of the forest land were allocated for timber harvesting on the basis of planned assignments; there were no contract arrangements between *leskhoz*es and forest users. Functions of inspection and control over forest management were performed by *leskhoz*es largely through evaluation of their own activities related to forest use, and protection; the efficiency of such “self-control” was low even under conditions of intense ideological pressure. Both forest management and practical forestry activities of *leskhoz*es were funded only from the budget. The entire forest revenue from the use of forest resources (stumpage charges) was paid to local budgets, which made *leskhoz*es and the whole system of forest management indifferent to the levels of stumpage prices.

Stumpage was used only for recording and accounting purposes, its level never exceeded 10 % of the price for roundwood, and in some periods, stumpage was not charged at all. Low stumpage charges led to low prices for logs, which, in its turn, accounted for the fact that value-added was created exclusively by wood processing in the forest sector. Low stumpage rates and low prices for logs did not promote sustainable use of forest resources, which was the main reason for the emergence of an inefficient structure of timber consumption, with only 10 % of harvested timber consumed by industries of chemical wood processing.

Forest management operations were not built upon traditional economic categories such as costs, profits, profitability, etc. Silvicultural and other forest management outputs were assessed only through ‘in-kind’ indicators (hectares, m<sup>3</sup>). There were no more or less relevant environmental restrictions for forest logging: the main logging practice was highly concentrated clear-cutting. The insufficiency of financial resources allocated for forest renewal and protection resulted in deterioration of the environmental condition of forests in areas of intensive felling operations, with local environmental crises in some areas (in the North-West, Volga Region, Lake Baikal, etc.). The centrally planned economy turned out to be incapable of ensuring efficient development of the forest sector in terms of both economic and environmental objectives.

### **3.3 Forest management and forestry practice under the transition**

The forest sector is one of those sectors where the transition to the market is difficult, and where so far no tangible impact of market reforms can be observed. This is due to various external factors (the heavy structural and financial crisis in the forest industry) as well as internal ones (reluctance and lack of skills to reform the sector). The reluctance of the sector to implement reforms is reflected in the legislation adopted to regulate forest relations during the transition. The first of these legislative acts was the Basic Principles of Forest Legislation enacted in 1993.

The Basic Principles of Forest Legislation:

- The Law failed to address the issue of forest and forestland ownership (ownership was not even mentioned in the text of the law), but at the same time, *de facto* it delegated key functions of forestland allocation for users to local administrations (at present, municipal administrations).
- *Leskhoz*es (forest management units) remained as the basic entities of forest management but their legal status was changed from that of public sector enterprises into public management bodies (according to the law, *leskhoz*es could not harvest and process timber from final cutting).
- The legislation introduced forest resource utilization arrangements for relations between the *leskhoz* and the user, based on long term use agreements (forest lease) and short-term use agreements (auctions).
- The Law reformed the financial system through replacing the dwindling budget allocations to fund forest management operations for internal proceeds to be earned by *leskhoz*es from thinning.

In 1997, the Basic Principles of Forest Legislation had to be replaced with the Forest Code owing to the obvious negative consequences of the forest management decentralization with the basic forestland allocation functions in the hands of municipal administrations, as well as in conjunction with the adoption of the new Constitution in 1993. The Forest Code of the Russian Federation changed the system of administrative and practical forest management in the following ways:

1. The Forest Code established the monopoly of the public federal ownership of forest land as a whole. Thereby, federal ownership rights were only declared rather than implemented, since principal rights were granted to regional authorities (i.e. administrations of subjects of the Russian Federation), including the right of decision-making on forestland allocation for use (including forest lease and auctions), and the right to establish stumpage prices and to capture the bulk of forest revenue from forest resource use.

2. The Forest Code did not change the legal status of *leskhoz*es, which were driven by economic incentives to earn their own money using public property and thus *de facto* were turned into enterprises, harvesting about 30 million m<sup>3</sup> of wood (or 30 % of the total final cut). *Leskhoz*es' proceeds from thinning (which is actually selective final cutting) are exempt from stumpage charges and other mandatory taxes; they use a simplified system of cost accounting (without depreciation), and thus get high revenues, which are not controlled by the Government. A drastic change in the situation occurred only with the enactment of the Budget Code (January 1, 2001), which requires that revenues from selling the *leskhoz*-harvested timber should become a part of the budget proceeds. The uncontrolled revenues turned *leskhoz*es into commercial entities, stripped of their direct function - to manage the State-owned forests. This situation emerged owing to the inability of the State to manage its property efficiently, and it was a reason for the liquidation of the Federal Forest Service in May 2000 and the transfer of its functions to the Ministry of Natural Resources of the Russian Federation.

3. The Forest Code introduced centralised command-based establishment of stumpage prices under the conditions when wood products were sold in home and foreign markets at free market prices. Since 1998, stumpage prices have been defined with tax rates in the Russian Federation, and the taxes are levied from forest users in the following order:

- Minimum stumpage rates are established by the Government of the Russian Federation in a centralized manner.
- Regional stumpage rates and forest lease charges are set by regional governments (they cannot be lower than minimum stumpage rates).

The revenue from timber sale at the minimum stumpage rates fully belongs to the budget system. Hence, forest management authorities acting as forest resource sellers remain indifferent to the levels and differentiation of charges for forestland use. No negotiating process is included in the procedures of establishing the stumpage prices. There are no stumpage marketing experts in *leskhoz*es acting as sellers. It is the tax status of charges for forestland use, coupled with a number of subjective reasons that preconditioned the low average stumpage price which amounted to Rbl. 24 per m<sup>3</sup> (or US\$ 0.8) in 2000. Such low stumpage prices testify to the fact that the existing system of forest management has turned out to be incapable of efficient forest use regulation where the bulk of harvesting and processing revenues, including export revenues, are appropriated by private timber business. The stumpage revenues are not sufficient for the State, as the owner of the forestland, to cover even those forest management and operation costs which are annually funded by the State budget (including the costs of reforestation, silviculture, fire and pest management). In 2000, the total amount of budget proceeds from stumpage and lease charges made up merely 60 % of the

amount of budget allocations for forest management. Another important reason for the liquidation of the Federal Forest Service in 2000 was the low level of public revenues from allocating forest areas to timber industries as well as the lack of proper control over timber flows, which contributed to the high level of "grey" economy in the forest sector.

4. The Forest Code establishes a legal and regulatory framework for the development of market relations in the area of forest use, based on the following arrangements:

- Long term agreements for forest lease.
- Short-term agreements for stumpage auctions.
- Forest concession agreements.
- Agreements for free-of-charge forestland use.

Out of these four arrangements, only the first two have been actually implemented. As for forest concession, there is as yet no legal federal framework to govern terms and procedures for concession-based natural resource use.

The free-of-charge forest use means that forest resources are utilized in the so-called agricultural forests, which belonged to *kolkhozes* and *sovkhozes* during the Soviet period. These forests occupy a large area in the Russian Federation (about 10 % of the State forestland) and are managed by entities, integrated into the system of the Ministry of Agriculture. The legal status of agricultural forests is not defined, neither is their ownership pattern (formally, all forests are declared State-owned). Forest lease, based on long term agreements, is regarded by the State as the main forest tenurial arrangement. In 2000, it accounted for about 50% of the total actual final cut.

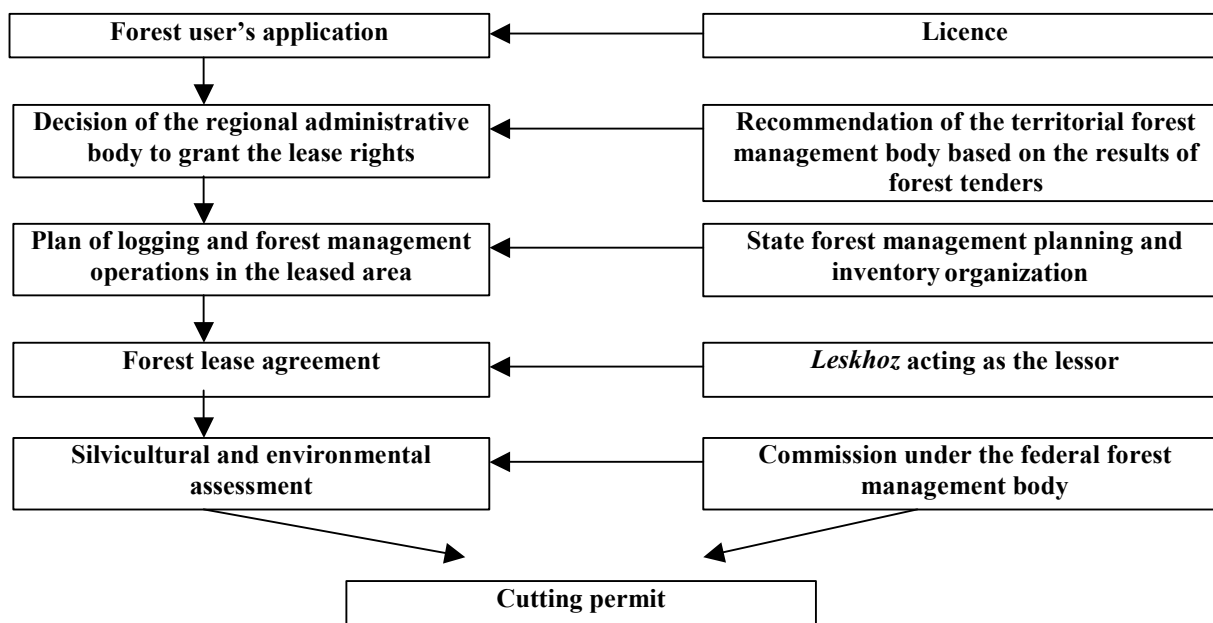
While during the Soviet period, the timber industry's interests overshadowed those of forest management, during the transition, the State turned into the sole owner of the forestland, and has been trying to "regain the territory", so to speak, using legislative controls. These controls include imposing terms and conditions of wood harvesting on forest users, which do not match their economic interests, e.g. felling rules and short periods of forest lease agreements. At present, most lease agreements (about 60%) are executed for periods shorter than 5 years, and as a result, forest users have no incentives to make long term investments in forest development, namely, in forest roads.

Forest users' behaviour in their leased areas is rigidly regulated through forest logging and management plans, which are developed by State forest management planning and inventory organizations without consultation with forest users and coordination with their business plans. Another forest lease procedure which remains very complicated, is the issuance of cutting permits (figure 2). It is this bureaucratically complex procedure that, among other things, results in substantial volumes of timber harvested without any permits – i.e. in the "grey" sector.

Figure 2 shows that the procedure of silvicultural and environmental assessment is mandatory for all foreign and local lessees in case their annual cuts exceed 150,000 m<sup>3</sup> in forest-rich areas, and 50,000 m<sup>3</sup> in sparsely-forested areas. Figure 2 shows that only the cutting permit gives the right to harvest timber meant for final cutting.

Figure 2 also explicitly demonstrates that existing forest lease arrangements do not include normal negotiating processes between forest authorities and forest users, instead, they are based on rigid administration on the part of federal and regional authorities.

Figure 2  
Procedures to acquire forest lease rights



In terms of transition to market relations, the most advanced forest utilization arrangement is auctions which allow for competition among forest users even in those regions where roundwood markets are monopolized by major consumers, including pulp and paper enterprises and saw mills. The efficiency of stumpage auctions has been proved by the fact that in these cases, actual stumpage prices exceed the minimum stumpage rates by 4 - 5 times, and in some areas the difference reaches 8 - 10 times. Nowadays, auctions account for about 20 % of timber sales; thereby only physically accessible resources are harvested, with no investments into road construction. Owing to poor road conditions in Russia, such forest areas are becoming fewer, which increases the danger for forests of environmental and social significance since timber industries may start to log them for the sake of high profits.

Analysing the existing economic relations in the area of forest use, one may characterise them as not yet representing a normal competitive market with negotiating processes between owners and users, and transparent flows of funds. The market suffers from a strong pressure on the part of regional authorities that make forest use-related decisions to cater for interests of individual industrial groups rather than based on market considerations. As indicated above, forest markets are subject to significant distortions brought about by the State monopoly, represented by *leskhoz*es, which have abundant financial privileges in relation to their harvesting timber from thinning which makes it possible for them to create much more favourable conditions for these operations compared to final cutting. The aforesaid leads to the conclusion that the forest reforms of 1993 - 2000 cannot be regarded as liberal reforms since the State, being the sole owner of the forestland, retains its strong position in the area of regulating forest relations, and for these purposes applies rather inefficient administration methods.



## 4 Trends in the development of the Russian forest industry 1980-2000

Over the period 1980-2000 great political, economic, organizational and social changes took place in the forest and forest industry sector of Russia, which decisively affected the sector's output and dynamics for the country as a whole and for regions. The period under review can be divided into two decades: 1980-1990 – pre-reform period of centrally planned economy; and 1990-2000 – the period of transition towards a market economy. Dynamic growth of almost all types of paper and forest products up to 1989 inclusive was a distinctive feature of the pre-reform period (table 6)

Table 6  
Forest industry production in Russia, 1980-1990

Item	Unit	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Wood removals	million m <sup>3</sup>	328	329	327	325	337	337	345	357	354	338	304
Sawnwood	million m <sup>3</sup>	80	80	80	79	79	80	83	83	85	82	75
Plywood	1,000 m <sup>3</sup>	1 459	1 472	1 464	1 523	1 546	1 594	1 695	1 689	1 727	1 735	1 597
Particle board	1,000 m <sup>3</sup>	3 491	3 741	3 964	4 080	4 487	4 673	4 808	5 120	5 490	5 654	5 568
Fibreboard	1,000 m <sup>3</sup>	1 236	1 273	1 264	1 360	1 404	1 450	1 568	1 569	1 603	1 592	1 546
Pulp	1,000 tons	6 770	6 950	7 060	7 500	7 720	7 950	8 240	8 230	8 350	8 110	7 530
Paper and paperboard	1,000 tons	7 000	7 140	7 110	7 520	7 730	7 910	8 230	8 390	8 580	8 480	8 320

In 1989 Russia ranked second in the world (after the USA) in wood removals, production of sawnwood and wood-based panels. Russia also took one of the leading places in the world in the production of pulp, paper and paperboard. Over the period from 1980 to 1990 wood removals grew by 7.9%, production of sawnwood 5.7%, plywood 18.4%, particle board 57.3%, fibreboard 29.7%, pulp 23.3%, and paper and paperboard – 12.6%. High volumes of forest industry production in the 1980s were secured by State supported modernization of facilities and construction of new logging, woodworking and pulp and paper enterprises, as well as by heavy demand for forest and paper products on domestic and foreign markets. The Russian Federation, as the largest Republic of the Soviet Union, supplied large volumes of products of the forest and forest industry sector to other Union Republics. In the period of 1980-1989, the entire Soviet economy was developing at high rates. The annual growth of Gross Domestic Product was for 3-5%.

Shifting logging and wood processing operations to the regions of Siberia and the Far East, where the largest forest resources were concentrated, was the strategic task of development of the forest and forest industry sector during the 1980s. In those years, the Ust-Ilimsk forest industry complex was constructed in the Asian part of the country, which, in addition to large-scale pulp production, had production capacities of 650,000 m<sup>3</sup> per year of sawnwood and 240,000 m<sup>3</sup> per year of particle board. At Tomsk timber transshipment integrated plant, a new shop was constructed for production of particle board with an annual capacity of 110,000 m<sup>3</sup>, as was another one – at Amurskiy LDK (integrated sawmilling and woodworking plant), with an annual capacity of 80,000 m<sup>3</sup>. However, in the last years of the pre-reform decade, a tendency towards slowdown of growth rates took shape, and since 1989, there had been a decline in production in the majority of branches of the forest and forest industry sector. Russia never achieved a competitive level in the production of some types of forest products, particle board and fibreboard in particular. Disproportions in territorial development of logging and wood processing capacities took place.

Orientation to construction of wood processing enterprises in the regions of Siberia adopted by the Government was to a certain degree a solution to the problem of bringing wood processing nearer to the location of wood harvesting operations. However, simultaneous rejection of construction of such plants in the central part of Russia, where the major consumers of forest products are situated, inevitably showed inefficiency of such a one-sided approach to location of wood processing industries. Under subsequent market economy conditions this miscalculation became apparent.

The development of chemical and chemical-and-mechanical wood processing lagged behind the development of logging. The management system in the forest and forest industry sector was extremely rigid, which restrained the initiative of plant managers; economic factors were suppressed by centralized distribution of material resources, machinery and industrial products. By the end of the 1980s, the economy went into recession.

Transition towards a market economy proved difficult and painful for Russia. In the period of transition, practically all branches of the forest sector found themselves in crisis, which manifested itself in the following: sharp reduction in the volumes of production; appearance of a great number of insolvent enterprises; reduction in domestic consumption of basic types of forest products; almost complete stoppage of construction and commissioning of new plants; low investment and innovation activities; widespread reduction in the output of logging and wood processing equipment; low technical level of forest industry production; reduction in labour productivity to the level of the 1950s; breaking down of federal- and regional-level management systems; disintegration of technologically linked industries; sharp deterioration in the social infrastructure of forest settlements. The basic indicators, as measured from important parameters, were several times lower as compared to other branches of the economy.

The output of paper and forest products for 1990-2000 is presented in table 7. While analysing the data of this table, two periods can be singled out: the first one – up to 1998 and the second – since 1999. A sharp reduction in the volumes of wood removals and production of roundwood and sawnwood is characteristic of the first period. Whereas in 1990, the volume of wood removals amounted to 304 million m<sup>3</sup>, in 1998 it had dropped to 78.4 million m<sup>3</sup> a fall of 74%. Roundwood production declined from 221 million m<sup>3</sup> to 58.6 million m<sup>3</sup> or a 73% drop. Output of sawnwood fell from 75 million m<sup>3</sup> to 18.6 million m<sup>3</sup> or a 75% drop.

Table 7  
Output of basic types of paper and forest products in Russia in 1990-2000

Item	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Wood removals	million m <sup>3</sup>	304	269	238	175	119	116	97	85	78	90	94
Sawnwood	million m <sup>3</sup>	75	66	53	41	31	27	22	20	19	19	20
Plywood	1,000 m <sup>3</sup>	1 597	1 520	1 268	1 042	890	939	972	943	1 102	1 324	1 484
Particle board	1,000 m <sup>3</sup>	5 568	5 409	4 522	3 941	2 625	2 206	1 472	1 490	1 568	1 987	2 335
Fibreboard	1,000 m <sup>3</sup>	1 546	1 517	1 565	1 159	767	748	588	631	618	777	890
Pulp	1,000 tons	7 525	6 451	5 676	4 403	3 314	4 197	3 075	3 164	3 210	4 225	4 960
Paper and Paperboard	1,000 tons	8 325	7 384	5 765	4 492	3 412	4 074	3 224	3 340	3 595	4 535	5 312

Table 8  
Wood removals by regions  
(million m<sup>3</sup>)

Region	1990	1998	1999	2000
Northern	68.1	22.1	26.6	29.2
North-Western	10.4	3.7	5.1	4.4
Central	23.4	6.9	7.7	7.5
Volgo-Viatskiy	20.0	7.5	8.1	8.4
Central Black –Earth	1.4	0.1	0.1	0.1
Povolzhskiy	5.8	1.2	1.2	1.0
North-Caucasian	2.9	0.3	0.3	0.3
Urals	44.1	10.7	10.5	10.1
West-Siberian	31.8	4.7	4.7	4.5
East-Siberian	65.9	14.6	16.3	17.0
Far-Eastern	29.6	6.4	9.4	11.5

A reduction in the volumes of wood removals was observed in all regions of the country (table 8). However, the scale of the reduction in different regions differed greatly. Over the period of 1990-1998, the volume of wood removals dropped: in the Northern region by 68%; in north-western region by 64%; in Central Black-Earth by 93%; in North Caucasian by 91%, in west-Siberia by 85%; and in the Far- Eastern region by 78%. Over the period under review production of plywood was reduced by 33%; particle board by 71%; fibreboard by 60%; and paper and paperboard by 38%. One of the main reasons for the reduction in industrial production in these years was the sharp deterioration in the economic situation of the Russian Federation. By 1998 the Gross Domestic Product in the country accounted for 57.5% as compared to the level of 1990, industrial output 46.2%, and investment in fixed capital only 21%. Other reasons for the reduction in forest industry production are as follows:

- Breakdown of economic and cooperative ties between logging, wood processing and wood consuming enterprises.
- Breakdown of the system of forest sector management at federal and regional levels.
- Sharp increase in cost of railway transportation of forest products, which put forest industry enterprises of the Urals, West-Siberian and East-Siberian regions in a difficult economic position.
- High level of prices for electric energy and fuel.
- Low technical level of production.
- Tough tax system, under which enterprises had practically no resources left for their development.

Accelerated privatization and formal changes of forms of ownership resulted in a sharp reduction in the volumes and efficiency of production of many enterprises. Much confusion arose amongst the new owners (the employees) as to how to run a business, and there was no available funding for technical improvements, or in some cases, even for day-to-day operational costs.

At many enterprises, the content of privatization plans did not fit the situation in the country. The privatization recommendations were often not considered by the new “owners”, when they were forced to act suddenly in a market framework. As a result, such enterprises failed to attract investments for the development of production. Support from policy, institutional-and-legal reforms were insufficient to counteract the problems with market infrastructure, business development, and availability and peculiarities of the capital markets. Besides, the State proved to be unable to manage its property efficiently. Economic management and institution of representatives of the State in joint stock companies with appropriate blocks of shares did not prove their value as forms of realization of State property. The State as an owner had not yet drawn up a well founded strategy for its property management.

The economic crisis, which reached its peak in August of 1998 forced the Government to make alterations to the budget-and-monetary system, tax, credit and tariff policy. The measures that were taken made it possible to change the economic and financial situation in the country for the better in 1999 and 2000. Growth of Gross Domestic Product in 1999 amounted to 3.5%, in 2000 7.7%, growth of industrial output to 8.1% and 9.1% respectively, and growth of investments in fixed capital to 5.3% and 1.4%.

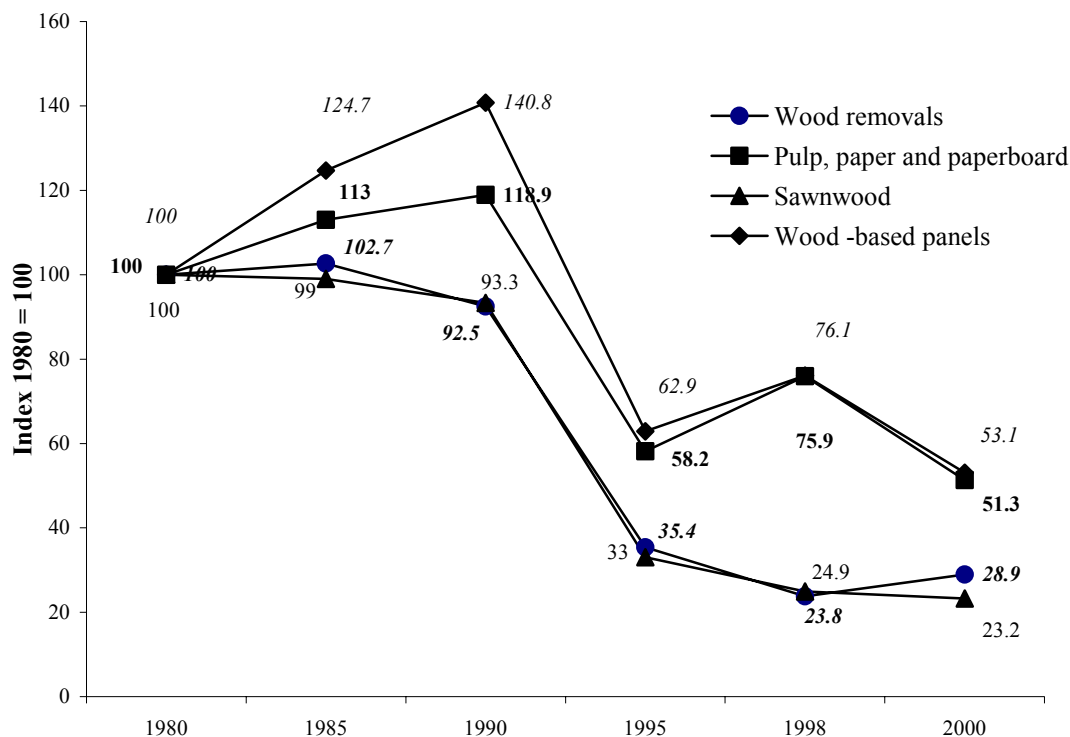
The situation in the forest and forest industry sector improved as well (table 9). In 1999 and 2000 growth of production of all types of forest products was achieved. The highest growth rates were observed in the production of plywood (20.1 and 11.8%), particle board (26.7 and 19.2%), fibreboard (25.8 and 14.2%), and paper and paperboard (26.1 and 15.5%). In 2001 growth of forest industry production continued.

Table 9  
Output of forest products in Russia in 1998, 1999 and 2000

Forest products	1998	1999	1999/1998 % change	2000	2000/1999 % change
Wood removals (million m <sup>3</sup> )	78.2	90.0	+15.1	94.8	+5.3
Roundwood (million m <sup>3</sup> )	58.6	69.1	+17.9	73.0	+5.6
Sawnwood (million m <sup>3</sup> )	18.6	19.1	+2.7	20.0	+5.7
Plywood (1,000 m <sup>3</sup> )	1 102	1 324.0	+20.1	1 484	+12.1
Particle board (1,000 m <sup>3</sup> )	1 568	1 986.5	+26.7	2 335	+17.5
Fibreboard (1,000 m <sup>3</sup> )	618	777.6	+125.8	890	+14.4
Pulp (1,000 tons)	3 210	4 225	+31.6	4 960	+17.5
Paper and paperboard (1,000 tons)	3 595	4 535	+26.1	5 312	+17.1

However, the 2001 indices of output still lagged behind those of the pre-reform period, which is clearly shown in figure 3. In 2000 the volume of wood removals amounted to only 28.9% as compared with 1990, production of sawnwood to 23.2%, wood-based panels to 53.1%, paper and paperboard to 51.3%. The above-mentioned figures prove how necessary it is to continue developing forest industry production.

Figure 3  
Output of forest products in Russia 1980-2000



## 5 Analysis of domestic consumption and trade in forest products in Russia 1980-2000

### 5.1 Domestic consumption of forest products in Russia

Wood and wood products are used in all branches of industry, notably construction, agriculture, and printing. An estimate of total consumption of forest products by regions of the country shows that the share of the European part, mainly central, privolzhskiy and southern regions, in consumption of industrial wood, products of wood processing and the pulp and paper industry accounts for 70%. It should be stressed that technical progress contributes to expanding the spheres of wood utilization. At the same time the structure of forest products consumption is changing: consumption of unprocessed wood (roundwood) is declining and consumption of products of high-degree chemical wood processing is growing.

Volumes of domestic consumption by types of forest products for Russia as a whole in 1980-2000 are presented in figure 4. Over the period of 1980-2000 the volumes of domestic consumption of industrial wood decreased by the following percentages: sawnwood by 80%, plywood by 38%, and paper and paperboard by 9%. Consumption of particle board and fibreboard increased slightly. Within the given period, consumption of selected types of forest products changed. Up to 1990 the volumes of consumption of industrial wood remained unchanged. Their sharp reduction began in 1990 and continued until 1998. In 1999 and 2000, growth of industrial wood consumption amounted to 23.4% against 1998. A similar situation is also characteristic of wood-based panels, paper and paperboard consumption. A reduction in domestic consumption of sawnwood was observed in both 1999 and 2000.

During the years of economic reform, per capita consumption of forest products fell as well: sawnwood from 0.401 m<sup>3</sup> in 1990 to 0.084 m<sup>3</sup> in 2000, wood-based panels from 0.057 m<sup>3</sup> to 0.025 m<sup>3</sup> respectively, and paper and paperboard from 43.1 kg to 24.1 kg. In 2000 per capita consumption of forest products was several times lower compared to other countries (USA, Canada, Finland, Sweden and others). For example, per capita consumption of paper and paperboard in the USA is 351 kg, whereas in Russia it is 24.1 kg. The primary reasons for the fall in domestic consumption of forest products in 1990-1998 are directly related to the economic and financial crisis in the country and in the branches of the industry in the transition period.

Fall of domestic consumption is linked to:

- Low solvency of enterprises consuming wood and processed wood products.
- Reduction of incomes of the major part of the population and the consequent inability to buy forest products for personal needs.
- Reduction in industrial and housing construction.
- Production recession in woodworking and pulp and paper industries.
- Reductions in the production of wood consuming industries (coal, machine building, furniture and others).
- Growth of exports.
- Increased imports of furniture, wood-based panels and joinery.

Figure 4  
Domestic consumption of basic types of paper and forest products 82.0

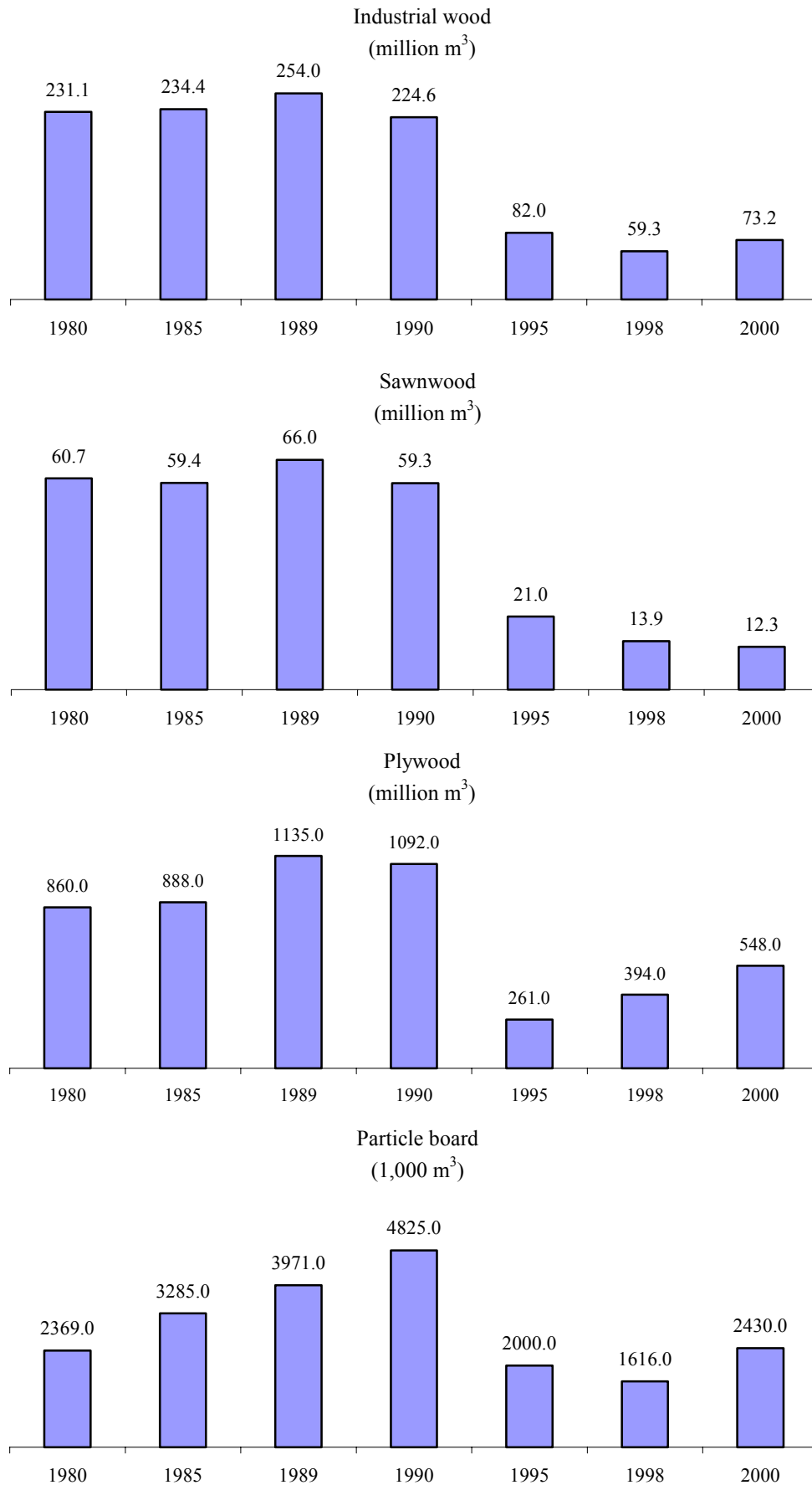
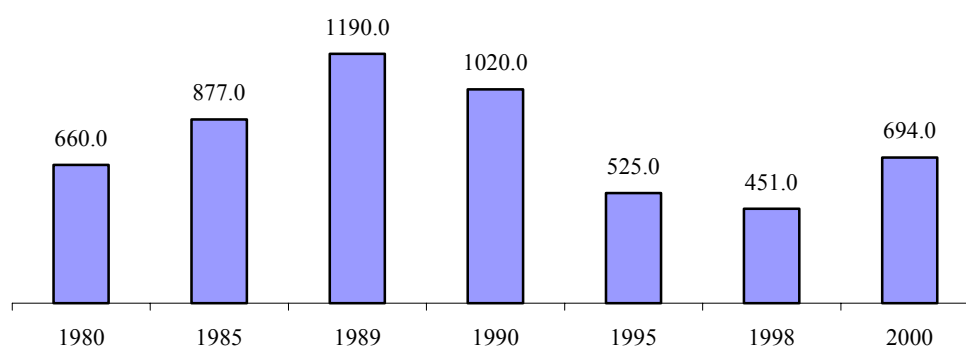
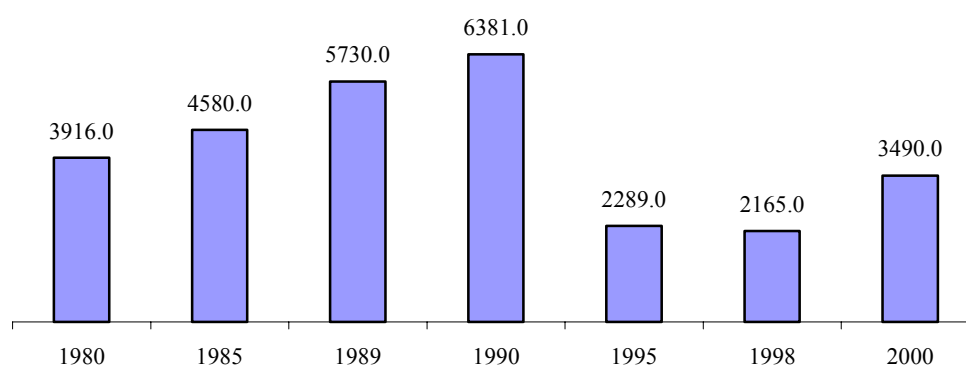


Figure 4 (continued)  
**Domestic consumption of basic types of paper and forest products**  
 Fiberboard  
 (1,000 m<sup>3</sup>)



Paper and paperboard  
 (1,000 m<sup>3</sup>)



The main spheres of domestic consumption of industrial roundwood/semi-processed timber are wood processing industries (pulp and paper, sawmilling, plywood, panel), construction, repair of buildings and installations, and the mining industry. The main spheres of consumption of sawnwood and wood-based panels are: construction/installations and repair of buildings, and the production of furniture, containers and packaging. The structure of forest products consumption, by main spheres in 2000, is presented in table 10.

Table 10  
**Main spheres of forest products consumption in 2000**

Item	<i>Industrial wood</i>		<i>Sawnwood</i>		<i>Wood-based panels</i>		<i>Paper and paperboard</i>	
	<i>million m<sup>3</sup></i>	<i>%</i>	<i>million m<sup>3</sup></i>	<i>%</i>	<i>1,000 m<sup>3</sup></i>	<i>%</i>	<i>1,000 tons</i>	<i>%</i>
Construction	0.9	1.2	5.8	47.2	395	10.8	-	-
Repair/installations of buildings	0.7	1.0	2.83	23.0	271	7.4	-	-
Furniture production	-	-	0.52	4.2	2 204	60.0	-	-
Mining industry	1.3	1.8	0.16	1.3	-	-	-	-
Containers and packaging	0.5	0.7	2.19	17.8	52	1.4	1 275	36.5
Machine building	-	-	0.7	5.7	106	2.9	-	-
Printing	-	-	-	-	-	-	2 215	63.5
Other needs	2.0	2.7	0.1	0.8	644	17.5	-	-
<b>Total</b>	<b>5.4</b>	<b>7.4</b>	<b>12.3</b>	<b>100</b>	<b>3 672</b>	<b>100</b>	<b>3 490</b>	<b>100</b>
Wood processing, sawmilling, wood-based panels	40.7	55.6	-	-	-	-	-	-
Pulp and paper production	27.1	37.0	-	-	-	-	-	-
<b>Grand total</b>	<b>73.2</b>	<b>100</b>	<b>12.3</b>	<b>100</b>	<b>3 672</b>	<b>100</b>	<b>3 490</b>	<b>100</b>

Over the period of 1990-2000, all spheres experienced reduction in consumption. Thus, consumption in construction was reduced by more than 80%. This is related to a general decline in construction, including housing construction, which had always been the major consumer of forest products.

There are several reasons for the reduction in the production of wooden railway sleepers. The first is a sharp growth of prices – under market conditions the price of sleepers became equal to that of high value cants. The second reason is high transport costs – almost the entire sleeper production is concentrated in Siberia and in Irkutsk oblast, while consumption is centred in the central and southern parts of Russia. Thirdly, it is related to an almost complete stoppage of new railway construction.

Consumption of forest products for repair of buildings and installations was reduced by more than 75%, although the number of houses and buildings grew slightly during that period. Such a situation cannot last long – the service life of wooden elements in construction does not exceed 50 years, and the buildings had not been repaired for many years. Consumption of forest products for container and package production was directly proportional to the decline in production; no product – no package. Shipping containers are needed mainly in light industry, as well as in electronics and machine building.

While analysing the changes in the structure of consumption of forest products, one other phenomenon should be pointed out. As regards some important items, there emerged a competition between domestic and imported goods. Over recent years, demand for high quality imported furniture, wallpaper and joinery (windows, doors, linings, parquet) has grown.

## **5.2 Forest products trade**

Export of forest products occupies one of the most important positions in foreign economic activity of the Russian Federation. In the pre-reform period, trade in forest products was the monopoly of the State, which exported roundwood, sawnwood, wood-based panels, pulp, paper and paperboard through the all-Union association “Exportles”. Trade agencies of “Exportles” were located in many countries of the world: Finland, Sweden, Japan, Italy, Great Britain, France, Germany and other countries. With the transition towards a market economy and liberalization of foreign trade, the monopoly of “Exportles” was eliminated. At present, thousands of enterprises and organizations of the Russian Federation engaged in foreign economic activity are in the international forest products market. It is not only manufacturing enterprises producing forest products; numerous trade agents, such as corporations, associations, partnerships and private entrepreneurs are also working in the sector. Federal and territorial structures, representing different ministries and administrations are also engaged in forest products trade.

Wood and wood products remain among the high priority and most effective export commodities of Russia. According to Roskomstat of the Russian Federation, forest exports regularly take third or fourth place among the basic branches of raw material exports (after oil, gas and - in certain years – aluminium).

The dynamics of forest products exports over the period under consideration are presented in table 11. Here general data on exports to “far abroad”, CIS and Baltic countries are given. The data on exports for 1980-1990 include deliveries of forest and paper products from Russia to former Union Republics. Three periods in export dynamics can be singled out for analysis of forest exports of Russia.

- The first includes the years from 1980 to 1988, when stable growth of exports of all types of forest products was observed.
- The second period starts in the years of “perestroika” and ends in 1998 (during these years the volumes of forest products exports fell considerably).
- The third period, 1999 and 2000, is characterized by an increase in Russian forest exports.



Table 11  
Forest exports of the Russian Federation, 1980 – 2000 (export to CIS countries excluded)

Item	1980	1985	1988	1990	1995	1998	2000	2000/1980 %	2000/1990 %
Roundwood (million m <sup>3</sup> )	37	37	41	31	18	20	31	-15.6	-1.9
Sawnwood (million m <sup>3</sup> )	20	20	21	16	6	5	8	-60.2	-50.3
Plywood (1,000 m <sup>3</sup> )	599	706	743	527	678	737	973	+62.1	+84.6
Particle board (1,000 m <sup>3</sup> )	1 122	1 388	1 636	743	169	100	135	-82.0	-81.8
Fibreboard (1,000 m <sup>3</sup> )	576	573	667	365	134	173	278	-51.7	-23.8
Pulp (1,000 tons)	1 493	1 615	1 812	993	1 332	1 056	1 660	+11.2	+67.2
Paper and paperboard (1,000 tons)	3 084	3 330	3 196	2 761	1 815	1 767	2 298	-25.4	-16.8

Table 12  
Exports of forest products to the former Union Republics (CIS and Baltic countries)

Item	1980	Share of the total exports, %	1985	Share of the total exports, %	1990	Share of the total exports, %
Roundwood (million m <sup>3</sup> )	19.6	54.0	19.1	52.0	17.3	55.0
Sawnwood (million m <sup>3</sup> )	12.1	62.0	12.0	60.0	8.8	56.0
Plywood (1,000 m <sup>3</sup> )	284.8	47.0	261.0	37.0	205.0	39.0
Particle board (1,000 m <sup>3</sup> )	790.0	70.0	1 090	78.0	639.0	86.0
Fibreboard (1,000 m <sup>3</sup> )	286.0	50.0	344.0	60.0	229.0	63.0
Pulp (1,000 tons)	672.0	45.0	645.0	40.0	781.0	79.0
Paper and paperboard (1,000 tons)	2 066	67.0	2 225	67.0	2 034	74.0

High volumes of export to the former Union Republics are characteristic of the pre-reform period (table 12). In the pre-reform period logging and wood processing enterprises of Russia supplied large quantities of forest products to the former Union Republics: roundwood (17-19 million m<sup>3</sup>) in the form of saw logs, pulpwood, mine timber, construction timber, etc.; sawnwood (9-12 million m<sup>3</sup>); paper and paperboard (2.2 million tons) as well as wood-based panels, joinery and other products of wood processing and goods made of paper and paperboard.

Bulk consumers of Russian roundwood and sawnwood were Ukraine (41%), Uzbekistan (16%) and Kazakhstan (15%). In turn, many Republics, using mainly Russian raw materials and semi-finished products, delivered furniture, specialities, plywood, matches, skis, etc. to Russia (Ukraine, Belarus, Lithuania, Latvia, Estonia). In the first years of reform, exports of most forest products fell. This applied to roundwood, sawnwood and wood-based panels in particular.

In 1999 and 2000 the highest growth rates of Russian exports were observed. Growth of roundwood exports amounted to 54%, sawnwood 66%, wood-based panels 38%, pulp 57%, and paper and paperboard 27%, export deliveries being primarily to the countries of Western Europe, China, and Japan. At the same time trade in forest products with CIS countries had declined sharply by 2000. In 2000 exports of roundwood to Ukraine, Belarus, Kazakhstan, Armenia, Georgia, Uzbekistan and other CIS countries amounted to only 0.7 million m<sup>3</sup> (a drop of 96% compared to 1980), exports of sawnwood fell by 89%, pulp 90%, and paper and paperboard 83%. Consequently the countries of Europe, Asia, Africa and North America account for the entire growth of exports. The major importers of Russian forest products are presented in table 13.

Table 13  
Major countries importing paper and forest products from Russia (2000 data)

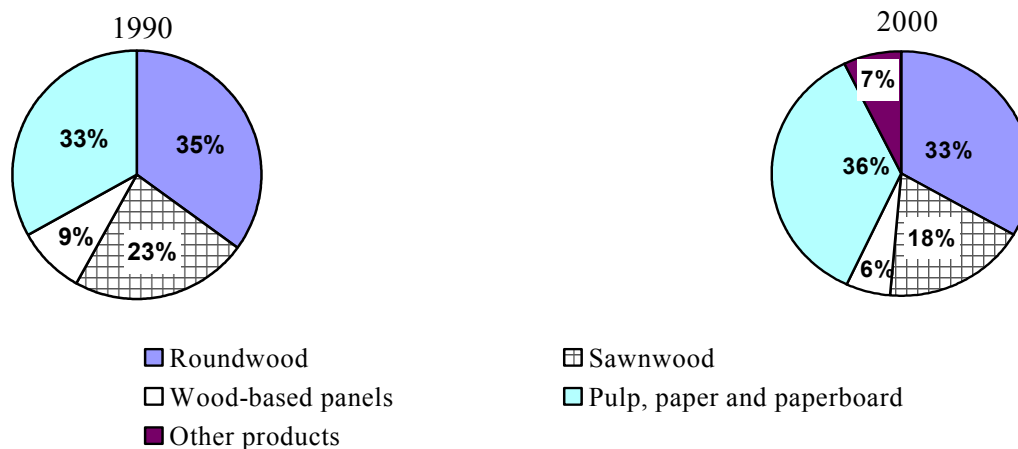
<i>Roundwood</i>	<i>Sawnwood</i>	<i>Wood-based panels</i>	<i>Pulp and paper products</i>
Finland	Japan	USA	China
Japan	Egypt	United Kingdom	Turkey
China	Germany	Ireland	Ireland
Sweden	United Kingdom	Egypt	India
Republic of Korea	Italy	Italy	Italy
Turkey	Netherlands	Germany	Poland
Norway	France	Sweden	Germany
Germany	Lithuania	Denmark	Republic of Korea
Austria	Latvia	Belgium	Hungary
Belgium	Estonia	Morocco	United Kingdom
Hungary	China	Syria	Belgium
	Belgium	Turkey	Egypt
	Turkey	Saudi Arabia	Lithuania
	Austria	Netherlands	
	Hungary		

Cost structure is one of the indices determining efficiency of the forest exports (figure 5). High shares of roundwood in total currency earnings are characteristic of Russian forest exports. Over the last ten years the structure of Russian forest exports has undergone practically no changes. In 1990 the share of roundwood in currency earnings accounted for 35%, in 2000, 33%.

In the pulp and paper industry the shares are 33 and 36% respectively. The relatively small amount of currency earnings is caused by raw material orientation of Russian forest exports. For comparison, Sweden's and Finland's currency earnings are higher than those of Russia (2.5-3 times) owing to the effective structure of forest product exports, primarily products of high-degree chemical wood processing, despite their much lower timber harvest volumes.

Figure 5

Structure of forest exports of the Russian Federation



## 6 Long term outlook scenarios for the Russian Federation forest sector

### 6.1 Long term social and economic outlook

The forecast of the Russian forest sector starts from its resource potential, which is important for domestic demand in forest products, but should also be analysed in the context of global demand. However, realization of these potentialities will, to a great extent, depend on macroeconomic developments, social and environmental conditions, and the scientific and technical progress of the Russian Federation.

The level of effectiveness of labour resources, which needs significant intersectoral and intrasectoral reorientation and adaptation to market conditions and new scientific and technical requirements, affects development of the forest sector. At the first stage of the forecast period (up to 2015), formulation and realisation of social and economic policy (for the rapid elimination of the consequences of the former planning system and the economic crisis that hit Russia at the end of the 20th century) seems to be of the utmost importance in connection with the transition from a planned to a market economy.

On the whole, not only restoration of economic potential, but also laying down the foundation for changes in the sectoral and technological structure of Russia's entire economy, and the forest sector in particular, are assumed during this period. Transition to sustainable economic growth should be secured by adequate social and economic policy, implementation of concrete programmes of development for the industries and regions, and large investment projects supported by the State. Therefore, the period up to 2015 can be considered as vitally important for scientific forecasting based on concrete research projects and adequate market knowledge. The long term forecast will be based on assessment of the most important trends and potential levels of scientific-and-technical and socio-economic progress, primarily at expert level.

Proceeding to potential estimates of future development of the forest and forest industry sector, it is necessary to consider the official national forecasts of further socio-economic development of the country as a whole. Macroeconomic indices of these forecasts are the basic prerequisites for development of the forest sector industries to secure demand for forest products on the domestic market as well as potential export on external markets. The basic indices of the following documents were assumed as the primary basis for the present study: medium-term programme "Structural reform and economic growth for the period of 1998-2005", drawn-up by the Ministry of Economy of Russia in 2000, "Main directions of social and economic development of Russian Federation for long term prospect", prepared by the fund "Centre of strategic projects", approved in principle by the Government of the Russian Federation in 2001. "Scenario of socio-economic development of the country for the period up to 2015", issued by the Institute of Economics of the Academy of Sciences of the Russian Federation, as well as a number of alternative and other forecasts and studies were also used. The scenarios of socioeconomic development of the country, carried out by various prognostic centres, provides the base for an assumption of an average annual growth of Gross Domestic Product in the range of 5-6% and growth of investment in the range of 10-12%.

According to a report prepared by the group of economists under the guidance of V. I. Ishaev, the member of the presidium of the State Council, the anticipated economic growth in Russia, in medium-term perspective, will amount to 5-7% per year as regards total output, and 10-15% in output in separate industries. In the opinion of developers of the strategy, these provisions are aimed at reforming and modernizing the economy, including the establishment of a favourable business and investment climate, structural and macroeconomic policy, determining the general development strategy of the country and representing the basis for sectoral strategic projects. In the document "Main directions of social and economic development of the Russian Federation for long-term prospect", three variants of development are proposed.

The first variant implies withdrawal of the State from practically all spheres of economic activity, opening of the country to the outside world and privatization of the major part of social functions. This option can lead to substantial economic growth, higher, in a short-term perspective than any other scenario. However, the probability of its occurrence is not high. It is related to the impossibility of any rapid establishment of a market institutional framework, which is vitally important under the conditions of liberal economy, and the inability of the majority of Russian enterprises to compete as equals with foreign participants in the market, which would lead to social consequences that are difficult to assess.

The second variant is oriented towards the extension of direct participation of the State in regulating economic and social relations, which means the necessity of a significant increase in tax collection and investment expansion of the State, all of which would not contribute to creating favourable conditions for the development of business activity. Moreover, this scenario implies preserving a closed economic structure, which would not allow participation in globalization, which can result in further technological lagging of our country behind the developed countries.

The third variant of modernisation, based on releasing of private initiative and strengthening of the role of the State in securing favourable conditions for economic management, including financial and social stability, balances the elements of the two other variants of the strategy. Instead of having a paternalistic State, or privatization of social functions (radical liberalism), a “subsidiaric” State is formed; it ensures a level of social security, which society by itself is unable to ensure. Special emphasis is laid on active integration of Russia into the world community and economy. At the same time, protection of Russian producers from unfair competition on the part of foreign participants in the market is envisaged for the transition period. This is the policy of common sense, proposing practicable solutions for relevant problems, which take account of current budgetary and general resource limitations. The programme of modernization makes it possible to minimize the social costs of transformations and avert the threat of a financial crisis.

Summarizing the forecasts connected with the long-term socio-economic development of the Russian Federation, the following conclusions can be made:

- The strategic goal of the Government is to secure sustainable economic and social development.
- The main task in the social sphere is to raise the living standards of the population, to increase real income, to change over to “address” the principle of allotment of social grants and social aid to the poorest sector of the population.
- Sustainable growth of basic macroeconomic development indices: Gross Domestic Product, industrial production and investment in fixed capital.
- Enhancement of the role of the State in support and promotion of socioeconomic development of the country in cases when the market mechanism fails to do so.

## **6.2 Scenarios of the forest sector development over the outlook period**

Three scenarios for the development of the forest sector for the period of up to 2015 and subsequent years are considered in the present study, based on an analysis of the above-mentioned programmes and forecasts of socio-economic development for the Russian Federation, as well as the strategy of development of forest, woodworking and pulp and paper industries for the period up to 2010, drawn up by the Ministry of Economy of the Russian Federation. The need for considering three scenarios is attributed to the following circumstances:

- At present a sustainable economic situation has yet to take shape in Russia as a whole, and in the forest sector in particular.
- One of the decisive conditions for the development of the forest sector is the availability of financial resources (investments). Their attraction depends on many internal and external factors.
- The principle “demand generates supply” is characteristic of a market economy. Demand depends on the level of economic development of the country, solvency of forest enterprises and organizations, competitiveness of manufactured forest products, the level of incomes of the population and other factors.

Possible scenarios of development of the forest sector of the Russian Federation for the period up to 2015 are presented below.

**Scenario I.** One of the variants of development of the Russian Federation is taken as the basis. This variant implies growth of Gross Domestic Product (GDP) in the range from 5% to 10% per year. According to comparable estimates, GDP will increase by 60-80% by 2010 compared with 2000. The share of investment in fixed capital will account for 25% of GDP. The State will contribute to development of material production through economic mechanisms in investment and innovation activities, social guarantees to population, and promotion of small-scale business. Proceeding from the growth of macroeconomic indices according to the first scenario, the following issues are assumed for the future development of the Russia forest sector:

- Overcoming of the crisis and its consequences is to be achieved with the transition to sustainable and efficient functioning of all branches of the forest sector.
- Available production- and technical potential of existing enterprises is used in full measure on the basis of their reconstruction, modernization and technical improvements, and in cases of need – reorientation to production of other types of competitive products.
- The structure of forest industry production is improved in the direction of increasing of the share of complex chemical and chemical-and-mechanical processing of the entire wood biomass, including wood waste; this applies primarily to the pulp and paper industry – for the purpose of overcoming the prolonged and depressed period of per capita consumption of paper and paperboard. To achieve this objective construction of new pulp and paper mills will be needed in the European part (Central, Northern regions) and beyond the Urals - in west and east Siberia and in the far east.
- Priority development of the forest and forest industry sector of the European part of the country is secured, where greater demand for forest and paper products exists for the domestic market of Russia, and major export markets of Europe, Near-East and North Africa are developed. The regions of European North, Centre and the Urals, which are rich in forests, should be rationally used as well as the forest resources of forest-deficient regions of Povolzhie and the south of Russia. Development of the forest and forest industry sector in the regions of Siberia and Far East should be concentrated primarily in economically developed zones accessible to transport, with processing of wood into transportable high value added products.
- Foreign economic activity will be oriented to improving the structure of forest exports in favour of competitive exports of pulp and paper and woodworking industries, and a reduction of export of round wood to foreign countries.
- Import of paper and articles from paper and paperboard as well as products of woodworking is reduced through expansion and improvement of quality of domestic products.
- Advanced technological processes are mastered, securing an ecologically safe level of environmental impact of forest industry enterprises, including all types of wood processing.

**Scenario II** proceeds from the most favourable development of the general political situation, social-and-economic and scientific-and- technical progress in all spheres of Russian economy, projected by the Government. Throughout the period, the average annual rates of GDP growth will be not less than 7%, reaching a peak of 10% by 2015. The rate of industry growth will be 8-11% per year. Production and technical potential is being renewed at an accelerated rate with transition to the period of 2010-2020 and in further perspective – to principally new technologies and output of high tech products with high value added. Introduction of resource- and energy saving technologies will accelerate the reduction of cost levels and consequently the accumulation processes and investments will grow in a more sustainable way. Growth of investments is expected at the level of 12-15%. Realisation of major social programmes is envisaged, in the spheres of public health service, education, housing facilities and public utilities. By 2015, housing starts will increase more than 3-fold against 2000. This will increase the average area of floor space per capita to 25 m<sup>2</sup> per person against the current 19 m<sup>2</sup>, although the gap between this figure and the average European level (30-35 m<sup>2</sup>) will not be bridged. The State will as usual promote the development of material production oriented to output of competitive products through economic mechanisms. According to the second scenario the forest sector should not only satisfy the highest level of demand for its products on the domestic market, but realize the forest potential of Russia on the external market in full measure and increase the level of its integration into the world economy. It is intended to change the structure of forest industry production in the most radical way, not only through renewal of the entire existing production and technical potential, but more through establishment of new enterprises and industries. This will allow considerable expansion of the range of competitive products meeting the requirements of world standards on domestic and external markets. Reaching the high level of per capita consumption of the basic types of forest products envisaged by this scenario will allow development of the export constituent of the forest and forest industry sector, not only for mass commodities but for quality ones as well. The location of forest industry production should be directed to new large forest industry regions in the middle stream of the Enisei, the basin of Podkamennaya Tunguska river, the Far-East zone, as well as to economically developed regions.

**Scenario III** can be called inertial. It also implies development, but on a more limited scale under the conditions of more rigid constraints and incomplete realization of marked intentions. Crisis phenomena hold out.

The economic situation remains unstable for a long period of time. The rates of growth of Gross Domestic Product are 3 - 4% per year. Investment growth rate is 6% per year. Many social problems of society remain unsolved. By 2015 the population decreases by 20 million. A more limited demand for forest products in the forest sector is expected, which will neither allow full realization of forest resource potential, nor will contribute to accomplishment of a number of economic, production-and technical and social tasks, taking into account limited economic potentialities. Thus pulp and paper production is expected to grow solely at the rate of modernization of operating mills, and the growth will amount to not more than 5% per year. This in turn will not allow the greater part of soft- and small wood to be used efficiently in many forest regions, which makes large-scale logging ineffective. Technological improvements to manufacturing equipment will proceed at low rates. Moving to new technologies will be delayed. Labour productivity and quality of products will lag behind the level of the leading timber producing countries. On account of the low competitiveness of a number of products, the country will import a large quantity of furniture, articles manufactured from paper and paperboard, and some products of woodworking. Export potentialities will be realized to a far lesser degree than in I and II scenarios, and an imperfect structure of export products will be preserved.

In table 14, the dynamics of basic macroeconomic indices of development in the Russian Federation for the period up to 2015 for all three scenarios is presented. These indices are fixed on the basis of a forecast of social and economic development of the Russian Federation.

As regards the subsequent period up to 2030, the federal level projections for such a long-run period are not available at present. However, presuming that the first or the second variants of social and economic development will be realized, one can assert with a large measure of certainty that the accumulated production and technical potential, together with widely available natural resources (gas, oil, coal, ore), will allow the dynamic growth of the country to be maintained in the future. The rates of growth of gross domestic product, industrial products, construction and other macroeconomic indices will remain high.

Overcoming the consequences of the crisis of the 1990s will contribute to speeding up the accumulation process in the subsequent period of up to 2030, which in turn, will affect the general growth of population income and raise the living standards securing further growth of demand on domestic market.

Table 14  
Basic macroeconomic indices of the Russian Federation to 2015

Item	2000 (reported)	Scenarios	Forecast (Index: preceding period = 100)			2015/2000 (Index 2000 = 100)
			2005	2010	2015	
Gross Domestic Product (billion rubles)	7 063	I	123	125	135	207
		II	135	135	150	273
		III	115	118	120	163
Industrial production (billion rubles)	4 762	I	125	125	140	219
		II	135	140	155	293
		III	117	119	122	170
Investment in fixed capital (billion rubles)	1 165	I	150	150	160	360
		II	160	175	190	532
		III	130	130	130	220
Money income of the population (billion rubles)	3 742	I	128	132	140	235
		II	143	145	150	309
		III	115	117	121	163
Retail turnover (billion rubles)	2 251	I	125	127	135	214
		II	130	135	140	246
		III	112	115	120	155
Commissioning of new residential houses (million m <sup>2</sup> )	30.0	I	133	125	130	217
		II	167	140	136	317
		III	113	106	106	127
Average provision of the population with housing (m <sup>2</sup> of the aggregate living area per person)	19.4	I	107	110	111	130
		II	107	110	112	131
		III	108	110	110	130
Population (million)	144.8	I	98	98	97	93
		II	99	100	100	99
		III	96	95	95	87

## 7 Demand for forest products on domestic and foreign markets

### 7.1 Demand for forest products on the domestic market

The estimation of prospective demand for forest products is a major element in forecasting the forest and forest industry sector development. Effective demand for forest products is determined primarily by the socio-economic situation in Russia, which for a long period of time has been characterized as critical.

The financial and economic situation, which took shape in the country in 1999, gave rise to an increase in demand in the forest products market, and a number of domestic products began partly replacing more expensive imported products such as furniture, wood-based panels, printing papers, and articles of paper and paperboard. Positive developments depend on the realisation of the socio-economic policy, as outlined in the official forest sector programmes and macroeconomic forecasts. Macroeconomic indices of socio-economic development in the Russian Federation and of forecasts of development of individual sectors of the economy (branches of the industry, construction, agriculture) were the initial basis for estimating demand for forest products for the outlook period.

Forest products markets should be considered as an aggregate of regional markets, where forest products are demanded to different degrees, depending on demand on the external market. It is convenient to single out seven regional markets in the strategic plan of Russia – North-Western, Central, Southern, Urals, West-Siberian, East-Siberian and Far-Eastern. The shaping of regional markets is affected by the following principal factors: demand and supply of forest products and products for further processing; demand and supply of final products both in the production sphere and for the needs of the population. These factors are characterized by such macroeconomic indicators as total population, industrial output, investments in fixed capital, dynamics of housing, availability of forest potential and the level of its utilization for production of basic types of forest products. According to the main features and specific prerequisites, the above mentioned regional markets consist of one or several regions registered by Goskomstat of Russia, which historically took shape according to geographical position, natural conditions, transport, production ties, certain ways of life and living standards. The composition of these regional markets is as follows:

**The North-Western market** incorporates the Northern and North-Western regions as well as Kaliningrad oblast. This is the region with a surplus of forest resources and clearly marked export orientation.

**The Central market** corresponds to the notion of Central Region. The region is forest sufficient and has a big share of the population, and of the production potential and buying capacity of the population.

**The Southern market** incorporates three regions with a forest deficiency: Central Black-Earth, North-Caucasian and Povolzhskiy.

**The Urals market** includes Urals and Volgo-Viatskiy regions. These regions are characterised by a surplus of forest resources and developed forest industry.

**The West-Siberian market** coincides with the West-Siberian region with a surplus of forest resources.

**The East-Siberian market** coincides with the East-Siberian region with a surplus of forest resources.

**The Far-Eastern market** coincides with the Far-Eastern region, having a surplus of forest resources and clearly marked export orientation.

An investigation of the state and structural changes of domestic markets of forest products, both of Russia as a whole and of the larger region as a whole, by the following spheres of consumption was conducted: construction; repair of buildings and installations; production of furniture; mining industry; production of containers and packaging; machine building; railway transport; printing; articles from paper and paperboard; demand for wood raw material for processing and other needs. This investigation revealed the following.

**In the construction sector** demand is determined by the rates of investment, however, forest products are mainly used in housing, public utilities and country cottage construction, which are to be developed in the most active way. At the same time the stable tendency towards a reduction in the share of wooden construction resulting from marked replacement of forest products by other construction materials (brick, metal etc.) is taken into account.

The total housing facilities of Russia account for 2,800 million m<sup>2</sup> of aggregate floor space or 19.4 m<sup>2</sup> per person. To reach the level of 21 m<sup>2</sup>, which is forecast by Gosstroy by 2005 with allowances given for the

removal from service of 520-550 million m<sup>2</sup> of dilapidated housing facilities, it is necessary to increase the annual level of commissioning of new houses to 40-45 million m<sup>2</sup> against 30 million m<sup>2</sup> in 2000.

One should bear in mind that in the late 1980s, the annual commissioning of new housing facilities amounted to 60 million m<sup>2</sup>. In the present-day situation, a clearly marked tendency took shape towards a sharp reduction in the share of “social” housing, that is, housing allotted to certain groups of the population (invalids, veterans, service-men, etc.) in the budget. The scope of housing construction will depend largely on the growth of income for the majority of the population and not only its richest section, although differentiation in this respect has grown swiftly.

In the future, the quality standards of dwellings (norms, arrangement, finish) will undoubtedly rise. Taking these factors into account, an annual commissioning of 60 million m<sup>2</sup> of housing facilities can be projected for the period of 2010-2015. It is worth mentioning that the share of multi-story houses in the total housing units is 50%, while the share of single-story wooden houses is about 15% or 380-400 million m<sup>2</sup>. The Federal special programme “Individual House” envisages an increase in annual low-rise building construction from 5 million m<sup>2</sup> to 15 million m<sup>2</sup>, including over 7 million m<sup>2</sup> of wooden houses. In the light of that, house restoration and rebuilding is also a possible growth industry. In the estimation of demand for forest products for construction and repair, country cottage construction is also taken into account. Although the general rate of progress of this type of construction has considerably slowed down, in suburban zones of many towns, especially large ones, such as Moscow and Saint Petersburg, elite cottage settlements have appeared. At present the population has over 10 million garden houses, their number is constantly growing and they are being continuously restructured. It should also be noted that a clear tendency in favour of brick buildings has become apparent. At the same time, more modified wood materials (sawnwood, plywood, wood-based panels) find application in internal and external finishing in housing and social-and-civil construction.

Demand for forest products for repair of existing housing facilities and household buildings is great in physical terms in connection with its lagging in recent years for financial and economic reasons. Here delayed demand is especially characteristic. Annual repair reserves in this sphere are estimated at 350-400 million m<sup>2</sup>. At present consumption of forest products for repair is 80% lower than to be expected under normal market conditions. Limited buying capacity in the sphere of construction and repair on the whole determines so far relatively low growth of demand for forest products, but in prospective, demand in this sphere will increase considerably depending on the scenarios of development.

By the year of 2015, the demand for sawn timber, plywood and wood-based panels is projected to increase, compared with 2000, by:

- I scenario – 180%
- II scenario – 210%
- III scenario – 80%

Demand for furniture and forest products for furniture production is affected by the growth of housing construction and a change of living standards of the population. At present the need of the population for furniture is very high, which is the principal factor of potential growth of its production. Thus in the countries of Western Europe annual per capita consumption of furniture amounts to \$120-230, in Russia about \$9.

Besides, in 1998 the share of imported furniture in sales in Russia reached 46%. Reduction in the share of imports during the last three years only proved the positive tendency in the development of the domestic furniture industry. For proper functioning of the industry, it is necessary to improve the quality and competitiveness of domestic furniture, reducing in future the share of imported furniture to approximately 15-20%.

**Demand for furniture** will grow under the influence of enhancing the welfare of the country and the people and will depend on the dynamics of personal income, growth of commissioning of dwelling-houses and rooms intended for social purposes, (public health service, culture, management, public utilities). Under the influence of these and many other factors, the furniture industry will form its own demand for forest and paper products.



In spite of the slight reduction in consumption of forest products in furniture production (on account of introduction of non-wood materials and changes in furniture assortment), by 2015 demand for forest products (in general) is projected to increase by:

**Sawnwood, plywood, particle board:**

- I scenario – 140%
- II scenario – 180%
- III scenario – 120%

**Fibreboard:**

- I scenario – 600%
- II scenario – 880%
- III scenario – 340%

**Demand for containers and packaging** will grow in accordance with the general growth of industrial production and the necessity for substantial improvement of container and package quality. Over recent years, the situation in this sector has undergone considerable changes. Industrial production was reduced by 50%, and in the container consuming processing industries such as machine building and metal working by 67%, and in light industry by 83%. The share of extractive industries, which consume only small volumes of packaging increased substantially. On the other hand, the share of military industrial complexes, which had in former times consumed large quantities of packaging, fell sharply.

The structure of container materials used changed considerably in favour of plastics and metal containers (from 22% to 33%). The internal structure of forest products changed appreciably as well in favour of paperboard containers. Whereas in 1990 the share of paperboard packaging in roundwood equivalent accounted for 42% of container production, in 2000 it reached 75%. In prospect, this ratio in favour of paperboard containers will grow further. A considerable decrease in demand for packaging paper and paperboard in the period of crisis (demand fell 75-80%) gave way to marked growth of domestic production during the last two years, which is taken as the basis for the prospective growth of these materials. In accordance with this, demand for forest products for production of container and packaging will increase by 2015 compared with 2000 (depending on scenario) by:

- I scenario – 150%
- II scenario – 220%
- II scenario – 110%

**In machine building** the major consumers of high quality sawn timber, plywood, and wood-based panels are car building, the motor industry and ship building. Depending on the development prospects of these industries, growth of demand for basic types of forest products will increase by 2015 compared with 2000 by:

**Sawnwood:**

- I scenario – 190%
- II scenario – 300%
- III scenario – 110%

**Wood-based panels:**

- - 100%
- - 100%
- - 80%

**In the mining industry** mine timber (pitprops and split logs) is consumed mainly in underground mining of ore and coal, and its consumption depends on the improvement of mining techniques. Taking into account the fact that in prospect, underground mining will be reducing production by 2015, estimates of consumption are relatively low.

In 2000 per capita consumption of **paper and paperboard** in Russia amounted to 24 kg, which is 10-15 times lower compared with the level of developed countries (USA, Finland, Sweden, Germany). While assessing the prospects of paper and paperboard in Russia, it is not sufficient to use classical (for developing economic systems) form, where consumption growth is correlated with growth of Gross Domestic Product. In our case the extremely low indices of per capita consumption for the pre-crisis year of 1990 (41 kg) had declined by half. Overcoming the crisis in itself will increase the rate of consumption growth and, what is more important; the projected economic upturn will inevitably be preceded by an increasing demand in information, thereby increasing demand for paper and paperboard.

Depending on the scenario, the level of per capita consumption by the year of 2015 will reach:

- I scenario – 75 kg
- II scenario – 80 kg
- III scenario – 58 kg

Demand for industrial wood in the domestic market is determined primarily by the demand on the part of sawmilling, woodworking and pulp and paper enterprises for its processing into different types of forest and paper products. The key final data on domestic demand, including demand for industrial wood for processing are given in table 15, table 16 and figure 6. The demand for selected types of forest products by spheres of application is described below.

**Sawnwood** – is primarily used in the sphere of construction and repair after appropriate processing into building products (windows, doors, floors, different structures). In this sphere, the share of sawnwood in total forest products consumption accounted for 70% in 2000, by the year of 2015 it will grow to 78%. In the sphere of containers and packaging production the share was 18% in 2000, by the year of 2015 it will be reduced to 6% due to replacement by container board.

**Plywood** – in 2000 the largest share of use was in furniture production - 30%, in 2015 it will be 32%. Consumption of plywood will increase considerably in construction and repair – from 23% to 32%, including moisture-resistant and fire-retardant types, as concrete formwork, and for finishing and interior purposes.

**Particle board** finds primary application in furniture production – 79% in 2000; by 2015 its share will increase to 84%. The share of particle board finished with different materials and ecologically sound particle board will also increase sharply.

**Fibreboard** (including MDF) – the largest share in 2000 in the construction sector was 39%, and by 2015 the share will decrease to 28%, (the absolute increase of consumption in this sphere being two-fold) due to an increase in its share in furniture production from 16% in 2000 to 41% in 2015.

**Paper and paperboard** have wide applications in printing, production of stationery, organizational-and-technical, for sanitary and household purposes, in 2000 63%, in 2015 61%; for the production of containers and packaging 37% and 39% respectively.

The need to import forest and paper products is attributed to the shortage of special and small-tonnage products from the domestic paper and furniture industries.

In 1998, the share of imported furniture reached 46%, but by 2005 this index is projected to be reduced to 25%, with a further reduction to 15-20%, which will roughly correspond to the level of the majority of developed countries of the world. This, in turn, by promoting accelerated development of domestic furniture production, will secure stable growth of demand for wood-based panels, plywood and sawnwood on the domestic market.

Table 15  
Demand for basic types of forest products on the domestic market of  
the Russian Federation to 2015 (including processing)

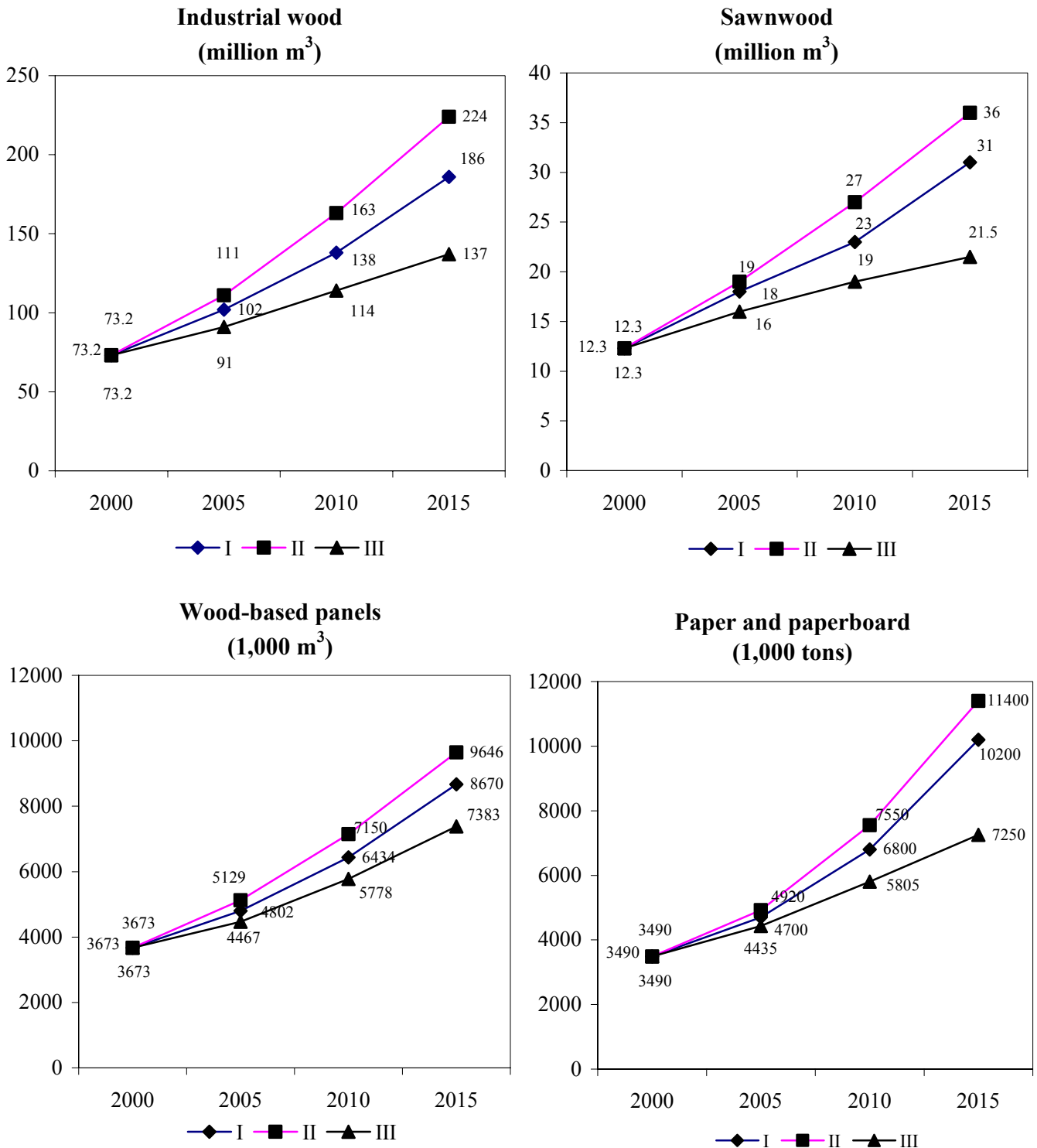
	Scenarios	Industrial wood (million m <sup>3</sup> )	Sawnwood, (million m <sup>3</sup> )	Plywood (1,000 m <sup>3</sup> )	Particle board, (1,000 m <sup>3</sup> )	Fibreboard (1,000 m <sup>3</sup> )	Paper and paperboard (1,000 tons)	Market pulp (1,000 tons)
2000 (reported)		73	12	548	2 430	695	3 490	429
2005	I	102	18	770	3 200	832	4 700	540
	II	112	19	880	3 350	899	4 920	650
	III	91	16	630	3 050	787	4 435	450
2010	I	138	23	950	4 300	1 184	6 800	600
	II	163	27	1 030	4 600	1 520	7 550	800
	III	114	19	780	3 990	1 008	5 805	500
2015	I	186	31	1 150	5 600	1 920	10 200	720
	II	224	36	1 280	5 950	2 416	11 400	1 150
	III	137	21	980	5 075	1 328	7 250	600
2015/2000 % increase	I	154	152	110	130	176	192	68
	II	206	193	134	145	248	227	168
	III	87	71	79	109	91	108	40

Table 16  
Estimates of domestic demand for industrial wood for processing in the Russian Federation  
(million m<sup>3</sup>)

Directions of processing	Scenarios	Year				2015/2000 (% increase)
		2000	2005	2010	2015	
Sawmilling	I	31.6	47.4	64.6	87.5	177
	II		50.6	76.5	105	232
	III		39.5	51	61.2	94
Pulp and paper production	I	27.1	36	50	71	162
	II		41	61	88	225
	III		34	42	51	88
Plywood production	I	3.9	5.6	6.9	8.3	113
	II		6.1	8.1	10.4	167
	III		4.7	5.7	6.9	77
Wood-based panel production	I	3.2	4.3	6.1	8.5	166
	II		4.7	7	10	213
	III		4.1	5.3	6.8	113
Other	I	2.0	2	2.5	2.5	25
	II		2	2.5	2.5	25
	III		2	2.5	2.5	25
Total	I	67.8	95.3	130.1	177.8	162
	II		104.4	155.1	215.9	218
	III		84.3	106.5	128.4	89

Figure 6

Dynamics of domestic demand for forest and paper products for the outlook period up to 2015



## 7.2 Demand for forest products on external markets

The estimations of demand for Russian forest products from external markets were made on the basis of analysis of the dynamics of production, consumption and trade in forest products by countries of the world for the period of 1980-2000 and forecasts of FAO and the United Nations Economic Commission for Europe for the outlook period (2010 and 2020). The analysis showed that an increase in demand for forest products, characteristic for the world community, can be attributed to the following factors:

- Ever-growing consumption of basic types of forest products in industry, construction, printing and other spheres of the economy in the greater part of the countries of the world.
- A projected deficit of forest products in the leading countries of Europe and Asia, and a reduction of their economic accessibility in connection with growth of labour costs.
- Enhancement of the forests' role in environmental protection, increase of the share of forestlands occupied by national parks, reserves and other detached forest areas, where fellings are forbidden or restricted.

In assessing demand for Russian forest products abroad, the following markets were primarily considered:

- Scandinavian market (Finland, Sweden, Norway) - roundwood.
- Central European market (Germany, France, Great Britain, Netherlands, Denmark, Austria) – sawnwood, plywood, pulp and paper products.
- Markets of the countries of Eastern Europe and Baltic countries – sawnwood, wood-based panels, paper and paperboard.
- Mediterranean markets (Italy, Spain, Turkey, Egypt, Lebanon, Morocco, Tunisia) – sawnwood and pulp and paper products.
- Asian markets (Japan, China, Republic of Korea) – roundwood, sawnwood and pulp and paper products.
- Markets of the CIS countries – roundwood, sawnwood, wood-based panels, paper and paperboard.

The programme of development of the world forest sector, elaborated by UNECE/FAO (European Forests and Timber: Scenarios into the 21 Century, New York and Geneva 1996) showed that in Europe the deficit (excess of projected consumption over production) by 2010 was projected as follows: roundwood – 26.8 million m<sup>3</sup>, sawnwood – 12.9 million m<sup>3</sup>, wood-based panels – 6.9 million m<sup>3</sup>, wood semi-products – 4.8 million m<sup>3</sup>, paper and paperboard – 5.2 million tons. By the year of 2015 the deficit of the given types of forest products would grow even more.

While estimating the potential for exports of forest products to the European countries, we simultaneously assessed potential exporters from other regions. On the basis of an analysis of available forecast data and economic assessments, the following conclusions could be made:

- North America cannot be considered as a serious exporter to Europe, as the production of forest and paper products there is oriented to domestic consumption, and export, the growth of which is insignificant, is oriented to the Pacific market.
- Supplies of roundwood from tropical countries will fall rather than increase.
- Expected growth of roundwood supplies from forest plantations of South America and South-East Asia is possible beyond 2010 but the volume will not be large.
- The potential of European countries for increasing production and export of such forest products as saw logs, pulpwood and sawnwood is limited.

In assessment of prospective demand for forest products in the countries of southeast Asia, the following factors should be taken into account:

- Higher population growth rates as compared with the regions of Europe and North America.
- Comparatively high rates of industrial development and growth of Gross Domestic Product.
- High rates of contracted capacities for production of paper and paperboard from woodpulp and wood-free pulp.

According to FAO projections, consumption of forest products in the countries of South -East Asia in the period up to 2010 will be growing at higher rates than their production. The deficit (difference between consumption and domestic production) of all types of forest products is expected to be:

- Roundwood (saw logs and wood raw material, pulpwood), 135 million m<sup>3</sup>.
- Sawnwood, 63 million m<sup>3</sup>.
- Wood-based panels, 51 million m<sup>3</sup>.
- Pulp, 52 million tons
- Paper and paperboard, 45 million tons.

Taking into account the high growth rates of the Gross Domestic Product of China and limited domestic forest resources, growth of imports of roundwood, sawnwood, pulp, paper and paperboard is expected and has been born out by recent growth in Chinese exports. On the whole, the potential import to China is estimated as follows: roundwood – 19.6 million m<sup>3</sup>, sawnwood – 9.0 million m<sup>3</sup>, wood-based panels – 4.5 million m<sup>3</sup>, woodpulp – 4.6 million tons, paper and paperboard – 13.0 million tons. The close proximity of Russian forest resources and industry enterprises in Khabarovsk, Primorskiy and Krasnoyarskiy Krai, Irkutsk oblast, show real potential for growth of exports to meet the demands of the Chinese market.

There is no reason to expect any reduction in the traditional demand for shipments of roundwood and sawnwood from Russia to Japan.

In perspective there will be considerable growth of demand for Russian forest and paper products in CIS countries; primarily in Kazakhstan, Uzbekistan, Armenia, Azerbaijan, Ukraine, and the Republic of Moldova, where there are acute deficits of roundwood, sawnwood, wood-based panels, paper and paperboard. As mentioned above, over the period of reform, imports of forest products from Russia to CIS countries were reduced by 90%. The primary reason for this was the difficult economic and financial position of the majority of enterprises in the CIS countries. With an economic upturn in these countries, the demand for forest products will grow. Taking into account the territorial closeness and small quantity of domestic resources of these CIS countries, Russia will be a potential exporter of forest products to the CIS countries.

According to projections, the volumes of Russian exports to CIS countries by 2015 (with account of their projected economic development) will be as follows:

- Roundwood, 2-4 million m<sup>3</sup> per year.
- Sawnwood, 3-5 million m<sup>3</sup>.
- Plywood, 200,000-450,000 m<sup>3</sup>.
- Wood-based panels, 400,000-800,000 m<sup>3</sup>.
- Pulp, 700,000-1,600,000 tons.
- Paper and paperboard, 300,000-800,000 tons.

On the whole the potential volumes of demand for forest and paper products on external markets by 2015 are estimated as follows:

- Roundwood, 20-25 million m<sup>3</sup>.
- Sawnwood, 14-24 million m<sup>3</sup>.
- Plywood, 1.7-2.7 million m<sup>3</sup>.
- Wood-based panels, 850,000-1,600,000 m<sup>3</sup>.
- Pulp, 2.7-5.4 million tons
- Paper and paperboard, 3.2-6.2 million tons

Summary data on the scope and structure of demand by types of Russian forest products from the domestic and external markets for the period of up to 2015 (according to the projected scenarios) is given in figures 7 - 13.

Figure 7  
Demand for industrial wood from the external and domestic markets, million m<sup>3</sup>

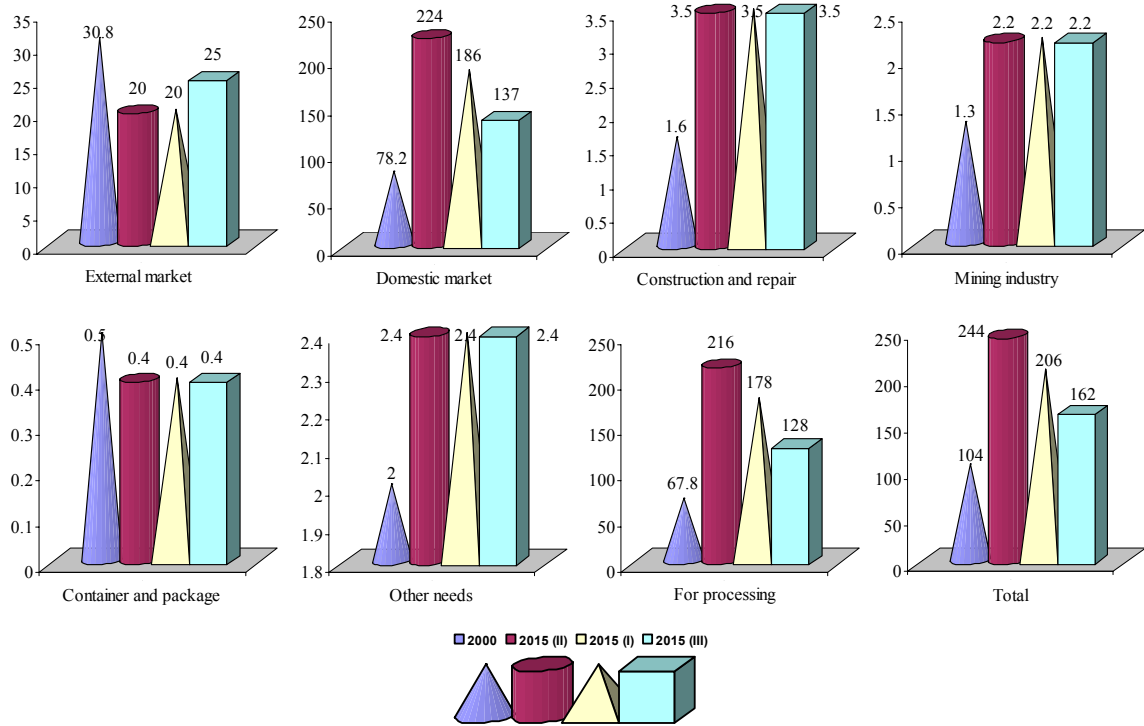


Figure 8  
Demand for sawnwood from the external and domestic markets, million m<sup>3</sup>

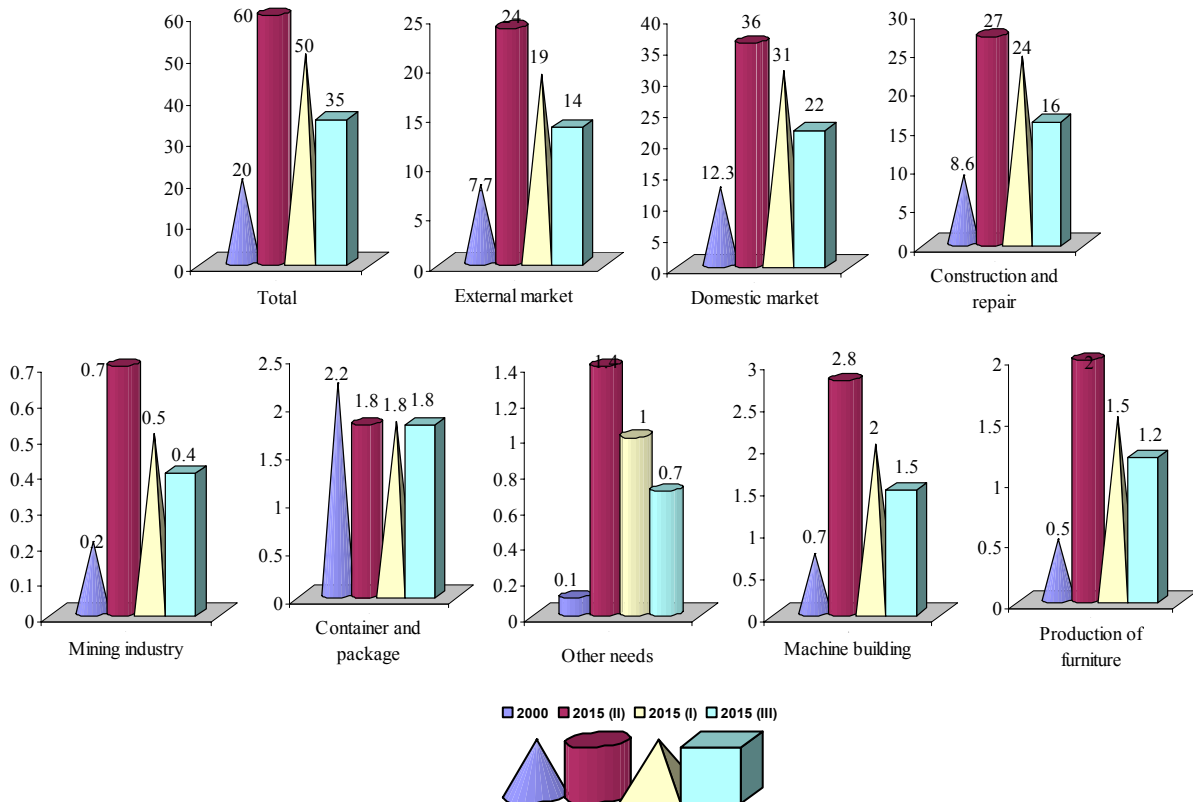


Figure 9  
Demand for Russian plywood from the external and domestic markets, 1,000 m<sup>3</sup>

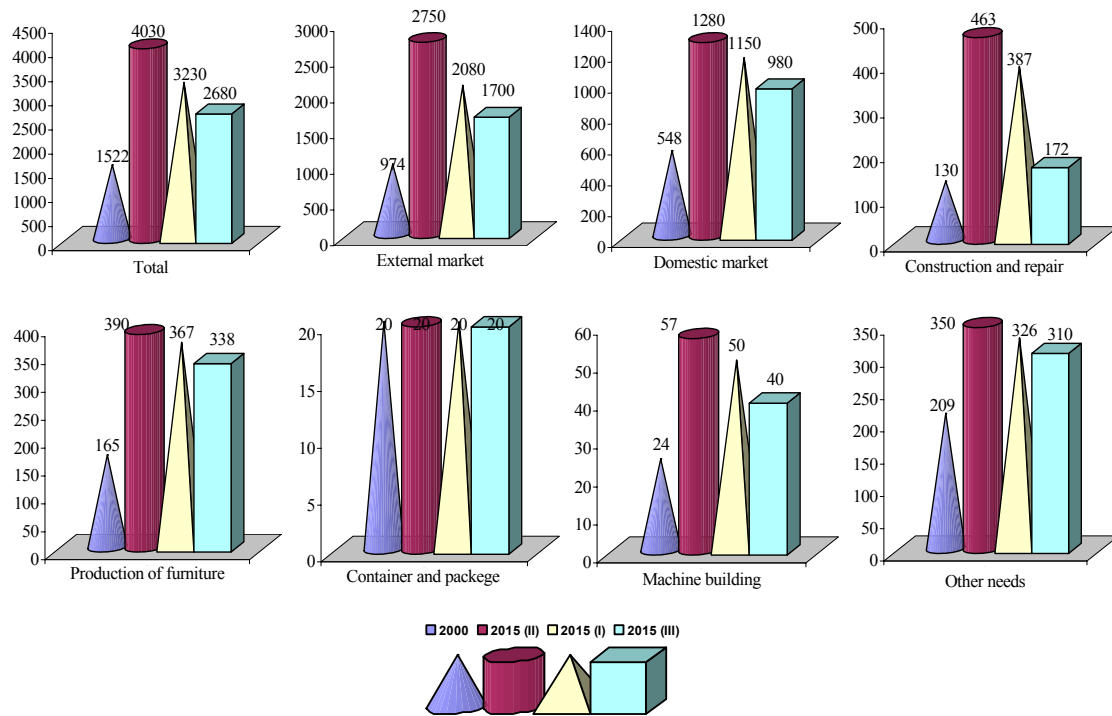


Figure 10  
Demand for particle board from the external and domestic markets, 1,000 m<sup>3</sup>

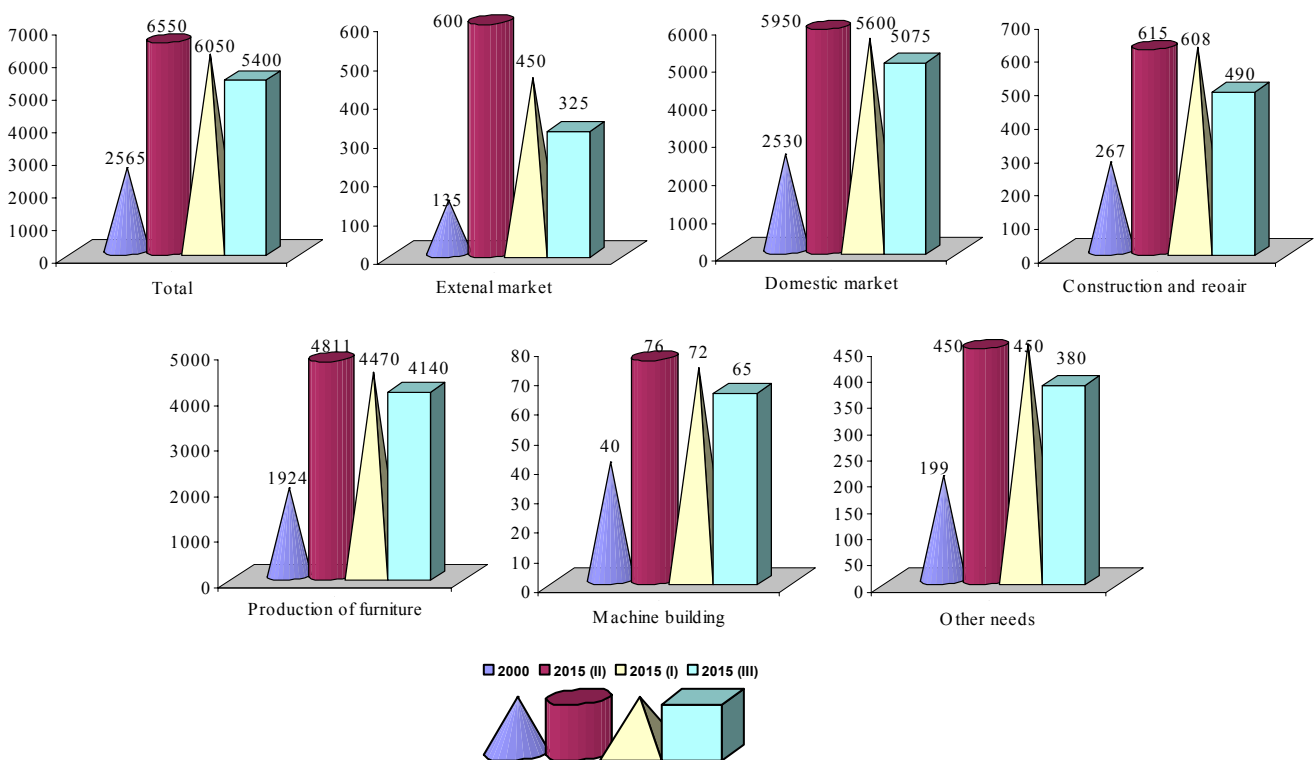




Figure 11  
Demand for fibreboard from the external and domestic markets, 1,000 m<sup>3</sup>

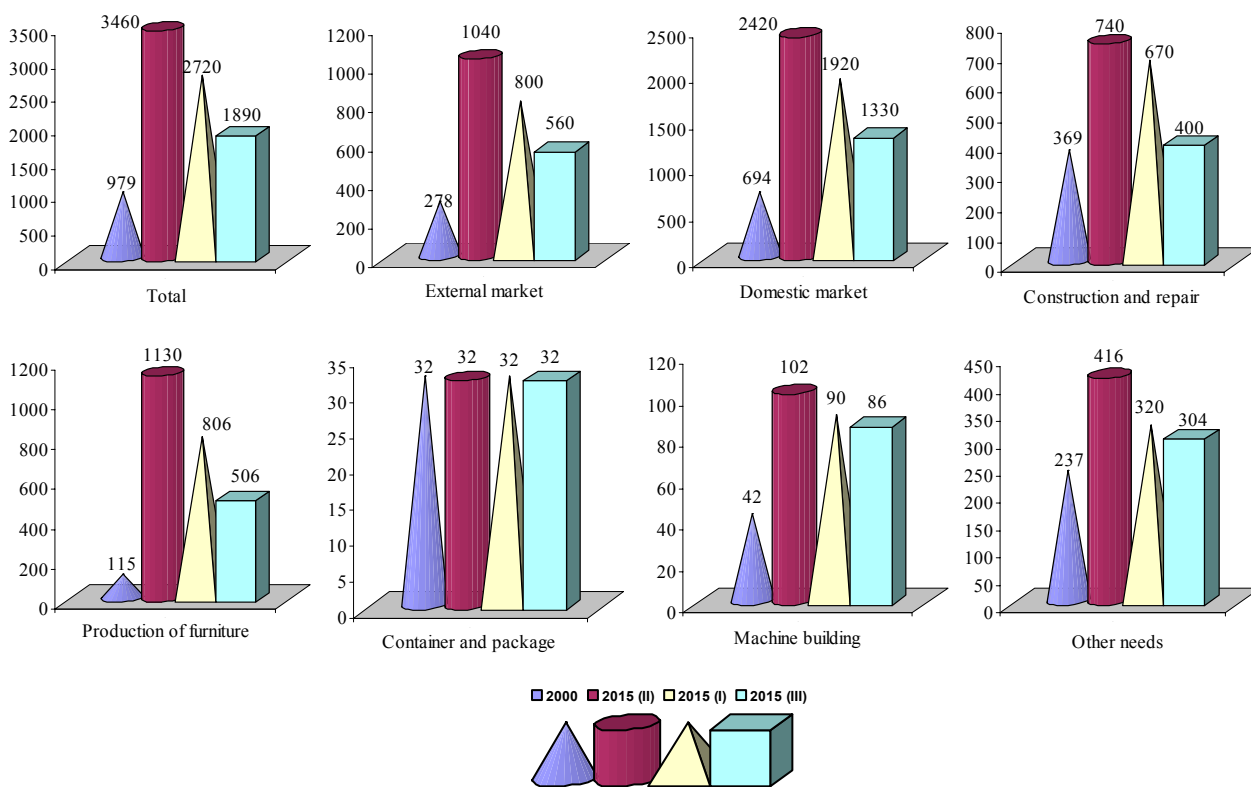


Figure 12  
Demand for paper and paperboard from the external and domestic markets, 1,000 tons

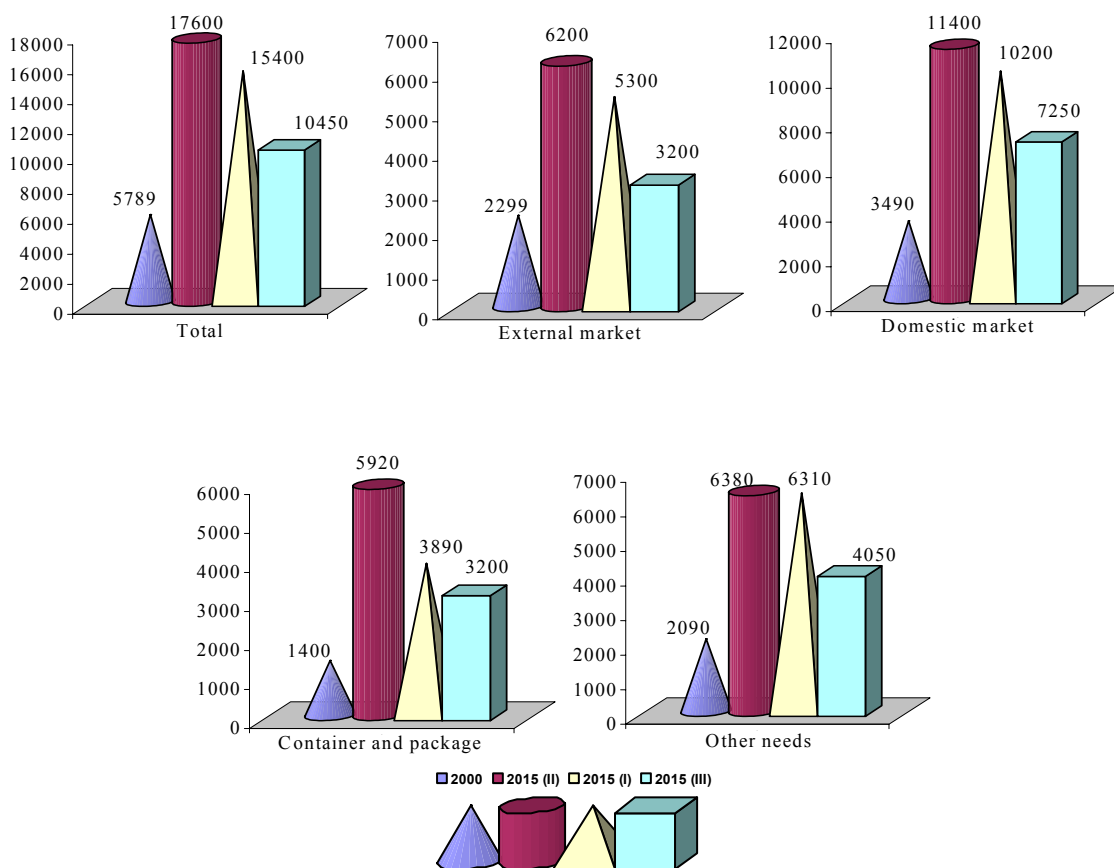
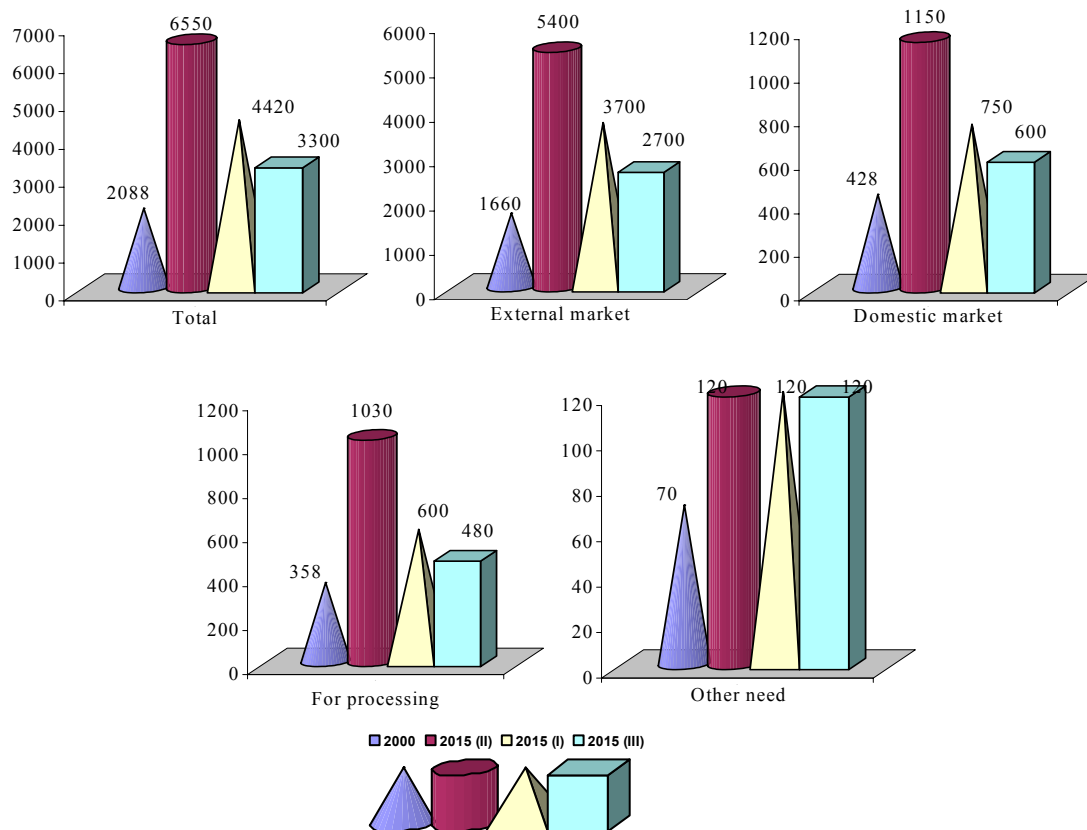


Figure 13  
Demand for market pulp from the external and domestic markets, 1,000 tons



## 8 Forecast of production, trade and consumption of forest products

### 8.1 Balances of demand and supply of forest products

Balance calculations coordinate volumes of demand for basic types of forest products with volumes of supply of these products. It is on the basis of the balance calculations that output of forest products for the outlook period is projected. Balanced volumes of demand and supply by all spheres of domestic and external markets determine the scale of forest products manufacturing in the final years of the perspective period for each of the considered scenarios. Coordination and balancing of volumes of demand and production of roundwood is carried out by the method of successive variant selection, proceeding from species mix and dimensional and qualitative characteristics of the wood raw material in the regions of the industry location.

Proceeding from forest inventory and planning documents, the assortment structure of forest products to be harvested is calculated based on characteristics of the forest resources where logging enterprises will operate. The total volume of harvested roundwood is subdivided into medium and large dimension wood (over 14 cm in diameter), which can be used for the production of sawnwood, plywood, sleepers, poles; and small wood (pulpwood, pit wood). The rest of the harvested volume from all types of fellings is fuelwood used for heating and technological purposes. The ratio of fuelwood for heating and for processing is determined by demand.

There are two directions of roundwood utilization – for processing and for consumption unprocessed. Proceeding from the prospective demand for basic types of forest products, the volume of roundwood required for the production of sawnwood, plywood, sleepers, wood-based panels and other products can be calculated.

The volumes of consumption of unprocessed wood are determined from the needs of construction, repair, population, the mining industry, and production of poles for communication lines. Demand for roundwood on external markets is also taken into account. Finally the harvesting volumes are determined as needed to satisfy the identified demand for forest products within the country and abroad. The resource part of the balance includes solid sawmilling residues, and plywood and sleeper manufacturing residues in addition to roundwood. These residues represent full value raw material for the production of wood-based panels, pulp and paper products. They can also be used for heating. Balance calculations of demand and supply for 2015 are presented in table 17.

Table 17  
Balance of demand and supply of forest products of the Russian Federation in 2015 by spheres of consumption (scenario 1)

Item	Industrial wood, (million m <sup>3</sup> )	Sawnwood (million m <sup>3</sup> )	Plywood (1,000 m <sup>3</sup> )	Particle board (1,000 m <sup>3</sup> )	Fibreboard (1,000 m <sup>3</sup> )	Market pulp (1,000 tons)	Paper and paperboard (1,000 tons)
Demand on domestic and external markets	206.3	50.0	3 230	6 050	2 720	4 420	15 400
Demand on domestic market	186.3	31.0	1 150	5 600	1 920	720	10 200
of which: In the spheres of final consumption	8.5	31.0	1 150	5 600	1 920	120	10 200
-construction	2.0	15.3	236	348	416	-	-
-repair	1.5	8.9	151	260	256	-	-
-production of furniture	-	1.5	367	4 470	806	-	-
-mining industry	2.2	0.5	-	-	-	-	-
-production of containers and packaging	0.4	1.8	20	-	32	-	3 890
-machine building	-	2.0	50	72	90	-	-
-other needs	2.4	1.0	326	450	320	120	6 310
For processing	177.8					600	
-sawmilling	87.5					-	
-sleeper production	2.5					-	
-pulp and paper production	71.0					600	
-plywood production	8.3					-	
-wood-based panel production	8.5					-	
Demand on external market	20.0	19.0	2 080	450	800	3 700	5 200
of which In CIS countries	3.0	5.0	300	320	320	600	1 300
In "far abroad" countries	17.0	14.0	1 780	130	480	3 100	3 900
Production	206.3	50.0	3 200	5 900	2 688	4 370	15 050
Import	-	-	30	150	32	50	350

## 8.2 Volumes of production and domestic consumption of forest products in the outlook period

Based on the balance calculations and assessment of demand for forest products on domestic and foreign markets, and the production potential for operating new enterprises and their provision with resources, volumes of production and consumption of basic types of forest products for Russia as a whole are determined (table 18).

Given the projected 70-100% growth of wood harvesting, it is expected that by 2015 production of industrial wood and sawnwood will increase by 153%, plywood by 120-170%, market pulp by 120-132%, paper and paperboard by 180-230%, and furniture by 230%. Utilization of fuelwood will increase from 4.2 to 25-33 million m<sup>3</sup> or 500-700%, pulp chips from 2.5 million m<sup>3</sup> to 11-15 million m<sup>3</sup> or 300-500%.

Volumes of forest industry production envisaged in scenario II meet the requirements of sustainable development of the forest sector to the greatest extent. Assuming these volumes are attained, the tasks of improvement to the production structure, raising the level of forest utilization, and improvement of the structure of Russian forest exports, will be realized. As a result of priority development of high-degree wood processing, the share of products from the pulp and paper industry in the total volume of commercial products will increase to 47%. The share of products of chemical and chemical- and mechanical wood processing in forest export will exceed 85%.

Structural changes in the territorial location of forest industries will be affected by many factors, among which, the expected demand on domestic and external markets, economic accessibility, and competitiveness should be considered as principal ones, in addition to the availability of wood raw materials. The transport constituent, i.e. the distance of transportation of forest and paper products from producer to consumer, remains an important factor.

Table 18  
Projected production volumes of basic types of forest and paper products  
in the Russian Federation up to 2015

	Scenarios	Volume of harvesting from all types of fellings (million m <sup>3</sup> )	Round-wood (million m <sup>3</sup> )	Sawn-wood (million m <sup>3</sup> )	Plywood (1,000 m <sup>3</sup> )	Particle board (1,000 m <sup>3</sup> )	Fibre-board (1,000 m <sup>3</sup> )	Paper and paperboard (1,000 tons)	Market pulp (1,000 tons)
2000 (reported)		169	117	20	1 484	2 335	909	5 312	2 036
2005	I	188	132	30	2 160	3 300	1 216	7 220	2 550
	II	194	136	32	2 350	3 500	1 344	7 720	3 300
	III	178	126	25	1 800	3 100	1 120	6 535	2 250
2010	I	219	155	38	2 650	4 500	1 744	10 250	3 300
	II	249	174	45	3 100	4 900	2 208	11 600	4 500
	III	201	138	30	2 200	4 100	1 440	8 230	2 600
2015	I	255	180	50	3 200	5 900	2 688	15 050	4 370
	II	301	210	60	4 000	6 400	3 424	17 400	6 500
	III	219	144	35	2 650	5 250	1 856	10 100	3 250
2015/2000 (% change)	I	51	54	150	116	153	196	183	115
	II	78	79	200	169	174	277	228	219
	III	30	23	75	79	125	104	90	60

Table 19  
Location of basic industries over the territory of Russia

	<i>Harvesting volume from all types of fellings</i>	<i>Sawnwood</i>	<i>Plywood</i>	<i>Particle board and fibreboard</i>	<i>Chemical woodpulp (including semi-chemical) and woodpulp</i>	<i>Paper and Paper-board</i>
	<i>(million m<sup>3</sup>)</i>	<i>(million m<sup>3</sup>)</i>	<i>(1,000 m<sup>3</sup>)</i>	<i>(1,000 m<sup>3</sup>)</i>	<i>(1,000 tons)</i>	<i>(1,000 tons)</i>
2000-total	169.0	20.0	1 484.0	3 244.0	6 155.0	5 312.0
of which						
European part	113.5	13.9	1 336.0	2 722.0	4 643.0	4 884.0
%	67.2	69.3	90.0	84.4	75.4	91.9
Asian part	55.5	6.1	148.0	522.0	1 512.0	428.0
%	32.2	30.7	10.0	15.6	24.6	8.1
<b>2015-total</b>						
<b>I scenario</b>	255.0	50.0	3 200.0	8 588.0	16 550.0	15 050.0
European part	173.9	31.2	2 540.0	6 937.0	10 357.0	13 100.0
%	68.2	62.4	79.4	80.8	62.6	87.0
Asian part	81.1	18.8	660.0	1 651.0	6 193.0	1 950.0
%	31.8	37.6	20.6	19.2	37.4	13.0
<b>II scenario</b>	301.0	60.0	4 000.0	9 824.0	20 350.0	17 400.0
European part	211.8	35.0	3 050.0	7 764.0	12 400.0	14 500.0
%	70.4	58.3	76.2	79.0	60.9	83.3
Asian part	89.2	25.0	950.0	2 060.0	7 950.0	2 900.0
%	29.6	41.7	23.8	21.0	39.1	16.7
<b>III scenario</b>	219.0	35.0	2 650.0	7 106.0	11 720.0	10 100.0
European part	148.0	21.8	2 233.0	5 655.0	7 680.0	9 000.0
%	67.6	62.3	84.3	79.6	65.5	89.1
Asian part	71.0	13.2	417.0	1 451.0	4 040.0	1 100.0
%	32.4	37.7	15.7	20.4	34.5	10.9

The location and share of the basic forest industries in Russia, by region (European vs. Asian), are listed in table 19. In the inter-sectoral context, priority will be given to the regions with the most developed infrastructure of forest industry. These are primarily the northern and north-western regions, in particular Arkhangelsk and Vologda oblasts, Republics of Karelia and Komi. In this region, it is projected to increase wood harvest volumes from all types of fellings by 70-100%, sawmilling by 180%, production of pulp by 100%. To satisfy the demand for pulp, paper and paperboard, construction of 3-4 new pulp and paper mills is required as well as plants for the production of plywood, wood-based panels, sawmills and logging enterprises, alongside with technical equipment dealers.

The Central region (20% of the population of Russia) has the highest level of consumer demand (37% of retail turnover) and a considerable unused forest resource potential (Moscow, Kostroma, Tver and Kaluga oblasts in particular). The potential harvest is estimated at 42 million m<sup>3</sup>. By 2015, it is projected to increase forest utilization in this region by 110-160%. The projected growth of production is as follows: sawnwood by 100%, plywood by 180%, particle board and fibreboard by 140%, and paper and paperboard by 180-230%. For the purposes of satisfying the quickly growing demand for paper and paperboard and possible utilization of substantial resources of wood raw material, including softwood and waste paper, the construction of a number of medium and low capacity pulp and paper mills is projected in the region.

The Southern region (29% of the population of Russia) comprises Central Black-Earth, Povolzhskiy and North-Caucasian regions, and is part of the forest deficient zone. Nevertheless, the total growing stock in the region accounts for 1.5 billion m<sup>3</sup>, hence the potential annual cut, including all types of fellings is estimated at 14 million m<sup>3</sup>. The main prospective direction in the region is production of furniture and products of wood-working. The volumes of production of sawnwood, plywood and wood-based panels will be determined by the possibilities of getting the maximum amount of industrial wood from local sources and partly from the adjoining regions of Urals, Volgo-Viatskiy and Central regions.

The Urals and Volgo-Viatskiy regions have substantial wood raw material and forest industrial potential. The potential rated cut is 93 million m<sup>3</sup>. At present the actual cut amounts to 36 million m<sup>3</sup> and by 2015 it is projected to double. Forest industry production is oriented mainly to the region's internal market, as well as to the forest-deficient regions in the south of Russia. The projected increase of products of woodworking between 2000 and 2015 is as follows: sawnwood and plywood 160%, pulp 240%.

In the West-Siberian and East-Siberian regions where the transport component is especially high, priority should be given to the development of woodworking and pulp and paper production in particular. Roundwood exports to China and the CIS countries of central Asia with a gradual change-over to shipment of sawnwood. The products of high-degree processing have unlimited access both to the Asia-Pacific region and the European internal and external markets. For the purposes of efficient utilization of forest resources of developed territories in west Siberia and to satisfy the demand for pulp and paper products, construction of 4-5 pulp and paper mills will be required (in Tiumen oblast – Nizhne-Obnskiy, Tobolskiy, Surgutskiy, in Tomsk oblast – Asinovskiy). In East Siberia new pulp and paper mills are to be built in Lesosibirsk, Boguchany, Kodinsk (Krasnoyarskiy Krai) and Kirensk (Irkutsk oblast).

In the Far-Eastern region, the development of which is directly dependent on the situation on the external market of the Asia-Pacific region, changes favouring the production and export of forest industry products are to take place, alongside an increase of harvesting volumes.

In view of the above, the forest and forest industry sector will be among the leading branches of the economy of Russia by 2015.

### **8.3 Volumes and structure of forest products export in the outlook period**

Proceeding from the estimation of demand for basic types of forest and paper products of the Russian Federation on domestic and foreign markets, and balance calculations of demand and supply, the expected export volumes for the outlook period are calculated for all scenarios. Exports of Russian forest products are affected by the following objective factors:

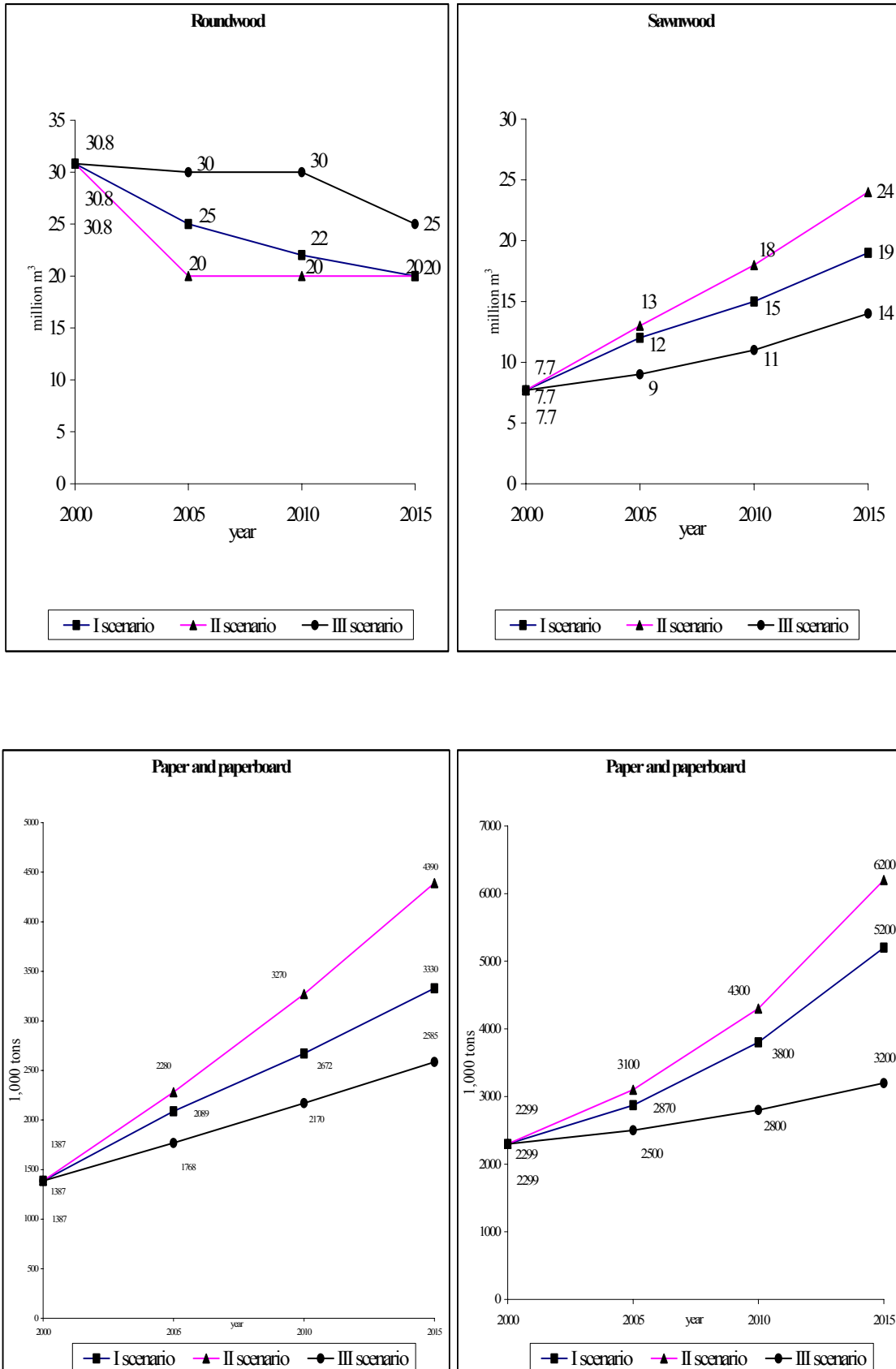
- Availability of potential demand for roundwood, sawnwood, wood-based panels, pulp, paper and paperboard on the markets of Europe, Asia, Africa and in part North America, which cannot be satisfied by shipments from other regions.
- Projected growth of consumption of forest and paper products in the CIS countries and traditional trade ties of these countries with Russia.
- Availability of rich forest resources in the Russian Federation, ensuring considerable growth potential.
- State support and regulation of the forest sector's foreign economic activity.
- Competitiveness of the greater part of Russian forest products both in quality and prices.
- Favourable geographical position of the Russian forest industry enterprises with respect to major importers of forest products, in Europe and Asia in particular.

The volumes of export by the years of forecast period are presented in table 20 and its dynamics in figure 14.

Table 20  
**Projected volumes of forest products exports**

Type of product	2000	2005	2010	2015
Roundwood (1,000 m <sup>3</sup> )	30.8	20-30	20-30	20-25
Sawnwood (1,000 m <sup>3</sup> )	7.7	9-13	11-18	13.5-24
Plywood (1,000 m <sup>3</sup> )	974.3	1 200-1 500	1 450-2 100	1 700-2 750
Particle board (1,000 m <sup>3</sup> )	135	200-300	260-450	325-600
Fibreboard (1,000 m <sup>3</sup> )	278	368-480	464-720	560-1 040
Pulp (1,000 tons)	1 660	1 850-2 700	2 150-3 750	2 700-5 600
Paper and paperboard (1,000 tons)	2 299	2 500-3 100	2 800-4 300	3 200-6 200

Figure 14  
Export of forest and paper products from Russia



The following changes are expected in the volumes and structure of Russian forest exports. Volumes of roundwood exports will remain considerable – 20-30 million m<sup>3</sup> depending on the scenario. However, they will fall slightly against 2000. Thus according to scenario I and scenario II, exports of roundwood will fall by 35% by the year of 2015 against 2000 and according to scenario III by 19%. These changes take place for economic and structural reasons. From the point of view of economics, export of roundwood is less efficient than export of value-added products.

As mentioned above, expansion of highly processed wood is a strategic direction of the development of the forest and forest industry sector of Russia. Development of pulp and paper, plywood, and sawmilling industries is related to an increase of roundwood processing directly at Russian enterprises. Roundwood will be exported from the regions with availability of spare resources and which are located close to markets.

During recent years, the export of sawnwood has been unstable. By 2015 with the development of sawmilling capacity, export of sawnwood, mainly sawn softwood, will increase by 80-210%. Export of plywood will increase 80-180%. Exports of particle board will increase by 200-340% and fibreboard by 140-300%, in connection with the construction of new wood-based panel plants and the modernization of existing wood-based panel plants oriented to production of competitive wood-based panels, such as MDF, OSB and others. With an increase of domestic demand and a reduction of imports, export of paper and paperboard will increase by 40-140%. A portion of the pulp which cannot be processed within Russia will also be exported. Export of pulp will increase by 70-220% against 2000.

## **9 Directions of forestry reform and assessment of forest resources in the outlook period**

### ***9.1 Trends of liberal reforms in forest management and in the forest sector as a whole***

A market-based system of forest management cannot be established without radical reforms in the basic elements of forest policy. The following specific forest sector reforms are assumed as a base for the previously mentioned scenarios.

#### ***9.1.1 Reform in the area of forest and forestland ownership and tenure***

With the establishment and development of the legislative framework for land tenure arrangements (including the adoption of the Land Code, the lifting of the ban to sell and buy agricultural land, etc.), the Russian Federation would gradually move away from the monopoly of federal public forest and forestland ownership based on the division of competence among federal and regional governments and municipal administrations, towards different ownership patterns, including federal, regional and private ownership. Regional and federal interests in managing the forest and gaining forest revenues are assumed to become balanced through the separation of forestlands into federally and regionally owned rather than through the division of competence as it is stipulated by current existing forest legislation.

Limited sales of forestlands would replace the existing practice of their command-based withdrawals and conversion of forestlands to other uses, based on economically irrelevant methods of forestland management. A legislative framework for selling and buying agricultural land would create enabling conditions for the emergence of private forestland ownership. The first private forestlands should be those, which were formerly in the ownership of agricultural organizations. The emergence and development of farmers' private forests should be regarded as an initial phase of forestland privatization to be followed with the next phases when forestlands could be owned by both domestic and foreign timber industry companies.

Forestland tenure rights should be reformed on the basis of economic and environmental criteria of forestland classification by ownership pattern as well as on legislatively defined owners' responsibilities for sustainable forest management.



### ***9.1.2 Restructuring the system of public forestland management***

Structural changes in the existing forestland management system are expected in a market-driven forest management system, necessarily based on separating the functions of public administration (monopolistic functions) from those of practical management (i.e. from competitive functions). With regard to forest use, protection and renewal, and public administration functions are supposed to rest with the National Forest Service, acting either as a structural unit within a federal executive agency, or as an autonomous juridical entity. Key governance functions of the National Forest Service should include the following:

- Development and implementation of National Forest Policies, ensuring sustainable development of the forest sector.
- Development, adoption and implementation of federal laws to regulate forest use, protection and renewal.
- Development of regulations and guidelines for decision-making in the area of forest use, protection and renewal.
- Decision-making on forestland allocation under all tenure arrangements (forest lease, concession, and auctions).
- Decision-making on forest use charges, and forest management budgets at the federal and regional levels.
- Forest resource status monitoring.
- Ensuring implementation of its management decisions.
- Forest law enforcement.
- The National Forest Service would exercise its authority through its territorial bodies, subordinate to the following relevant federal executive authorities:
  - Forest services of federal districts.
  - Regional forest services.
  - Local services (at the level of municipal entities).

It is being recommended to preserve federal forest management and administration bodies at the lower (i.e. leskhoz) level since it is a prerequisite of efficiency, that they should be free from any practical forest management operations.

All forest operations (use, protection and renewal) are assumed to be contracted out to relevant operators on a competitive basis. A market environment in silvicultural production should be represented by:

- Forest users, developing forests under long-term agreements (forest lease and concession) and short-term agreements (forest auctions).
- State unitary forest management enterprises to be established, using the capacities of leskhozov's operational units.
- Other organizations and physical entities capable of operating in practical forestry.

All practical forest management operations should be ordered, remunerated, and conducted through territorial bodies of the National Forest Service exclusively on a contract basis.

### ***9.1.3 Reform in forest use regulation***

Forest areas are expected to be allocated for use exclusively on a contract basis without any preferences or privileges granted by regional governments and municipal administrations. Forest lease and auction procedures are expected to be substantially improved towards their liberalisation and de-bureaucratization. To attract large-scale investments into forest industries, forest lease arrangements should include the following:

- Initial lease periods of at least 15 - 20 years, with the right to resume the lease provided the lessee has been fulfilling his obligations under the agreement.
- Delegation of practical forest management functions within the leased areas to the forest user (current and long-term planning, plans of felling and forest management operations being incorporated in business plans), without issuing annual cutting permits.
- Obligation of the forest user to perform all practical forest management activities within the leased area on a contract basis.

- Transparency of competitive procedures and flows of funds, covering the relations of lessees with relevant authorities, in the area of resource use and renewal.

Forest auctions should meet the following requirements:

- Agreements should specify the obligations of the parties.
- Forest users should necessarily partake in funding the costs of reforestation and those of physical and social infrastructure (road construction).
- Competitive procedures should be transparent and open, with public involvement ensured through mass media.

Various forest tenure arrangements (lease, concession, auctions) are considered as appropriated tools.

#### ***9.1.4 Reform in the financial system to ensure sustainable forest development***

To comply with sustainable forest management criteria, the financial system is assumed to be based on the following principles:

- The leasing of forest areas to the timber industries should focus on economically accessible forest resources to insure their economic survival.
- Economic incentives for all forest stakeholders to generate forest revenue through forest resource utilization.
- Forest revenue distribution among forest stakeholders in compliance with their public forest management functions.
- Guaranteed funding for reforestation and protection.
- Transparent flows of funds for all sets of activities in the area of forest use and renewal (silvicultural practices to end-use products).

The financial system should comply with the aforementioned principles and rely on rent-based arrangements for forest revenue capture and distribution. In the forest sector, a transition to rent-based arrangements implies that:

- Stumpage prices would be established only on the basis of buy-and-sell agreements through forest lease, concession or auctions.
- Public management of costs and benefits in the timber industries would be guided through their mandatory standardisation for purposes of accounting for the impacts of rent-generating factors to ensure equitable distribution of forest revenues between the State (as the forestland owner) and private business.
- A continuing negotiation process is needed to coordinate and safeguard the interests of all the forest stakeholders in the area of forest resource use and renewal.

Once rentals are introduced, the taxes are supposed to be either reduced or abolished (profit tax, sales tax, etc.) which would, in the long-run, enhance the value of forest resources and allow a “greener” financial system in the forest sector, with incentives towards sustainable use of forest resources through introducing low-waste and waste-free technologies. Rental proceeds would be distributed on the basis of the following sharing arrangements:

- Funds to cover the standard-based costs of reforestation are to be channelled directly to those public forest administration bodies, which are responsible for the said activities according to the forest legislation.
- Amounts equivalent to the differences between rental rates and the standard-based costs of reforestation are to be paid to the federal and regional budgets for subsequent investment into the development of the forest sector and other activities under public support.
- Forest rentals would generate higher public revenues from forest resource utilization, and thus enable Russia to accomplish the following:
  - To liberalise its foreign trade of forest products through exemption from existing export duties, which now account for 5 - 20 % of export prices.
  - To bridge prices in domestic and foreign forest product markets to eliminate the ‘stratum’ for the ‘grey sector’ economy in the forest sector, which is estimated to account for 20 to 35 % in the gross turnover of forest products.
  - To make exports of processed products more attractive
  - To introduce forest certification; its principles have been already developed but are not applied due to lack of funds.

The above-considered reforms are aimed at liberalizing economic relations in the forest sector, and their implementation would take 5 - 10 years. Only under these circumstances could Russia get a market-driven forest sector, providing high public revenues and functioning in compliance with the principles of sustainable development.

## 9.2 Assessment of forest resources for the outlook period and their availability for securing growth of forest industry production

Based on the estimate of demand for basic types of forest and paper products and balance calculations of demand and supply for the outlook period, it can be concluded that by 2015, the volumes of forest industry production will increase 100-200% against 2000, which will inevitably require growth of wood harvesting. On the whole, wood harvest volumes will increase by 80%. Therefore, it is important to make an assessment of the potential forest resources of the country as a whole and of all regions. For the purpose of defining projected growing stock in the outlook period, the calculations were made on the basis of the following premises:

- The actual growing stock of the Russian Federation as a whole and of each region for 2000 was assumed as a source basis.
- The rated quantity of wood removals according to high variant (scenario) for forest sector development was assumed as projected volume of wood harvesting
- The expected (rated) annual increment was taken according to the data of the latest forest resources inventory.
- The rated values of forest losses due to fires, insects and diseases were assumed at the level of average values of these indices for the ten year period 1990-2000.

Taking the assumed premises into account, the projected growing stock will total 82.9 billion m<sup>3</sup> in 2005, 83.6 billion m<sup>3</sup> in 2010, 84 billion m<sup>3</sup> in 2015, 85.6 billion m<sup>3</sup> in 2020 and 87 billion m<sup>3</sup> in 2030.

The rated data on growing stock, annual increment and wood harvesting volumes for the Russian Federation as a whole and by regions for 2015 is presented in table 21.

Table 21  
Rated values of growing stock, annual increment and harvesting volumes for 2015

	Total growing stock, (million m <sup>3</sup> )	Annual increment (million m <sup>3</sup> )	Projected volume of harvesting (million m <sup>3</sup> )	Projected volume of harvesting as % of:	
				growing stock	annual increment
Northern	8 277.0	98.0	74.5	0.9%	76.0%
North-Western	1 950.0	31.0	16.2	0.8%	52.3%
Central	3 750.0	66.0	30.0	0.8%	45.5%
Volgo-Viatskiy	2 310.0	43.0	23.6	1.0%	54.9%
Central Black-Earth	230.0	4.0	1.7	0.7%	42.5%
Povolzhskiy	690.0	14.0	6.5	0.9%	46.4%
North-Caucasian	755.0	9.0	2.9	0.4%	32.2%
Urals	1 360.0	93.0	39.0	2.9%	41.9%
West-Siberian	11 500.0	125.0	25.5	0.2%	20.4%
East-Siberian	28 600.0	276.0	48.5	0.2%	17.6%
Far-Eastern	21 528.0	207.0	32.2	0.1%	15.6%
<b>Russian Federation- total</b>	<b>84 000.0</b>	<b>970.0</b>	<b>301.0</b>	<b>0.4%</b>	<b>31.0%</b>

The data given in the table shows that the assumed volumes of wood removals for the outlook period for all regions are fully secured in terms of availability of forest resources, which will make sustainable forest management possible. Moreover, there is a considerable reserve left for further increase of wood removals, which is illustrated by the figures of the share of final and intermediate fellings in the annual increment. By 2015 this share is expected to amount to:

- **Russian Federation**                      **31%**
- North-Western region                      52%
- Central    45%
- West-Siberian                                      20%
- East-Siberian                                      17%
- Far-Eastern                                        16%

For comparison, in the developed timber-producing countries, the share of wood removals in the annual increment is 50-70%. In the Russian Federation, the main index limiting the volume of harvesting is annual allowable cut, which ensures continuous and relatively even forest utilization for a long period. Taking the annual allowable cut of the year 2000 as a maximum possible harvesting volume (for the whole outlook period up to 2015), which can not be exceeded for silvicultural and ecological reasons, the conclusion can be made that the projected annual allowable cut utilization rates will account for slightly more than 50% - for the Russian Federation as a whole, and from 20 to 70% for individual regions.

At the beginning of 2001 the total growing stock of mature and over mature stands in the Russian Federation accounted for 44.1 billion m<sup>3</sup>, and of immature stands 10.0 billion m<sup>3</sup>. By 2015 80% of all immature stands will reach the mature and over mature category. Proceeding from the projected volumes of fellings the total growing stock of mature and over mature stands by 2015 will not decline but will grow. The development of forest industries in the Russian Federation will thus have no limitations that might arise from a deficit of forest resources.

## 10 Wood use for energy generation

In the 1980s over 7,000 steam and hot-water boilers were in operation at enterprises of the forest and forest industry sector of Russia, including 747 at pulp and paper mills. These boiler units consumed 26.5 million tons of standard fuel per year. In logging and woodworking industries, the share of crude oil, diesel oil, gas and coal accounted for 45% of the fuel consumed, other types of fuel being fuelwood and wood residues. In the pulp and paper industry the share of fuelwood and wood residues was merely 5%. The primary types of fuel were crude oil, gas and coal. This situation was connected with low prices for fossil fuel, which did not stimulate the use of wood as a power source. Fuelwood-based power generation was developing mainly at those enterprises, which were not connected to centralised electric power supply systems. Generation of internal thermal and electric power was performed using the following systems: steam boiler – steam engine – steam turbo-generator. At that time, a range of chipping machines for the production of fuel- and pulp chips from fuelwood, sawmilling and woodworking were created, as well as fuel storage and boiler units burning wood fuel in the form of chips and sawdust.

Boiler houses used both fuelwood and logging and woodworking residues for energy generation, mainly thermal. In 1990 consumption of wood for energy purposes in the country as a whole amounted to: fuelwood 60,000 m<sup>3</sup>, logging waste 2.3 million m<sup>3</sup>, and woodworking residues 11.7 million m<sup>3</sup>. By 2000 a sharp reduction of wood removals, and reductions in the production of sawnwood, plywood and wood-based panels caused a reduction in the consumption of wood for energy purposes (which is clearly shown in table 22).

Table 22  
**Consumption of wood as fuel in the Russian Federation**  
*(million m<sup>3</sup>)*

<i>Item</i>	<i>1990</i>	<i>2000</i>
Fuelwood	60.0	52.3
Logging waste	2.3	2.2
Woodworking residues	11.7	5.0

It should be pointed out that the fall in wood consumption for energy purposes in the period of 1990-2000 was far less than the fall in forest industry production. In the transition period, prices for energy resources were growing at a higher rate than prices for wood. According to forecasts of the Ministry of Economic Development for the next ten years, prices for natural gas will increase 4-5 fold, and prices for diesel oil and electric energy will grow considerably. In this situation, one of the most important tasks of the forest and forest industry sector is to increase consumption of wood and wood residues for generation of power (both thermal and electric). As world and domestic experience shows, utilization of wood to provide enterprises with thermal and electric energy can be achieved according to several different patterns:

- Direct combustion of wood fuel in hot-water furnaces, steam boilers of internal production, and heating boiler-houses for generation of thermal energy.
- Direct combustion of wood fuel in the furnaces of steam boilers for joint generation of thermal and electric energy at small steam turbine thermoelectric power stations.

Looking ahead, the feasibility of increasing the utilization of wood and wood residues for energy purposes is corroborated by the following factors:

- At present, different versions of equipment for boiler-houses and power stations burning wood fuel have been developed in the Russian industry. If this equipment is demanded by forest industry enterprises, it can be manufactured.
- Domestically produced hot-water boilers with furnaces for wood fuel, steam turbines, electric generators, pumps, ventilators, smoke extractors and other equipment are in line with the best foreign models as regards their technical characteristics, with the price being considerably lower.

While estimating potential volumes of wood and wood residues utilizable for energy purposes the following primary data were used:

- Projected volumes of wood removals by scenarios and assortment structure; roundwood for sawmilling and plywood production, pulpwood for pulp and paper production, other industrial wood, fuelwood for processing and fuelwood for combustion.
- Economically accessible volumes of logging waste with separation of waste suitable for processing and waste best suited for energy purposes.
- Projected volumes of production of sawnwood, plywood, wood-based panels and products of other wood processing operations and potential volumes of residues from these operations suitable for energy purposes.
- Ratio of prices for coal, black oil, electric power and other fuel- and energy resources and prices for wood intended for use as fuel.
- Transport and territorial factors.

The projected volumes of wood and wood residues intended for use as fuel, calculated taking account of the above mentioned factors, are given in table 23.

Table 23  
**Utilization of wood as fuel up to 2015**  
*(million m<sup>3</sup>)*

	<i>I scenario</i>	<i>II scenario</i>	<i>III scenario</i>
Fuelwood	50.0	50.0	55.0
Logging waste	3.3	4.5	5.5
Woodworking residues	6.0	7.0	8.5

## 11 Social policy in the forest sector

The social objectives of forest sector development should be directed to solving several important problems, including the key one – the social protection of workers and people residing in inhabited localities where forestry and forest industry activities are conducted.

Social policy implies fulfilment of the following tasks:

- Preserving and maintenance of currently available workplaces.
- Creation of additional perspective jobs.
- Maintenance of efficient employment of population at enterprises and in organizations.
- Promotion of small-scale business, individual labour and independent activities of the population in forest sector.
- Raising the income of people employed at enterprises and organizations of the forest sector on the basis of increasing labour productivity, improvement of structure and methods of remuneration of labour.
- Raising the qualification of specialists and workers
- Retraining of workers for new professions to meet the requirements of scientific and technical progress, and the restructuring and reorientation of production processes.
- Formation of social partnerships.
- Creation of good working, living and recreational conditions for the people engaged in the forest sector.
- Timely resolution of employment problems of residents of forest settlements in which forest industry activities are discontinued for objective reasons by contributing to the development of job opportunities there, related primarily to restoration of the forest resource potential.

Solving of social problems should be linked with concrete natural, climatic, and socioeconomic conditions of the forest sector enterprises and organizations (location in the regions of the Extreme North or in the regions equated to them, depressed economic regions, localities with mono-economic structure of production, forest-surplus and forest-deficient regions).

Market economic systems inevitably involve cyclical aggravation of employment problems. Unemployment requires a sectoral strategy of purposeful employment policy and mechanisms for its realization. The main strategic directions and model for development of social policy in the forest sector of the Russian Federation are as follows:

- Achievement of modern standards of living for forest sector employees and the surrounding community.
- Development of social and socio-cultural infrastructure of forest settlements with the purpose of giving more opportunities to forest sector employees and members of their families in receiving at the least a basic requirement of services: education, public health, culture, etc.

Formation of efficient employment takes on a special significance in order to overcome the consequences of a 67% reduction in production and a 42% reduction in personnel engaged in it (which entailed reduction in labour productivity and the relative level of labour remuneration). To solve this problem, the State forest policy should secure: preserving and maintenance of existing workplaces which meet the requirements of structural policy in the forest sector; renewal of technologies (with the related creation of new jobs); and conditions for the development of small-scale business, individual labour and independent activities. A practice should be established of forecasting (on a regular basis) the professional and skill level employment structure of the forest sector, as well as elaboration of measures to avert unemployment in the forest regions of the country.

The problem of employment in mono-profile settlements where the employment situation is critical should be resolved with the active participation of the State and the bodies of local self-government. It applies to over 400 settlements whose mono-profile structure is conditioned by forest sector enterprises. In this connection, elaboration of special programmes for settlements with a critical employment situation is required at the regional and municipal levels. The programmes should envisage measures for preserving existing work places, reorientation and diversification of basic production, and for the creation of new jobs. This will require enhancement of State requirements regarding the quality of work places, their compliance with the world level of productivity, working conditions and safety, ergonomic requirements and requirements for professional qualification. The system of training and retraining of personnel for the forest sector should also be developed on the basis of State higher educational institutions of forestry and forest industry specialisation.

Improvement of living conditions of employees of the forest sector living mostly in forest settlements is one of the major problems. In this area, it is necessary to complete acceptable housing, social-and-cultural facilities and establishments to local government bodies. As these bodies do not have sufficient funds for the maintenance of social sphere support, the federal budget will be needed for a certain period of time. Later in this process, the problem of full and sufficient financing of social expenses should be finalized. This is to be done through restoration of the economics of the forest industry and forestry enterprises and making sufficient tax payments to local budgets for financing social programmes. Radical improvement of housing and social and living conditions of the sector's employees should be secured. Preferential crediting of forest sector employees for individual and cooperative housing construction will play an important role in solving this problem.

Elimination of any disproportion in the remuneration of forest sector employees is a major social and economic task. Intersectoral relationships in remuneration of labour requires regulation. For that purpose, guarantees are assumed to be introduced for remuneration of skilled labour taking account of the qualitative and quantitative heterogeneity of labour, both in forestry and in forest industry production.

In the period 2000-2005, the main task consists of overcoming the negative consequences of mass outflow of skilled personnel from the industry, stabilizing the number of perspective work places, commissioning of new work places as well as shutting down those workplaces which are lacking in prospects, and taking measures for finding jobs for workers being made redundant.

In the period 2006-2010, the primary task will be the all-around improvement of the quality of workplaces (modernization, improved production and working conditions). Conditions should improve significantly from technical up-grading of basic production equipment and qualificational and vocational training of personnel. In this period, rapid employment growth in the industry should not be expected, as it will be restrained by more rapid growth of labour productivity as well as by the necessity for higher wages.

In the period 2011-2020, with formation of market relations, implementation of structural changes and the corresponding changes on the labour market, the employment level in the forest and forest industry sector will be affected by growing output on the one hand and improvement of the quality of vocational training on the other hand.

So in this period changeover to the methods of in-house personnel training is to be carried out at the level of the integrated diversified structures of corporate management in the forest and forest industry sector. These methods proved their value in the practice of western countries, where they have enabled the qualitative level of labour resources to be improved, which in turn, has contributed to an increase in labour productivity and an acceleration of scientific and technical progress. The increase in the number of workplaces will likely be the result of the expansion of production.

To avoid a shortage of specialists and managerial personnel fit for working under market economy conditions, a number of measures should be taken for training, retraining and raising the qualifications of specialists of forest industry enterprises.

Special attention should be given to training managers and leading specialists of enterprises in new fields (management, marketing), in particular by means of:

- Higher education specialities in – economics, management of forest and the forest industry sector.
- Raising the qualifications of managers and specialists in management of enterprises under market economy conditions.

In the subsequent periods, improvement of training and raising qualifications should be provided on the basis of direct agreements between secondary - and higher- educational institutions and corporate managerial structures of the industry (the needs of the latter for training of qualified specialists fit for working under the conditions of developing market relations).

## 12 Environmental protection and ecological safety in the forest sector

Protection of the environment is not only a national but also a global problem. In 1992 the UN Conference on Environment and Development, at the level of Heads of States and Governments, was held in Rio de Janeiro. As a follow up the UN convened a World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa, September 2002, which offered a major opportunity to develop further understanding of these issues and allowed a mature debate on practical ways to achieve progress.

The “Declaration on Environment and Development” was adopted at the Conference. It comprises 27 recommended principles, describing the essence and goals of sustainable development. The Conference adopted fundamental documents including the Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity.

The term “sustainable development” appeared in connection with the problem of the environment, at the stage of integration of formerly isolated problems. Sustainability is defined here as the development, which satisfies the present-day needs, but does not endanger the ability of future generations to satisfy their needs. Sustainable development is a process of changing, in which exploitation of resources, investment patterns, orientation of technological development and institutional changes are harmonized and raise the value of currently available and future potential with the purpose of satisfying the needs and aspirations of people. The strategy of sustainable development is directed to the achievement of harmony between people and between society and nature. The forest and forest industry sector affects the environment in two ways:

- Harvesting of wood - natural resource – and its consequences for the ecological situation in general and for regions with intensive forest exploitation.
- Immediate environmental impact of logging, woodworking, pulp and paper and wood chemical enterprises in the form of effluent discharge, dust and gas emission, and the generation of unused residues.

The current predominant logging technology with a large share of final felling and use of heavy logging machines (mainly tracked ones), and the violation of adopted logging and timber transportation technologies (these cases have become more frequent in recent years in connection with the appearance of a large number of small logging operations lacking professional skills) negatively affect forest stands, hamper reforestation processes, produce breeding grounds of insects and diseases, reduce the biological immunity of stands, and increase fire hazards.

All industries based on mechanical, chemical/mechanical, and chemical processing of wood involve consumption of pure water and generation of effluent and dust-and-gas emissions, requiring treatment. Over the past ten years the indices of adverse environmental impact of the forest and forest industry sector’s operation have significantly fallen; consumption of pure water and effluent discharge into reservoirs was reduced by 44%, discharge of contaminants by 62%, atmospheric emissions by 74%, which was mainly the result of the reduction of volumes of production and to a lesser degree of technical measures for enhancement of ecological safety of operating enterprises (table 24). Nevertheless, the ecological situation in a number of regions with high concentrations of industries based on chemical/mechanical and chemical processing of wood remains tense. Such a situation is basically caused by the low technical level of production, causing the generation of large volumes of sewage and effluent, as well as inadequate treatment facilities at enterprises.



Table 24  
**Environmental impact of enterprises of the forest and forest industry sector.**

Item	Unit	1990	1998	2000
Water consumption	(million m <sup>3</sup> /year)	2 950	1 403.0	1 610
Discharge of contaminants into reservoirs:				
biological consumption of oxygen per 5 days	(1,000 tons/year)	349	176.0	130
suspended matter	1,000 tons/year	230	122.0	93
:				
Atmospheric emissions	1,000 tons/year	1 182	351.9	315
:				
of which solid	1,000 tons/year	260	76.2	69

Enhancement of ecological safety in the future should proceed along the following lines:

- Wide application of resource-saving environmentally sound technologies, machines, equipment, chemicals and materials, ensuring reduction in the volume of sewage, gases and dust emissions from basic production.
- Increase in the efficiency of treatment of sewage, gases and dust effluent by the application of methods of anaerobic bio-oxidation, membrane technology, reverse osmosis, electro-chemistry, ozone treatment, catalytic oxidation of vapour-gases, biological destruction of sulphur-organic matters.
- Efficient utilization of all waste and sediments generated in the processes of treatment.

It is necessary to introduce technologies, machines and equipment currently used by foreign enterprises into basic production, namely:

**a) In the logging industry:**

- Short-wood logging and application of wheelbase logging machines, especially in the European part of the country.

**b) In the pulp and paper industry:**

- “Prolonged” cooking and “cold” discharge of pulp.
- Bleaching of pulp without use of elementary chlorine, with application of oxygen, ozone and hydrogen peroxide.
- Washing of pulp with application of washing presses and machines for fractional washing of pulp on flat continuously moving wires.
- Treatment of condensates and vapour- and gas effluent of cooking and evaporation shops, fusion cake solvents.
- Stabilization of the operation of sodium recovery boiler units through raising the concentration of liquors arriving for burning to 65-70% (liquor super-concentrates plant) and their equipment with automated process control systems; switching power boilers to natural gas.

**c) In the woodworking industry:**

- Ground sorting of logs in sawmilling, which will eliminate the use of ponds.
- Equipment for particle board and plywood manufacturing facilities with scrubber free systems for removal of formaldehyde from ventilation effluent and with plants for removal of urea formaldehyde resin from waste water, containing resin;
- Application of non-toxic binders in the production of plywood and wood-based panels, ultraviolet hardened paintwork materials, water diluted lacquers and non-toxic glues in furniture production.

In addition to purely technical measures, organizational changes in logging and wood processing activities are needed, securing strict observance of statutory forest use regulations by all participants. In the Russian Federation a set of laws and subordinate acts on the problems of forest policy, including the “Forest Code of the Russian Federation” has been drawn-up and adopted.

However, to ensure their efficient action as applied to the forest and forest industry sector it is required to specify and work out anew the following normative conditions:

- Scientifically and technically justified volumes of maximum permissible discharge of contaminants into reservoirs and the atmosphere per production unit for all wood-processing operations, taking into account the experience of foreign countries.
- Economically sound rates of payments for use of water resources and discharge of contaminants into the environment.

Efficient control (at federal and regional levels) over the formation and especially proper use of ecological funds is also necessary, in accordance with the Law of the Russian Federation “On Protection of the Environment” of 19.12.91.

As regards pulp and paper industry enterprises, their share in the total volume of discharge of contaminants into reservoirs is about 90%, and into the atmosphere some 70%. In the future, water and atmospheric contamination by these enterprises per unit of produce will be reduced to the standards adopted at advanced foreign enterprises, the ecological safety of which has been proved in practice under the conditions of high concentration of such operations (Finland, Sweden) and a high level of environmental requirements.

Finally State support of measures for enhancement of ecological safety of the forest and forest industry enterprises is needed in the form of tax allowances, reasonable interest credits, as well as budgetary financing of development of new resource-saving and ecologically safe technologies, machines, equipment, chemicals and materials and their introduction in production.

The final goal is securing sustainability of forest management with all forest functions preserved, and ensuring complete ecological safety of all forest industry operations and enterprises.

## Some facts about the Timber Committee

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

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

- With the active participation of member countries, undertake short-, medium- and long-term analyses of developments in, and having an impact on, the sector, including those offering possibilities for the facilitation of international trade and for enhancing the protection of the environment;
- In support of these analyses, collect, store and disseminate statistics relating to the sector, and carry out activities to improve their quality and comparability;
- Provide the framework for cooperation e.g. by organizing seminars, workshops and ad hoc meetings and setting up time-limited ad hoc groups, for the exchange of economic, environmental and technical information between governments and other institutions of member countries that is needed for the development and implementation of policies leading to the sustainable development of the sector and to the protection of the environment in their respective countries;
- Carry out tasks identified by the UNECE or the Timber Committee as being of priority, including the facilitation of subregional cooperation and activities in support of the economies in transition of central and eastern Europe and of the countries of the region that are developing from an economic point of view;
- It should also keep under review its structure and priorities and cooperate with other international and intergovernmental organizations active in the sector, and in particular with the FAO (Food and Agriculture Organization of the United Nations) and its European Forestry Commission and with the ILO (International Labour Organization), in order to ensure complementarities and to avoid duplication, thereby optimising the use of resources.

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

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In all cases, the author(s) of the discussion paper are identified, and the paper is solely their responsibility. The ECE Timber Committee, the FAO European Forestry Commission, the governments of the authors' country and the FAO/ECE secretariat, are neither responsible for the opinions expressed, nor the facts presented, nor the conclusions and recommendations in the discussion paper.

In the interests of economy, Discussion Papers are issued in the original language only, with only minor languages editing and final layout by the secretariat. They are distributed automatically to nominated forestry libraries and information centres in member countries. It is the intention to include this discussion paper on the Timber Committee website at: <http://www.unece.org/trade/timber>.

The Discussion Papers are available on request from the secretariat. Those interested in receiving them on the continuing basis should contact the secretariat as well. Your comments are most welcome and will be referred to the authors:

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### ***Russian Federation Forest Sector Outlook Study***

This study analyses the national and international demand and provides forecasts for consumption, trade and production of major forest products in the Russian Federation. The authors elaborate conclusions for the forest sector stakeholders, which could be useful for further discussion about the forecasts and possible conclusions for policy makers. It starts from a historical analysis of major developments in the Russian forestry and forest industry sector, focusing on the collapse of the planned economy in the Russian Federation after 1990 and the current indicators for recovery. It uses macroeconomic assumptions, partly approved by the government, as a background to elaborate three forest sector scenarios.

### ***European Forest Sector Outlook Study (EFSOS)***

The European Forest Sector Outlook Studies (EFSOS) are the continuation of the European Timber Trends Studies dating back to the 1950s. These studies forecast development in the forest and forest products sector over the following twenty years. The current programme consists of two primary studies on the outlook for forest resources and on forest products. A large number of ancillary studies are also in progress or planned. The geographical scope has been broadened to include all European UNECE member states which collectively have over 70% of the world's temperate and boreal forest. Products covered include all major wood end-products. The results of EFSOS are intended for government policy makers as well as analysts and researchers.

### ***UNECE Timber Committee and FAO European Forestry Commission***

Further information about forests and forest products, as well as information about the UNECE Timber Committee and the FAO European Forestry Commission is available on the website [www.unece.org/trade/timber](http://www.unece.org/trade/timber). Information about the UNECE may be found at [www.unece.org](http://www.unece.org) and information about FAO may be found at [www.fao.org](http://www.fao.org).

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