THE RUSSIAN FEDERATION FOREST SECTOR OUTLOOK STUDY TO 2030

Cover photo:
Russian forest (courtesy of VNIILM)

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OUTLOOK STUDY TO 2030

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Contents

Foreword

The forests of the Russian Federation are immensely important for the present and future of humanity: they account for more than 20 percent of the planet's forest estate and therefore play crucial environmental and economic roles at the local, national and global levels. The Russian forest sector has considerable potential for development.

This report presents an independent expert evaluation of the current state of the Russian forest sector and its prospects to 2030. It addresses many aspects of the sector, including management, industry, policy, science, education, the environment, certification and legality of wood origin. It is based on internationally accepted approaches to sustainable forest management and recognition that the Russian forest estate is an ecological asset of global importance.

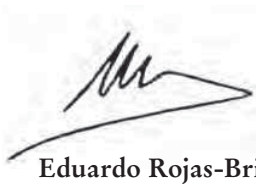
The report canvasses three scenarios for the forest sector: inertial, moderate, and innovation. The Russian forest sector will continue to increase production under all scenarios, but only the innovation scenario will ensure the progressive development of Russian forests based on the principles of sustainable forest management.

The study makes clear that, if it is to pursue the innovation scenario, the Russian forest sector needs the realization of reforms related to its restructuring and improved governance. Broad international cooperation will be an essential factor in achieving this and, therefore, the Russian Federation is cooperating actively with FAO in many areas related to the use, regeneration and protection of its forests. This outlook study is an important output of that cooperation; it makes a significant contribution to our understanding of the dynamics and potential for further development of the Russian forest sector, and the challenges it faces.

The Federal Forestry Agency initiated this independent expert research study and supported all its phases. FAO rendered overall support to project implementation including on the methodology. The Federal Forestry Agency and FAO both directly participated in the project Advisory Board.

The study was compiled by a multidisciplinary group of experts, including representatives from research, education, the private sector and civil society. It reflects the views of experts representing governmental agencies, academia, civil society and private business. We thank all those involved in the production of this important report.

Achieving the goals of the Russian forest sector will have a positive effect on the social, economic and environmental situation in the country and worldwide. We hope that the recommendations contained in this report will serve as a good basis for the decisions that must be made to improve the structure and dynamics of the forest sector in the Russian Federation.



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Acronyms

BAT	best available technology
CEPL RAN	Centre for Problems of Ecology and Productivity of Forests, Russian Academy of Sciences
ENA FLEG	Europe and North Asia Forest Law Enforcement and Governance
FAO	Food and Agriculture Organization of the United Nations
FAWS	forest available for wood supply
FLEG	Forest Law Enforcement and Governance
FRA	Global Forest Resources Assessment
FSC	Forest Stewardship Council
GDP	gross domestic product
GNC LPK	State Scientific Centre of Forest Sector
ICFPA	International Council of Forest and Paper Associations
IIASA	International Institute for Applied Systems Analysis
IPCC	Intergovernmental Panel on Climate Change
MGUL	Moscow State Forest University
Minpromtorg	Ministry of Industry and Trade of the Russian Federation
NAI	net annual increment
NEP	net ecosystem production
NIPIEIlesprom	Research and Design Institute on Economics, Production Management and Information for Forest, Pulp and Paper and Woodworking Industries
OSB	oriented strand board
OWL	other wooded land
PEFC	Programme for the Endorsement of Forest Certification
PPI	pulp and paper industry
RAO Bumprom	Russian Association of Pulp and Paper Organizations and Enterprises
Rosleshoz	Federal Forestry Agency
SFI	State Forest Inventory
SFR	State Forest Register
SPbGTURP	Saint Petersburg State Technological University of Plant Polymers
TPP	Chamber of Commerce and Industry of the Russian Federation
UNECE	United Nations Economic Commission for Europe
VIPKLH	Russian Institute of Continuous Education in Forestry
VNIILM	Russian Research Institute for Silviculture and Mechanization of Forestry
WWF	World Wide Fund for Nature

Executive Summary

MAIN PURPOSE OF THE OUTLOOK STUDY

The main purpose of the Outlook Study is to present an independent expert evaluation of the current state of the forest sector in the Russian Federation and possible alternatives for its development to the year 2030. The federal authorities, represented through the Advisory Board, initiated and encouraged the project and mobilized all the necessary resources and data for the work.

The study analyses the main systemic problems of the forest sector in the country and offers potential solutions. It has been designed to aid policy-makers in developing and implementing informative decisions. It aims to increase the openness, transparency and investment attractiveness of the Russian forest sector for national and international investors.

METHODOLOGY OF THE STUDY

The concept of the study rests on the comparison of supply and demand for forest resources. This methodology is fundamentally different from earlier approaches implemented in the "Strategy of the development of forest sector of the Russian Federation until 2020" (Prikaz Minpromtorga, 2008) and the draft programme "Development of forestry for the period of 2012–2020" (Rosleshoz, 2012a), in which forecasts were based on supply estimates. The principle difficulty was the absence of monitoring in Russia of demand for forest products in national and international markets. This complication was addressed by way of expert evaluation; however, this cannot be considered a substitute for systematic and purposeful studies. The present study recommends to *create in the Russian Federation an official structure for monitoring, forecasting and elaborating proposals on stimulating demand for forest products.*

SCENARIOS

The forest sector forecast is based on three scenarios: inertial, moderate and innovation. The **inertial** scenario is based on past trends. The **moderate** scenario presumes moderate economic development and represents progress from the inertial to innovation stages. The **innovation** scenario represents the most favourable alternative. It assumes relatively high and stable economic growth, measures of state support, stimulation of consumption of forest products, improvement of the foreign trade structure, and increase in the share of advanced wood processing. The economic lag of the last two decades is to be overcome through innovations and breakthrough technologies, building on existing global technological developments. One of the findings of the project is the concept of the "enveloping curve" – a gradual transition from the inertial to moderate and then innovation scenarios within 20 years by 2030. This approach is recommended for the design of state plans and programmes for the forest sector in the Russian Federation.

CURRENT STATE OF THE FOREST SECTOR

The last two decades of active Russian political and economic reforms have shown the forest sector of the country to be comparatively slow in adapting to market relations and requirements. The forest sector is not a priority of national forest policy. Russia accounts for over 20 percent of the world forests, but its share in the world forest products trade is below 4 percent. Semi-processed roundwood and sawnwood make up over 54 percent of its exported wood products. Forests occupy over half of the land of the country, but the share of the forest sector in the gross domestic product (GDP) is only 1.3 percent; in industrial production, 3.7 percent; in employment, 1 percent; and in export, revenue

2.4 percent. These facts prove that the colossal forest potential of the country is essentially under-utilized. The opportunities presented by the forest sector are clearly underestimated by state economic policy and policy-makers.

OUTLOOK FOR FOREST RESOURCES POTENTIAL

The total area of forest land in the Russian Federation in 2010 was 882 million hectares. By 2030 it will increase by 0.9-1.5 percent, depending on the scenario. This increment will occur mainly due to the artificial and natural reforestation of abandoned and inconvenient agricultural lands and as a result of forest expansion on non-forested lands and tundra.

Total growing stock in the Russian Federation in 2010 made up 83 billion cubic metres. According to the forecast this will increase by 2.4-5 percent due to increases in forest area, global warming, nitrogen precipitation and underuse of allowable cuts. Net annual increment (NAI) will increase from 1 016 million cubic metres per year by 7.7-10.4 percent.

Total carbon stock without soil organics in 2010 was over 50 billion tonnes. According to the forecast it should increase by 2030 by 2-4.7 percent. By 2030 net ecosystem production (NEP) in Russia will increase from 611 million tonnes per year by 7.2-10.1 percent and will reach 673 million tonnes per year under the innovation scenario. The annual increment of NEP will be 2.2-3.0 million tonnes per year. The study recommends introducing NEP in the tables of the FAO Global Forest Resources Assessment, in order to calculate the carbon balances of regions and countries in the world.

Total losses of wood as a result of fires, windfalls, pests and diseases will increase by waves, but these losses will not essentially affect the positive dynamics of the carbon stock. The area of forest available for wood supply (FAWS) will fall from 677 million hectares (in 2010) to 654-665 million hectares (in 2030), by 3.4-1.8 percent, depending on the scenario. The share of these lands in the total forest area will decrease from 84 percent to 79-80 percent due to separation of the new forest conservation reserves and preserves. Growing stock in these forests would fall from 68 billion cubic metres to 66-67 billion cubic metres. Net annual increment (NAI) in these forests will fall from 853 billion cubic metres per year to 844 billion cubic metres per year under the inertial scenario. Under the innovation scenario the NAI should grow to 858 million cubic metres per year. Allowable cut (633 million cubic metres per year in 2010) would increase up to 650-710 million cubic metres per year. Its share in the NAI will increase from 74 percent in 2010 to 77-83 percent in 2030. The study advises national policy-makers to *start objective systematic calculations of the economically allowable cut*, which would exclude all physically and economically inaccessible forest resources. This is absolutely necessary in order to develop appropriate policy targets for forestry.

The dynamics of basic forest resource indexes in the Russian Federation also coincide in terms of direction with the expected dynamics of European and North American forests. For the Russian Federation, which has the largest forest area in the world, the project recommends the *creation of a Ministry of Forests*, responsible for sustainable forest management; development of national forest strategies, policies and legislation; and design of economic mechanisms to support the policies and realization of forestry programmes.

FOREST INDUSTRY OUTLOOK

According to the Outlook Study, roundwood production in the Russian Federation will increase from 143 million cubic metres in 2010 by 1.6-2.1 times, and will reach over 300 million cubic metres in 2030 under the innovation scenario. Export growth will be insignificant taking into consideration the state policy on developing advanced wood processing inside the country. To increase wood consumption in the domestic market, measures should be taken to stimulate wood demand, primarily by developing the wooden housing construction industry. Logging growth will be ensured by priority investment projects and the construction of advanced road networks.

Sawnwood production will increase from 24.7 million cubic metres in 2010 by 1.5-2.7 times. Housing construction will reach 1 square metre per capita. Industrial and civil construction will also advance.

Plywood production will rise from 2.7 million cubic metres in 2010 by 1.5-2.1 times in 2030. Export estimates take into account the expected demand of the main importers, including Egypt, the European Union and the United States. National production will cover domestic market demand with insignificant imports.

Particle board production will expand from 5.4 million cubic metres in 2010 by 1.6-2.1 times by 2030 to meet the demand of furniture and construction industries, and will constitute one of the most dynamic sub-sectors. Expected developments include the large-scale replacement and modernization of equipment, the introduction of new technologies with continuous output and no or low toxicity, and the production of oriented strand boards (OSB).

Fibreboard production will increase from 1.7 million cubic metres in 2010 by 1.7-2.5 times. Wet-process and medium density fibreboard manufacturing will also increase, and extra thin (2.5-7 mm) boards will be produced.

Wood pulp production should grow from 2.1 million tonnes in 2010 by 1.6-1.9 times in 2030. Up to 62.5 percent of the pulp will be consumed by the producers themselves for paper and paperboard manufacturing, while 37.5 percent will be sold in national and international markets. Export growth will occur at the rate of production expansion.

Paper and paperboard production should grow from 7.7 million tonnes in 2010 by 1.9-3.3 times, substantially decreasing the lag behind developed economies on per capita consumption of these products. Economic policy foresees a reduction in the dependence of national markets on paper and paperboard imports. By 2030 domestic consumption of paper and paperboard will reach 20 million tonnes. Per capita consumption will increase by 3.1 times up to 141 kilograms (kg) per capita per year. For comparison, in Canada this index currently makes up 175 kg; in the United States, 230 kg; and in Finland, 346 kg per capita per year.

Wood biomass for energy use will double, increasing from 32 million cubic metres to 75 million cubic metres. The national market will be the prime consumer of this biofuel. Limited export only is foreseen for pellets and will originate from those regions with the necessary transportation and economic conditions.

The forecast assumes improvement in the current regional allocation of forest industries. Advanced processing in the richly wooded regions of Siberia and the Russian Far East will develop at higher rates. Siberia will increase its production capacity for sawnwood by 5.6 million cubic metres, plywood by 2 million cubic metres, fibreboards by 2.9 million tonnes, and paper and paperboard by 2.8 million tonnes.

Large investments and radical progress in the investment climate would be necessary to materialize these forecasts. This problem stretches far beyond the area of influence of the forest sector. According to the World Bank index of ease of doing business, Russia ranks 120 in the list of 183 countries of the world (World Bank, 2012). The Government of the Russian Federation has pledged to lift the Russian rank up to the twentieth position within the next six years. This achievement would be an important precondition for the gradual transition from the inertial to moderate and then to the innovation scenario of development, presented in this Outlook Study.

REFORESTATION, CONSERVATION AND PROTECTION

In the field of forest reproduction, conservation and protection, the **inertial** scenario pursues traditional tasks of forest conservation and protection against fires, pests, diseases and illegal activities. The **moderate** scenario assumes not only conservation, but also quality enhancement of existing resources, transitioning to sustainable forest management. The main emphasis is placed on prevention of unwanted change of tree species and balancing methods of logging and reforestation. The moderate scenario maintains the current

spatial structure of the forest sector. Under this scenario, two-thirds of logging should take place in the richly wooded regions, which account for only one-third of the entire population of the country.

The **innovation** scenario provides for spatial restructuring of the forest sector. The sector will have to regain lost positions in the sparsely and moderately wooded regions of Russia. About two-thirds of the population and one-third of forests are located within this territory. The not-utilized annual increment of 255 million cubic metres should be used as a priority. To do so, the study recommends doubling the existing harvesting volume by 2020 and tripling it by 2030. Thus, only half of the not-utilized increment will be used. Expansion of advanced processing and wood energy production would expand wood sales from intermediate removals and replace low-value stands with high-value forests. Under the innovation scenario the share of tree planting in forest regeneration would reach 50 percent.

Forest policy-makers are *recommended to revise legislative acts that prohibit timely renewal and reconstruction of forests in the sparsely and moderately wooded regions*. Expansion of protective afforestation should form a part of the innovation strategy, and would allow increases in the forestry and agricultural potential of the country.

The study *recommends applying the principle of the enveloping curve to the implementation of the three scenarios*: a gradual transition from inertial to moderate to innovative development. It also recommends using this approach for the development of all state forest sector programmes.

FOREST RESOURCES AND CLIMATE CHANGE

Russia provided above 90 percent of the carbon sink of the world's boreal forest in 2000–2007, including Canada and Scandinavia. Estimates of the average carbon sink in Russian forests during the past 10 years are in the range of 500-700 million tonnes per year. According to the available forecasts, the most significant climatic changes in the world are expected in the Russian Federation. Observed changes have already had a significant impact on the forest. If the predicted warming at the end of the twenty-first century becomes a reality, the carbon emissions from the permafrost lands of Russia will likely exceed current emissions from tropical deforestation by several times. This is a problem of global importance, not yet recognized by the international community. The report recommends *studying the problem of permafrost processes at the international level* and its inclusion in the ongoing negotiation process on climate change. It further recommends a full verified accounting of the forests' influence on the global greenhouse gases budget.

FOREST CERTIFICATION

By the end of 2011, 30 million hectares of Russian forests had been certified under the Forest Stewardship Council (FSC) scheme. A much smaller area (177 000 hectares) was certified under the Programme for the Endorsement of Forest Certification (PEFC). At present, Russia ranks second after Canada for area of certified forests. Certified forests represent 26 percent of all Russian forest leased for logging. In 2010, forest leaseholders harvested 123 million cubic metres out of 176 million cubic metres of total harvesting in the country. The average growth rate of certified forests is about 2.7 million hectares per year. The area of certified forests in the Russian Federation will increase from 24 million hectares in 2010 by 2.6-4.2 times to reach 103 million hectares by 2030 under the innovation scenario. Development of demand for certified forest products is necessary for the further growth of forest certification in Russia.

ILLEGAL LOGGING

According to Rosleshoz official figures, illegal logging in 2010 totalled 1.3 million cubic metres. This volume represents less than 1 percent of the total wood harvest in the country and meets the best international standards in the forest sector. According to WWF

Russia and World Bank estimates, however, up to 20 percent of logging in Russia (about 35 million cubic metres) is of illegal origin. The total amount of budget lost as a result to this illegal activity may reach 13-30 billion roubles annually.

The inertial scenario foresees a reduction in illegal logging turnover by 5-10 percent in 2030; the moderate scenario predicts a 20-30 percent decrease; and the innovation scenario assumes a 70-80 percent drop. It is not realistic to expect a decline in illegal logging over 80 percent, that is, below 4 percent of the total harvesting in the country. For an effective and sustainable solution to this problem it is necessary to resolve macroeconomic issues far beyond the influence of the forest sector, such as unemployment and low incomes in rural areas.

FOREST POLICY AND INSTITUTIONS

The first draft of the forest policy of Russia was submitted for broad public debate in April 2011. Its adoption is expected pending majority agreement. Public institutions and legislation should be reformed on the basis of the new policy. Forest policy during the forecast period should lead the transition from the inertial to the moderate scenario (2020) and then to the innovation scenario (by 2030). The policy should be comprehensive and include measures to support forestry, forest industry, investments, science, education, international trade and cooperation.

SCIENCE AND EDUCATION

In 2010 the forest sector of the Russian Federation employed about 1.1 million employees, including forestry at 40 percent, wood processing at 40 percent, and the pulp and paper industry at 15 percent. According to the innovation scenario, employment will increase by 1.2-1.8 times up to 2 million people in 2030. The development of the forest sector will need serious support in terms of scientific and professional staff. The number of researchers should grow from 3 500 people in 2010 by 1.1-1.7 times in 2030, depending on the scenario.

In 2010 funding of scientific research amounted to 450 million roubles, equivalent to 0.08 percent of the GDP of the forest sector. Public financing of science will increase by 1.9-4.1 times.

In 2010 the total federal budget for professional education and training for the forest sector totalled 5 billion roubles (0.86 percent of forest sector GDP), including higher education at 3 billion roubles, secondary at 1.5 billion roubles, and basic professional education at 0.5 billion roubles. The growth of total spending on education will increase by 1.4-2 times reaching 2.3 billion roubles (about 1 percent of forest sector GDP) by 2030 under the innovation scenario. Scientific and staff support under the innovation scenario may be most effectively implemented on the basis of state-private partnership through technology platforms.

HISTORICAL CHANCE

General analysis of the forecast leads to the conclusion that the Russian forest sector is facing a unique historic opportunity for the major reconstruction and creation of a fundamentally new forest sector for the twenty-first century. This should be achieved through the implementation of the innovation scenario on the basis of innovations and breakthrough technologies, new techniques, advanced knowledge and scientific achievements that have been accumulated over the previous two decades by world forest industrial leaders while the Russian forest sector struggled for survival. This approach relates not only to engineering and technology, but also to politics, governmental institutions, science and education. Russia has all the necessary and sufficient conditions to embark on this path. Moreover, for many branches of the Russian forest sector it is likely the only route to survival in the face of growing competition and free trade development.

The current system underpinning the forest sector in Russia was mostly designed, constructed and developed in the middle of the past century on the basis of the design

decisions, technology and knowledge of that time. The system includes capital assets, institutions, policies, science and education in the forest sector. As of now, the system is mostly physically worn out, obsolete, regressive and in need of profound fundamental reconstruction. However, these circumstances provide an invaluable opportunity to construct a fundamentally new forest sector, bypassing those intermediate stages, which developed economies have passed through over the past decades. In other words, the Russian forest sector has been given a unique chance. It must step over the twenty-year developmental stage and enter the new reality as a renewed, vigorous, modern and progressive segment of the national and global economy. Realizing this opportunity, presented in the innovation scenario of this study, is a challenging task. It will require urgent and serious scientific elaboration, the provision of qualified staff, foresight, and the forecasting of technologies and world markets for decades ahead.

1. Russian Federation Forest Sector

1.1 INSTITUTIONAL ORGANIZATION OF FOREST MANAGEMENT

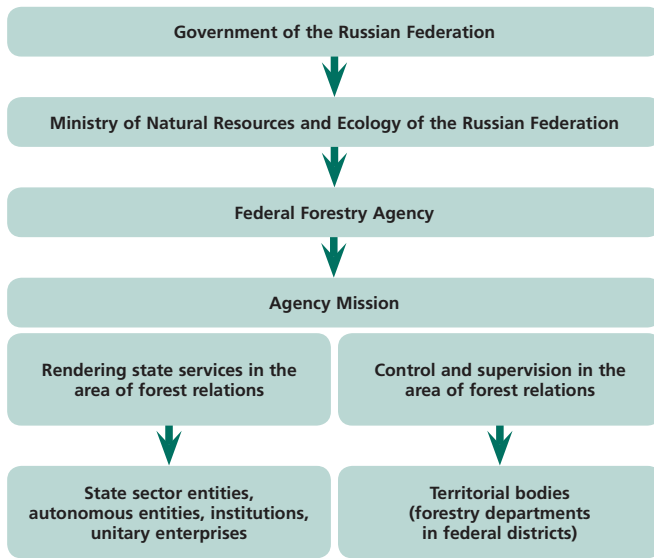
Two decades of political and economic reforms in the Russian Federation have demonstrated that the forest sector is both slow and has difficulty in adapting to market relations and international requirements related to sustainable forest management. Moreover, the sector is not a priority for national economic policy.

Several features characterize forest sector development in Russia. First, the *absence of a coordinated forest policy* adopted at the federal level on the basis of consent of state institutions, business and society. A draft forest policy document is presently the subject of national discussion in Russia.

A second feature is *the instability of legal regulation governing forest relations*. Over the last twenty years, federal forest legislation has changed several times. The "Basic Forestry Legislation" (Osnovy lesnogo zakonodatelstva, 1993) decentralized forest management and transferred the management functions related to forest land to local government authorities in administrative districts. The 1997 "Forest Code" subsequently transferred management functions relating to forest land to the government authorities of the 83 federal *subjects* of the Russian Federation, leaving legislative and supervisory functions to federal government authority (Federal Law, 1997). Federal Law no. 122 (2004) centralized forest management and transferred forest management functions to federal executive bodies. Then, Acting Forest Code (Federal Law, 2006) once again decentralized forest management and transferred state supervisory functions related to forest land to government authorities of the subjects of the Russian Federation.

A third feature is the *unstable position of the federal executive body within the sphere of forest relations*. From 2000 to 2012 the position of the Federal Forestry Agency changed

FIGURE 1.1
Institutional organization of state forest management, June 2012



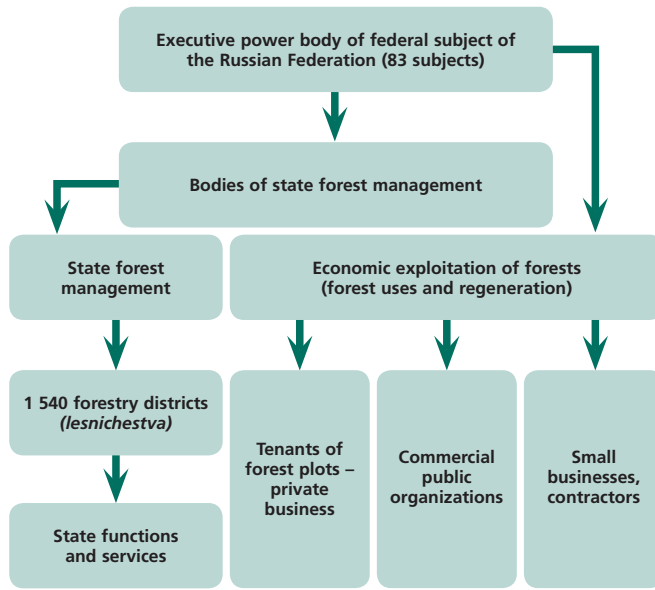
four times: until 2008 it fell under the Ministry of Natural Resources; from 2008 to 2010 it was subordinated to the Ministry of Agriculture; from 2010 to May 2012 it answered directly to the Government of the Russian Federation; and as of May 2012 it reports to Ministry of Natural Resources and Ecology (Ukaz Prezidenta, 2012).

The sphere of competence of the Federal Forestry Agency includes: (1) control and supervision in the area of forest relations, except for forests in protected areas; (2) rendering public services; and (3) management of state assets in the area of forest relations.

The Federal Forestry Agency renders the following services: (1) state forest inventory and forest husbandry; (2) forest pathology monitoring; (3) seed growing; (4) aerial forest fire protection operations; (5) scientific research; and (6) additional vocational education. These services are provided by institutions and enterprises subordinated to the Federal Forestry Agency or through tenders on the basis of state purchase. The Federal Forestry Agency does not have territorial bodies in the subjects of the Russian Federation (Figure 1.1).

Federal plenary powers in the area of forest relations at the regional level are implemented through forestry departments in eight federal districts and the 83 federal subjects of the Russian Federation. The following plenary powers have been transferred to government authorities of the subjects of the Russian Federation: (1) elaboration and validation of forest plans, legal forestry regulations, implementation of state expertise on forest exploitation projects; (2) lease and concession of forest parcels, conclusion of contracts for purchase and sale of wood stock, organization and carrying out of wood auctions; (3) issuance of permits for undertaking geological works on forest land; (4) organization of management, conservation, protection and regeneration of forests; (5) maintenance of state forest register; (6) implementation of federal forest supervision; and (7) establishment of lists of officials authorized to perform federal forest supervision. These plenary powers are implemented by state structures within the bodies of executive power of the subjects of the Russian Federation. At the field level, the structures are represented by forestry districts (*lesnichestvo*). The institutional organization of state forest management at the level of the subjects of the Russian Federation is indicated in Figure 1.2.

FIGURE 1.2
Institutional organization of forest management in the Russian Federation



Private business carries out forest management in accordance with lease contracts. The leasing of forests was introduced for the first time by the "Basic Forestry Legislation of the Russian Federation" in 1993. Subsequent legislative acts modernized lease relations and changed time periods, procedure, and the rights and obligations of the parties. According to the Forest Code of 2006, forest parcels are conceded in tenancy to legal and natural persons in accordance with: (1) lease contracts for the period of 10 to 49 years, otherwise (2) in accordance with contracts for the purchase and sale of wood stands for a period not exceeding one year. Contracts for the purchase and sale of wood stock are mainly directed at forest use for local needs and meeting the wood demand of the local rural population.

Rights to conclude forest parcel lease contracts and contracts for purchase and sale of wood stands are acquired by legal and natural persons through wood auctions. An exception is made for priority investment projects, which are subject to selection and validation through a tendering procedure. Priority investment projects are considered those related to the setting up and modernization of wood-processing infrastructure to the amount of no less than 300 million roubles. The Ministry of Industry and Trade of the Russian Federation (Minpromtorg) keeps records of investment forest projects aimed at innovative development of the forest sector. Tenants carry out forestry operations on leased land accounting for over 14 percent of forest estate land (*lesnoy fond*). Authorized unitary enterprises and autonomous entities carry out forestry operations on unleased land.

1.2 FOREST RESOURCES POTENTIAL

The State Forest Register (SFR) of the Russian Federation, as of the beginning of 2010, estimates forest area as 1 183.7 million hectares, including 1 143.6 million hectares of forest estate land. Forest estate land does not include forest land pertaining to the Ministry of Defense and urban forests (6.1 million hectares), protected forests (26.9 million hectares), and other categories of land – 7.1 million hectares (Table 1.1).

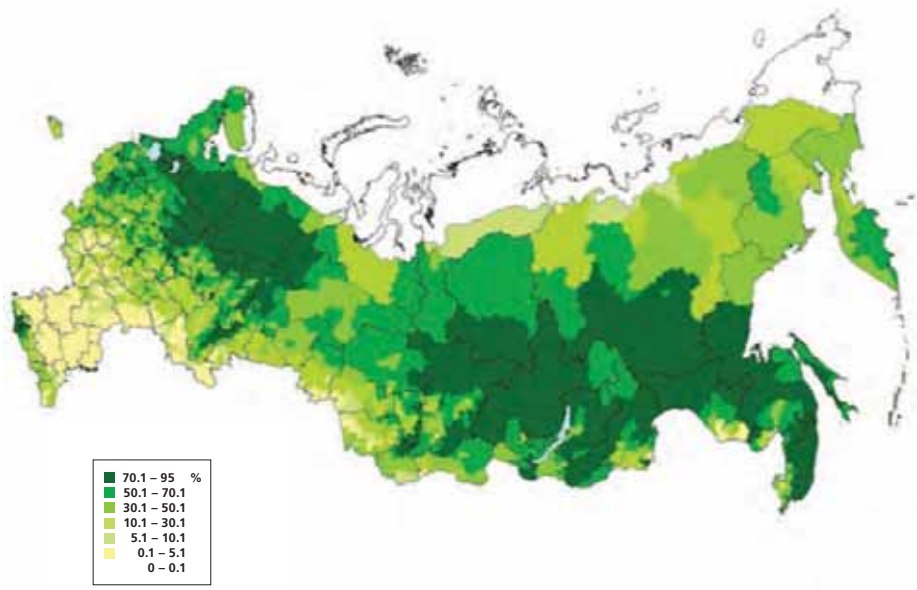
According to SFR classification, the concept of "forest land" includes shrubbery (75 million hectares), and urban forests (1.4 million hectares). According to FAO classification, these categories of forest land are excluded from the concept of "forest" and pertain to the category of "other wooded lands" (OWL). The percentage of forest cover on the territory of the Russian Federation, that is, the area of forested land as a share of the total land area of the country, amounts to 46.6 percent (Figure 1.3).

Forest estate land (*lesnoy fond*) includes: (1) forest land covered by forest vegetation; (2) forest land not covered by forest vegetation but destined for forest regeneration (felled areas, burned-out forests, open forests, failed areas etc.); and (3) non-forested land, destined for forestry management (clearances, roads, bogs etc.). Forest land accounts for

TABLE 1.1
Forest area in Russia in 2010 (thousand ha)

Forest land categories	Total area with forests	Including forest uses			Forest land	Including covered by forest vegetation
		Protection	Exploitable	Reserve		
Forest estate land	1 143 563.7	275 002.8	610 723.6	257 837.3	862 575.3	770 315.6
Defence and security lands	4 745.9	1 281.9	3 462.9	1.1	3 952.3	3 656.7
Urban forest	1 350.4	1 350.4	0.0	0.0	1 110.6	1 007.3
Protected forest	26 944.0	26 944.0	0.0	0.0	17 850.3	16 878.4
Lands of other categories	7 078.2	3 152.7	3 767.5	158.0	6 466.4	5 638.3
Including forest estate parcels previously owned by agricultural organizations	4 603.8	2 016.3	2 587.5	0.0	-	-
Total forests	**1 183 682.2**	**307 731.8**	**617 954.0**	**257 996.4**	**891 954.9**	**797 496.3**

FIGURE 1.3
Forest cover of the Russian Federation (%)



75.4 percent of total forest area, of which 67.4 percent is covered by forest vegetation, and 8.0 percent is not covered by forest vegetation. Non-forested land accounts for 24.6 percent.

Russia's forests are represented predominantly by boreal forests. Main forest-forming tree species are larch, pine, spruce, fir, cedar, birch and aspen (Table 1.2). They account for over 98 percent of land covered by forest vegetation. Standing larch trees account for 35.8 percent, pine accounts for 15.6 percent, and birch accounts for 15.0 percent of forested land area. Subboreal and nemoral forests, composed of broadleaved oak species, beech, elm, lime tree and maple, account for only 2 percent of total forest area.

Forest-forming tree species of the coniferous group account for 68.4 percent, hard-leaved deciduous accounts for 2.4 percent, and soft-leaved deciduous accounts for 19.3 percent.

TABLE 1.2
Changes in areas of main forest-forming tree species (thousand ha)

Main forest-forming tree species	1988	1993	1998	2003	2005	2010
Coniferous						
Pine	113 564.0	114 326.0	116 740.0	117 473.0	117 295.0	120 227.1
Spruce	78 810.0	75 866.3	77 658.0	77 198.4	76 417.7	77 660.7
Larch	277 898.0	263 348.0	265 719.0	264 287.0	264 269.9	275 785.9
Siberian cedar	40 166.0	39 797.6	41 033.2	40 852.0	41 171.6	38 867.3
Hard-leaved deciduous						
Long-boled oak	3 761.0	3 808.0	3 719.0	3 633.7	3 611.9	3 670.8
Short-stemmed oak	3 198.7	2 971.3	3 110.3	3 200.0	3 161.0	3 206.1
Beech	698.5	701.3	786.0	789.6	793.1	685.2
Soft-leaved deciduous						
Birch	85 531.0	87 732.5	94 170.5	97 950.0	99 683.7	115 723.5
Aspen	17 711.4	18 907.9	20 035.0	20 573.4	20 802.0	23 739.5

Other tree species (pear tree, chestnut, European walnut, Manchurian walnut, etc.) account for less than 1 percent of lands, while other species including shrubbery (dwarf Siberian pine, shrubby birch, etc.) account for about 9 percent of the area.

Forest areas under main forest-forming species have remained essentially stable over recent decades. Spruce forest decrease since 1988 has been related to felling, fires and slow rate of spruce regeneration. In 2010 spruce forest area increased sharply. The causes of this phenomenon are unknown. The increase of soft-leaved deciduous wood stands is explained by the regular substitution of coniferous with non-coniferous (succession) on vast felled areas and burned-out forests, and also by the low demand for wood of these species.

In the hard-leaved deciduous group, stone birch, five species of which grow in Eastern Siberia and the Far East, accounts for about half of the total area. The most precious species – long-boled oak and beech – account for about one-quarter of the total area within this group. The area under hard-leaved deciduous wood species remains constant owing to protection categories.

Area distribution of the main forest-forming tree species by age groups is as follows: young growth accounts for 17.1 percent, middle-aged accounts for 28.5 percent, ripening accounts for 10.7 percent, and mature and over-mature accounts for 43.8 percent. About 50 percent of the total coniferous area is represented by mature and over-mature stock. Their concentrations are found mostly in remote forest parcels with difficult access, on lands with excessive soil humidity.

According to available data from 2010, total standing volume in the forests of the Russian Federation amounts to 83.4 billion cubic metres, including forests located on forest estate land (80 billion cubic metres) and on lands of former rural forests (3.4 billion cubic metres). Countrywide average growing stock accounts for 105 cubic metres per hectare, with mature and over-mature standing wood stock (without shrubbery) accounting for 132 cubic metres per hectare, and exploitable forests for wood harvesting accounting for 165 cubic metres per hectare. Annual increment of growing stock in the forests of the Russian Federation is rather low and does not exceed 1.27 cubic metres per hectare of lands covered by forest vegetation.

Since 2008 positive changes in gross growing stock have taken place on forest land (Table 1.3). Growing stock increase takes place at the expense of forested parcels of forest land, previously owned by agricultural organizations, and also at the expense of the area covered by low-value, soft-leaved deciduous forest stands. A substantial concentration of low-productive coniferous stands has been noted on lands with excessive soil humidity.

More than half of the forests of the Russian Federation grow on permafrost soils (Siberia and Far East) in severe climate conditions, which determine low productivity and the fragmentary nature of growing stock. Only 45 percent of forest area is available for exploitation. The predominant part thereof – in the European North, in the Urals and along the Trans-Siberian Railway – is exhausted as a result of intensive exploitation. The economic availability of mature forests is even lower. Thus, the share of productive

TABLE 1.3
Growing stock dynamics (million m³)

Indicators	2008	2010	Increase
Total growing stock	76 404.08	79 977.20	3 573.12
Of which mature and over-mature forests	42 633.32	44 017.41	1 384.09
Coniferous	57 704.43	58 999.76	1 295.33
Of which, mature and over-mature	32 855.68	33 242.15	386.47
Hard-leaved deciduous	1 986.59	2 034.11	47.52
Soft-leaved deciduous	15 157.91	17 376.32	2 218.41
Net annual increment	947.29	1 016.08	68.79

(I–III site classes) mature and over-mature coniferous growing stock does not exceed 16 percent.

The increment in forest estate land amounts to 1 016 million cubic metres per year, out of which 853 million is in forests available for wood harvesting. In accordance with silvicultural regulations, the annual allowable cut must not exceed the wood increment in forests available for wood harvesting.

According to data from experts of the Russian Research Institute for Silviculture and Mechanization of Forestry (VNIILM), over 200 million cubic metres of non-coniferous species can be annually harvested without damage to the country's forests. Due to low demand for non-coniferous species, however, the process of ageing of small-leaved deciduous forests is underway in a number of regions, thus increasing decay and mortality. Forest mortality takes place with consequent decrease in growth and deterioration of forest health conditions. A critical situation is developing with aspen forests: over-mature stock is subject to rot and loss of essential wood qualities.

On forest land pertaining to the Federal Forestry Agency, 173.6 million cubic metres of wood were harvested in 2010. The harvesting of predominantly coniferous wood entails changes of species and the exhaustion of coniferous growing stock. The established annual allowable cut in 2010 amounted to 634 million cubic metres, including 61 million cubic metres in protective forests and 573 cubic metres in exploitable forests. The largest amount of annual allowable cut in coniferous forests amounted to 128 million cubic metres. The share of the established amount of allowable cut that is used remains below 28 percent.

In 2010 123 million cubic metres of wood were harvested on leased parcels, while 52 million cubic metres were harvested on the basis of timber sales contracts. Only 50 percent of the allowable cut of leased wood stock was harvested. The utilization of soft-leaved deciduous stands remains low.

1.3 FOREST MANAGEMENT ISSUES

The general forestry background in the Russian Federation is characterized by an imbalance in distribution and consumption, and management and regeneration of forest resources (Table 1.4).

Russian forests are conventionally classified in two big groups. ***Sparsely wooded and moderately wooded regions*** occupy the Central, Volga, Ural, Southern and North Caucasus Federal Districts. These regions account for 15.4 percent of country area, 16.7 percent of forested area, and about 28.8 percent of growing stock. This area accounts for 68.5 percent of the country's total population with two-thirds of its total industrial and agrarian production and trade. These regions are at the *epicentre* of domestic forest consumption. ***Richly wooded regions*** occupy some parts of Northwestern, Siberian and Far Eastern Federal Districts. Richly wooded regions are traditionally oriented towards external markets.

Sparsely and moderately wooded regions have historically carried the major forest exploitation load and by the 1950s were mostly exhausted. In 1943 the Government of the USSR made a decision to separate forests by groups and shift forest harvesting to richly wooded regions. From the beginning of the 1970s, richly wooded regions started producing over two-thirds of forest harvesting in the country. In the meantime, in sparsely and moderately wooded regions, the underused increment continued to accumulate and at the present time has reached 255 million cubic metres per year, exceeding the level of national forest harvesting. This resulted in an accumulation of mature and over-mature wood stands, deterioration of ecology, and the expansion of pests, diseases, windfalls and forest fires. The need for sanitary felling, including clear cuts, has risen sharply.

Final felling reached its peak during the 1960–1990s, exceeding 300 million cubic metres per year (Figure 1.4). This felling took place mostly in richly wooded regions

TABLE 1.4
Characteristics of forest resource potential in the Russian Federation

Indicators	Russian Federation	Sparsely wooded and averagely wooded regions	Richly wooded regions
Area (%)	100.0	15.4	84.6
Population (%)	100.0	68.5	31.5
Industrial production output (%)	100.0	61.6	38.4
Commodity turnover (%)	100.0	68.6	31.4
Forested areas (million ha)	770.3	128.5	641.8
Percentage (%)	100.0	16.7	83.3
Annual increment (million m^3)	1 016.1	297.3	718.8
Percentage (%)	100.0	28.8	71.2
Annual increment available for exploitation (million m^3)	552.3	297.3	255.0
Percentage (%)	100.0	53.8	46.2
Wood harvesting in 2010 (million m^3)	173.6	60.3	113.3
Including final felling (million m^3)	131.1	41.7	89.4
Underutilized part of increment in available forests in 2010 (million m^3)	421.2	255.6	165.6
Percentage (%)	100.0	60.7	39.3

along main overland and water ways. The result was the exhaustion of sawtimber as the most profit-making resource in view of the shortage of technologically advanced wood processing. In the 1990s the transition to an unregulated market economy was accompanied by a threefold decrease in the amount of wood harvesting in the country, with a twofold decrease in richly wooded regions.

Table 1.5 shows the links between felling and forest regeneration for the period 1950–2010. The ratio of tree planting and young growth thinning to the total area of forest regeneration is an important indicator of forestry development. The transition to a market economy was accompanied by a decrease in forest harvesting and regeneration. Forest harvesting decreased by 2 times while tree planting and young growth thinning shrank by 3-4 times compared to the Soviet years preceding market reforms.

Russian forestry continues to experience unfavourable forest succession. The share of soft-leaved deciduous stands increases by 22 percent after felling and reaches 52 percent

TABLE 1.5
Wood felling and forest regeneration in the Russian Federation

Indicators by years	1950	1960	1970	1977	1990	2000	2005	2010
Total wood felling (million m^3)	237	336	354	369	304	168	170	174
Forest regeneration area (thousand ha)	635	1 155	1 850	1 889	1 846	973	812	819
Including tree planting (thousand ha)	382	477	843	842	684	263	187	171
Young growth thinning (thousand ha)	n/a	398	1 023	1 180	1 270	583	423	323
Tree planting (% to forest regeneration area)	44.7	37.6	39.1	41.7	37.0	27.0	23.0	20.9
Young growth thinning (% to forest regeneration area)	n/a	34.5	55.3	62.5	68.8	59.9	52.1	39.4
Protective afforestation (thousand ha)	284	434	724	758	85	28	7	3

FIGURE 1.4
Final felling in the Russian Federation, 1950–2010

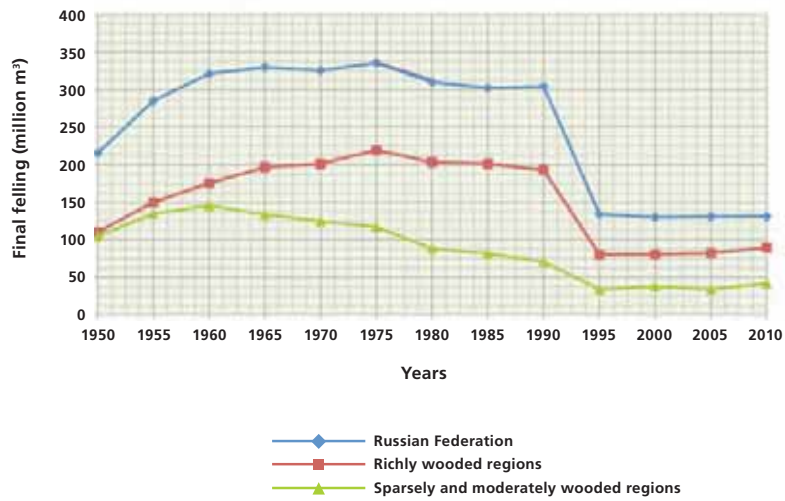
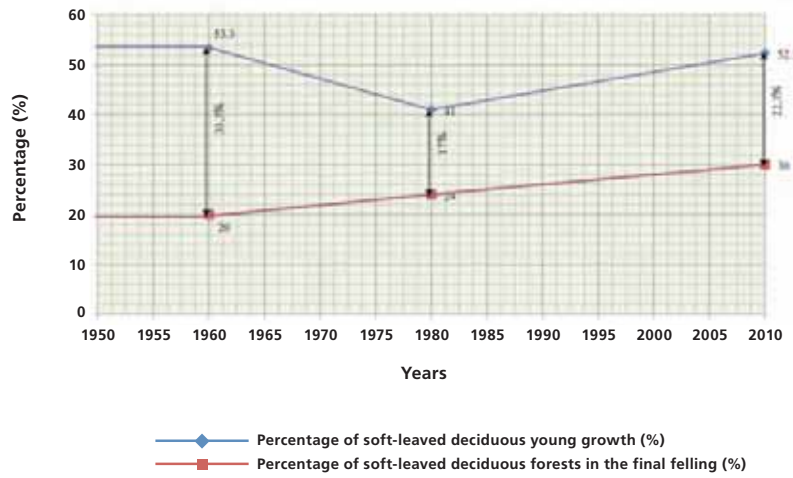


FIGURE 1.5
Percentage of soft-leaved deciduous young growth (%)



of the total young growth area. This explains the necessity to expand artificial forest regeneration by tree planting and young growth thinning to avoid unfavourable forest succession (Figure 1.5).

In the draft programme of forestry development until 2020 (Rosleshoz, 2012a), the ratio of tree planting to forest regeneration remains at the 2005–2010 level (about 22 percent). The ratio of young growth thinning also does not improve. According to forecasts, in 2020 it will account for about 40 percent of the final felling area. In these circumstances, the inertial scenario will prevail. The transition to sustainable forest management via the innovation scenario will require a change in the tendencies, volumes and methods of forest regeneration.

1.4 CONSUMPTION OF FOREST PRODUCTS

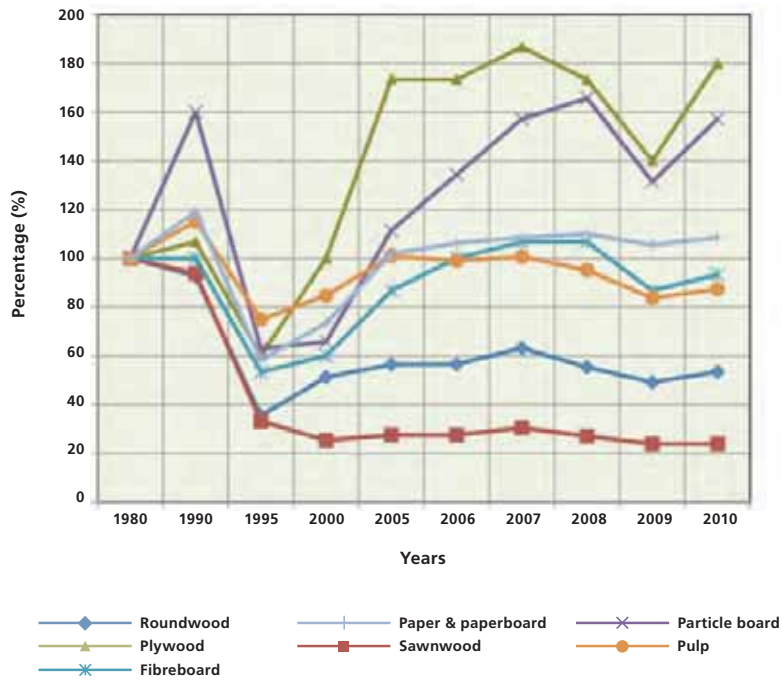
The production output of forest products for the period 1980–2010 is indicated in Table 1.6. It ought to be noted that data reported by the Federal Service of State Statistics (Rosstat) may underestimate small business activity. According to expert evaluation, for example, sawnwood production in 2010 amounted to 24.7 million cubic metres compared to 19.0, according to Rosstat evaluation.

In 2010 the Russian domestic market consumed almost two-thirds (61 percent) of the national forest sector production. The remaining part (39 percent) was exported. In 2010 gross forest products export revenues amounted to US$9.5 billion, including European countries, 37 percent; Asian countries, 49 percent; and other countries, 14 percent. Raising roundwood export tariffs in 2008 significantly decreased roundwood exports (Table 1.7 and Figure 1.6).

TABLE 1.6
Wood products in the Russian Federation, 1980–2010

Indicators	1980	1990	1995	2000	2005	2010	2010/ 1990 (%)	2010/ 2000 (%)
Roundwood (million m³)	328.0	304.0	134.9	167.9	170.0	173.6	52.6	103.4
Sawnwood (million m³)	80.0	75.0	26.5	20.2	22.0	19.0	25.3	94.1
Plywood (million m³)	1.5	1.6	0.9	1.5	2.6	2.7	168.7	180.0
Particle board (million m³)	3.5	5.6	2.2	2.3	3.9	5.5	98.2	239.0
Fibreboard (million m³)	1.5	1.5	0.8	0.9	1.3	1.7	113.3	188.9
Pulp (thousand tonnes)	2 405	2 770	1 801	2 037	2 429	2 100	75.8	103.1
Paper and paperboard (thousand tonnes)	6 998	8 325	4 070	5 140	7 126	7 750	93.1	150.8

FIGURE 1.6
Basic forest products in the Russian Federation



Domestic forest products consumption is limited to state and general public demand. Demand restraints include budgetary funds allocated for the purchase of forest products for state needs (defence, education, healthcare, etc.). Population demand is determined by purchasing capacity dependent on real income. According to statistical data in 2010, monthly real income gain per capita amounted to 16 857 roubles. The share of forest products accounts for 435 roubles monthly, which is about 2.6 percent of income.

The Russian Federation is characterized by a high degree of income differentiation within the population. The high-income population that can afford to purchase wood products lives mostly in big cities. The income of the rural population and those residing in small provincial towns and townships as a rule does not permit the formation of sustainable demand for the construction of wooden houses and the purchase of furniture, books and other wood derivatives.

Chemical and mechano-chemical wood-processing sectors consumed 21.3 percent of the amount of harvested wood in 2010. This percentage is far below that of other countries with highly developed forest sectors. For comparison, the share of chemical and mechano-chemical wood processing in the United States accounts for 76.2 percent; in Finland, 84.0 percent; and in Canada, 69.0 percent of the amount of harvested wood. The consumption pattern of sawnwood and wood-based panels is indicated in Table 1.8.

A significant share of domestic demand for forest products in Russia is met through imports. In 2010 the Russian Federation imported 1 534 400 tonnes of paper. Imports of paper and paperboard amounted to US$2 130 million, with paper products amounting to US$1 823.7 million and furniture at US$2 372.5 million. The overall value of imported forest products amounted to US$8 055.8 million. Thus, the issue of import substitution must be highlighted in forecast assessments of forest sector development.

TABLE 1.7
Export of basic forest products in the Russian Federation, 1990–2010

Forest products	1990	2000	2005	2007	2008	2009	2010
Roundwood (million m³)	15.0	30.8	48.3	49.3	36.7	21.7	21.2
Sawnwood (million m³)	7.1	7.8	14.8	17.3	15.3	16.2	17.7
Plywood (thousand m³)	394.0	974.0	1 527.0	1 503.0	1 326.0	1 334.0	1 512.0
Particle board (thousand m³)	115.0	135.0	242.0	479.0	411.0	496.0	490.0
Fibreboard (thousand m³)	43.0	299.0	380.0	455.0	402.0	411.0	277.0
Pulp (thousand m³)	389.0	1 660.0	1 946.0	1 900.0	2 035.0	1 702.0	1 650.0
Paper and paperboard (thousand m³)	906.0	2 293.0	2 737.0	2 590.0	2 635.0	2 595.0	2 538.0

TABLE 1.8
Domestic consumption of sawnwood and wood-based panels in the Russian Federation, 2005–2010

Spheres of utilization	Sawnwood		Plywood		Particle board		Fibreboard	
	(1 000 m³)	(%)	(1 000 m³)	(%)	(1 000 m³)	(%)	(1 000 m³)	(%)
Construction	4 300	61.7	410	31.6	190	3.5	480	24.0
Building and edifice restoration	420	6.0	340	26.4	210	3.9	690	34.4
Furniture production	730	10.5	195	15.0	4 910	90.0	595	29.7
Production of packages and packaging materials	390	5.6	35	2.6	40	0.9	45	2.2
Automobile, railway coach and container manufacturing	1 010	14.5	150	11.6	10	0.2	24	1.2
Other spheres of utilization	120	1.7	165	12.8	90	1.5	170	8.5
Total	**6 970**	**100**	**1 295**	**100**	**5 450**	**100**	**2 004**	**100**

TABLE 1.9
Per capita consumption of basic forest products in leading forest-industrialized countries and the Russian Federation

Country	Sawnwood (m^3)	Wood-based panels (m^3)	Paper and paperboard (kg)
United States	0.23	0.11	230.0
Canada	0.52	0.25	175.0
Brazil	0.12	0.03	44.0
China	0.03	0.07	68.0
Japan	0.12	0.06	198.0
Republic of Korea	0.11	0.11	170.0
Germany	0.22	0.15	236.0
Italy	0.18	0.08	164.0
United Kingdom	0.13	0.09	173.0
Sweden	0.66	0.15	275.0
Finland	0.79	0.11	346.0
France	0.18	0.08	176.0
Russian Federation	0.05	0.06	48.7

TABLE 1.10
Position of the forest sector in the economy of the Russian Federation, 2010

Indicators	Percentage (%)
Gross domestic products	1.3
Industrial production	3.7
Foreign currency earnings	2.4
Capital investment	0.9
Employment (number of people employed)	1.0
Budgetary revenues	0.2
Budgetary financing of scientific research	0.01
Electric energy consumption	2.0

Data reported in Table 1.9 attest to the possibilities of increase of domestic demand for forest products.

Table 1.10 characterizes the economic position of the forest sector of the Russian Federation and its growth opportunities.

2. Methodology of the Outlook Study

This section presents the methodological approaches of this Outlook Study: (1) forecasting methods for forest resources; (2) forecasting methods for forest products; and (3) scenarios for the development of the forest sector.

2.1 FORECASTING METHODS FOR FOREST RESOURCES

Forecasting of Russian forest resources is conducted on the basis of the State Forest Inventory (SFI). The forecast calculation model is based upon a multiple correlation equation in which the forest productivity indicator (Y) is the function of the following factors: (X) the amount of forestry financing distributed by years and scenarios; (Z) climatic changes; and (M) restrictive factors.

Model calculation methods and productivity of forest ecosystems were based upon known thermodynamic relations of quanta of photosynthetically active radiation (PAR) and CO_2 molecules absorbed by green plant cells during the photosynthesis process. Information on incoming PAR and its absorption by the green foliated mass derive from NASA satellite data. Over 3 000 trapeziums were assigned to the entire Russian territory and their specific data were recalculated for 1 460 forestry districts.

An assessment of possible climate changes was performed on the basis of reported data. Ecological restrictions included ratio of evaporation to precipitation (E/P), and nitrogen input and output flows (K_N). It was assumed that if $K_N < 1$, the forest area under assessment suffers from a shortage of nitrogen.

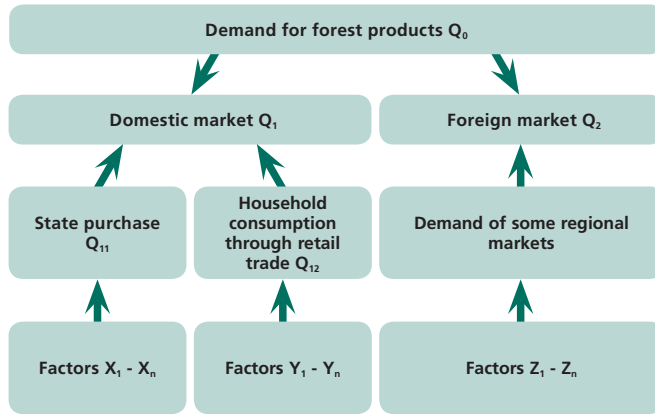
2.2 FORECASTING METHODS FOR FOREST PRODUCTS

In Russia, where wood resource potential far exceeds utilization, the most important for forest sector development forecasts is assessment of domestic and foreign demand for forest products. In practical terms, this means the inevitable subordination of supply of resources to demand, and not vice versa, as occurs in countries with resource shortages. Domestic and foreign demand for forest products must: (1) determine the efficient structure of roundwood consumption by different uses; (2) establish an efficient structure for consumption of finished forest products, taking into consideration import substitutability with non-timber products; (3) establish the production output of industrial forest products in relation to macroeconomic performance indicators; and (4) elaborate a long-term strategy of distribution for forest industries, taking into consideration domestic and foreign market orientation. Forecasting of demand for forest products must be conducted in a differential manner for domestic and foreign markets due to the influence of different factors (Figure 2.1).

Demand in the domestic market is determined by state and household demand. The level of domestic demand for forest products in the state sector is determined by the following factors: (1) the budgetary sectors' development programme; (2) state purchase increases; (3) the proportion of budgetary expenditure allocated for the purchase of forest products; (4) conditions of state purchase, for example, the necessity of certification and import substitution; and (5) the proportion of fuelwood in fuel and energy resources.

Consumer demand for forest products is not a priority in comparison with demand for food, clothing and footwear, healthcare, education, recreation and culture. The minimum consumption basket does not include expenditure for the purchase of furniture, paper and other wood products. Domestic consumption of national forest products

FIGURE 2.1
Forecasting of demand for forest products



may also be jeopardized due to the accession of the Russian Federation to the World Trade Organization (WTO). Factors determining household consumption demand for forest products include: (1) number of inhabitants; (2) gross domestic product per capita; (3) average real income per capita of the population; (4) proportion of wood product cost in the minimum consumption basket; and (5) budgetary expenditure for stimulation of demand for forest products.

The following factors impact the forecasting of forest products exports: (1) forecasting of foreign market consumption of forest products; (2) the share of imports from Russia in total consumption of other countries; and (3) WTO and forest certification impact on forest trade. Taking into account the aforementioned factors, the forecasting of demand for forest products is also restricted by the availability of reliable information and scientific analysis. Consequently, demand substantiation in this study is based upon expert estimates.

2.3 FOREST SECTOR SCENARIOS

This Outlook Study examines three scenarios: inertial, moderate and innovation. The **inertial scenario** is based upon the prolongation of tendencies in Russian forest sector development formed over the last 20 years (1990–2010). It does not envisage any additional support on the part of the forest sector through increased investment in modernization and reconstruction of production facilities. The inertial scenario is also based upon the assumption that the global financial crisis will continue. It considers the possibility of tariff increases by natural monopolies for gas, electric energy and railway transportation of forest cargo. Price increases for wood and forest products, and also construction of new pulp and paper plants, are not envisaged. The inertial scenario does envisage the modernization and reconstruction of functioning forest industry enterprises, and the realization of a few priority investment projects related to construction of sawmills, plywood and board factories. Export of sawtimber and sawnwood and import of paper and paperboard will assume a predominant place in international trade. The inertial scenario is based upon a low increase in rates of basic macroeconomic performance indicators of the Russian Federation for the 2010–2030 period. The evolution of management, conservation, protection and regeneration of forests is envisaged in conformity with existing forest legislation.

The **moderate scenario** presumes a transition from the inertial to the innovation scenario. It assumes that the Russian Federation economy will emerge completely from

the financial crisis in 2012–2015. Thereafter, the GDP growth rate will be 4-4.5 percent per year, accelerating in the second decade.

The scenario envisages the modernization of basic wood-processing enterprises. Medium density fibreboard (MDF) and oriented strand board (OSB) will prevail in the market structure for wood boards. An increase in the number of priority investment projects in the Volga, Ural, Siberian and Far Eastern federal districts is also envisaged. Production capacities for some new pulp and paper plants shall be constructed and put into operation in the European part of the Russian Federation and Siberia. They will be oriented towards the technologically advanced processing of low-quality, non-coniferous wood and the manufacturing of import substitution products. This will enable a decrease in the import of paper and paperboard, thus achieving a positive trade balance of pulp and paper products. New federal laws on industrial policy and new forest legislation are required for the realization of the moderate scenario. The scenario also requires the application of state support measures in the form of tax and investment allowances.

The **innovation scenario** is based upon the following assumptions: (1) industrial production, investments and wages shall increase over 4 percent per year; (2) new pulp and paper plants shall be constructed in the Northwestern, Ural and Siberian federal districts and will be partly operational no later than 2020; (3) large-scale technological modernization of existing forest industry enterprises shall be undertaken on the basis of breakthrough technologies and innovative wood construction materials; and (4) wood housing will be constructed in accordance with the national project "Available and comfortable housing for Russian citizens", including housing supply countrywide to the amount of 140.0 million square metres per year, that is, 1 square metre per Russian citizen.

The use of nanocellulose shall be expanded in the pulp and paper industry. The development of bioenergy at wood-processing plants will enable them to meet demand for electricity and heating. The innovation scenario presumes state support for the development of forest infrastructure and the realization of priority investment projects. The scenario suggests improvement of foreign trade infrastructure, a decrease in imports and an increase in the export of high added-value products. It is assumed that the issues of sustainable development and global warming will contribute to the promotion of the Russian forest sector within the national economy, receiving tax and investment allowances, and other preferential and promotional instruments.

The manufacturing of new bioproducts with high added value shall essentially modify the structure and economics of the pulp and paper industry. Knowledge generation and the stimulation of breakthrough technologies, liquid and solid biofuels, pharmacological products, carbon fibre-reinforced plastics, composite materials and polymer materials shall be priorities during the first decade. In the second decade, a qualitative shift will occur in pulp and paper production and consumption, which will change the forest product structure in domestic and foreign markets.

3. Forecast of forest resources

Forestry development for the period to 2030 was predicted for three scenarios: inertial, moderate and innovation. National forest inventory data for the period from 1956 to 2010 were used as the basis for forecast estimates, as well as Pan-European Indicators for Sustainable Forest Management (Forest Europe, 2011).

3.1 CURRENT FOREST RESOURCE DYNAMICS

Since 1956, total area, growing stock and forest increment in the Russian Federation have tended to increase; however, average growing stock per hectare and average age have decreased noticeably (Table 3.1 and Figure 3.1). Gradual rejuvenation of forests has taken place due to felling, forest fires and the transfer of agricultural land covered by young growth to forest land. In particular, many young growth areas were transferred between 2003 and 2008, resulting in an increase of land areas under forests by 20 million hectares.

The decrease in growing stock per hectare can be explained by lag between assessment of forest area and growing stock in the Russian Federation. Thus, between 1956 and 2010, forest area increased by 15.3 percent, while total forest growing stock increased by 9.6 percent.

3.2 FOREST AREA

The forecast of total forest area in the Russian Federation till 2030 is indicated in Table 3.2 and Figure 3.2. The category "other wooded land" (OWL) includes shrubbery and urban forests. Data related to 2010 were corrected for the FAO report (FAO, 2010) and differ somewhat from the national data used as a basis for the forecast till 2030. According to the forecast, forest area in the Russian Federation will increase by 0.9-1.5 percent by 2030, depending upon the scenario.

TABLE 3.1
Forest dynamics

Year	Forest land (million ha)	Forest cover (million ha)	Growing stock (million m^3)	Growing stock (m^3/ha)*	Annual increment (million m^3)	Annual increment (m^3/ha)	Age of wood stands (years)
1956	773.5	674.6	76.1	113.0	807.9	1.20	94
1961	848.1	695.4	77.5	111.0	789.2	1.13	98
1966	812.9	705.6	76.9	109.0	792.1	1.12	97
1973	862.0	729.6	78.6	108.0	821.1	1.13	96
1978	881.4	749.4	80.6	108.0	824.2	1.10	98
1983	880.5	766.6	81.9	107.0	838.6	1.09	98
1988	884.0	771.1	81.6	106.0	822.5	1.07	99
1993	886.5	763.5	80.6	106.0	822.1	1.08	98
1998	881.9	774.2	81.8	106.0	853.9	1.10	96
2003	882.9	776.1	82.1	106.0	886.7	1.14	93
2008	890.7	796.1	83.2	105.0	947.3	1.19	88
2010	891.9	797.4	83.4	105.0	1 016.1	1.27	82

* Calculated for land area under forest.

FIGURE 3.1
Growing stock volumes and age

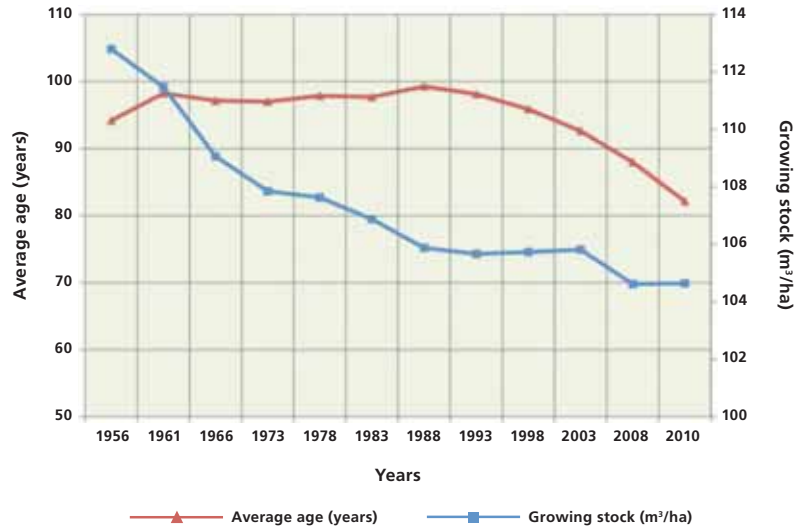


TABLE 3.2
Forest area

Years	Forest area (thousand ha)		
	Forests	Other wooded land	Total forest area
1990-2010			
1990	808 949	75 143	884 093
2000	809 268	71 606	880 875
2005	808 790	73 169	881 959
2010	809 090	73 220	882 310
Inertial			
2010*	817 544	73 300	890 844
2015	820 000	73 380	893 380
2020	822 000	73 460	895 460
2025	824 000	73 540	897 540
2030	825 000	73 620	898 620
Moderate			
2010*	817 544	73 300	890 844
2015	821 000	73 579	894 579
2020	823 500	73 849	897 349
2025	826 000	74 109	900 109
2030	827 500	74 175	901 675
Innovation			
2010*	817 544	73 300	890 844
2015	822 000	73 779	895 779
2020	825 000	74 237	899 237
2025	828 000	74 677	902 677
2030	830 000	74 730	904 730

* According to SFR–2010 data.

3.3 GROWING STOCK

According to the inertial scenario, total growing stock will increase up to 83.3 billion cubic metres in 2030 (Table 3.3, Figure 3.3). This increase in relation to 2010 will amount to 2.2 percent. The net annual increment (NAI) of standing timber will also increase from 1 016 to 1 094 million cubic metres per year.

FIGURE 3.2
Forecast of forest area (million ha)

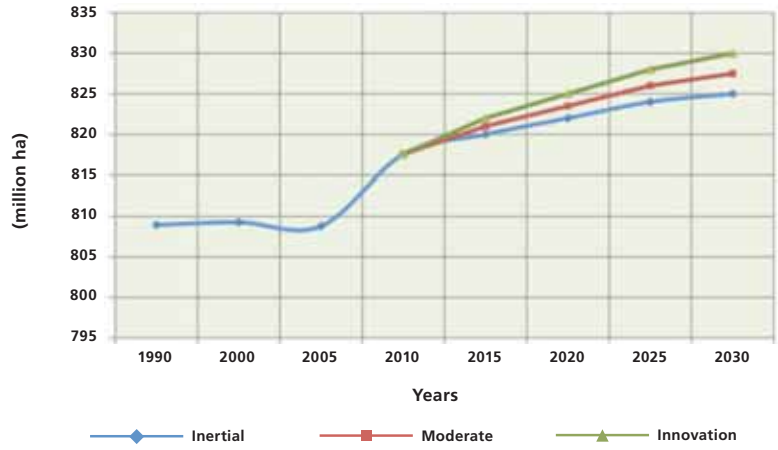


TABLE 3.3
Growing stock, increment and age of wood stands and shrubbery

Years	Growing stock (million m³)			Annual increment (m³/yr)	Age of wood stands and shrubbery (years)
	Forests	Other wooded land	Total		
2010					
1990	80 039	1 604	81 644	822	99
2000	80 270	1 593	81 863	854	96
2005	80 479	1 651	82 130	887	93
2010	81 522	1 775	83 298	1 016	82
Inertial					
2015	82 800	1 840	84 640	1 045	81
2020	83 100	1 890	84 990	1 061	80
2025	83 224	1 940	85 164	1 078	79
2030	83 325	1 990	85 315	1 094	78
Moderate					
2015	82 921	1 845	84 766	1 046	81
2020	83 780	1 900	85 680	1 063	80
2025	84 252	1 955	86 207	1 091	79
2030	84 405	2 005	86 410	1 108	78
Innovation					
2015	83 022	1 850	84 872	1 048	81
2020	84 400	1 910	86 310	1 076	80
2025	85 200	1 970	87 170	1 104	79
2030	85 490	2 020	87 510	1 122	78

FIGURE 3.3
Forecast of growing stock (billion m³)

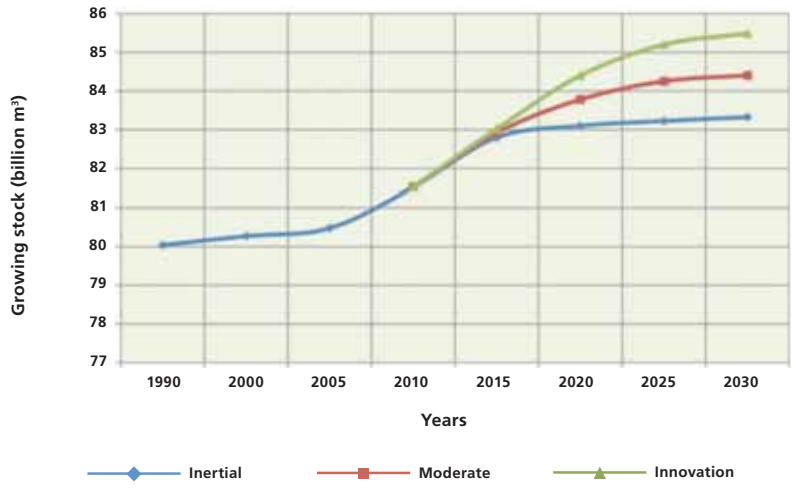
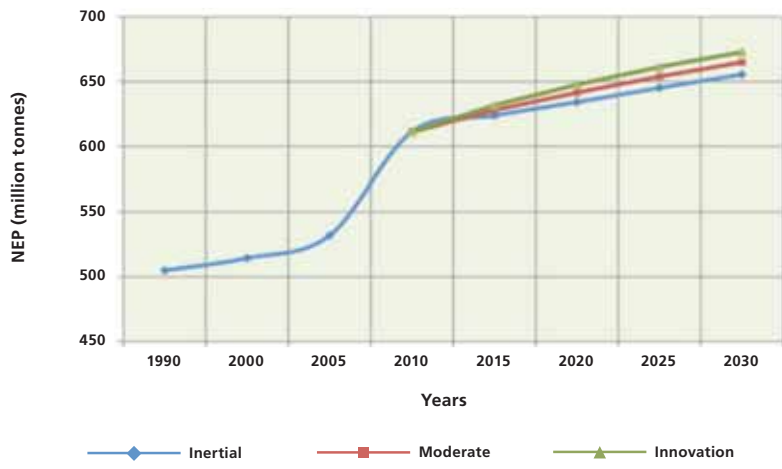


FIGURE 3.4
Forecast of net ecosystem production (NEP) per year (million tonnes)



The average age of wood stock and shrubbery will exhibit a stable declining tendency: from 82 years in 2010 to 78 years in 2030. This will occur as a result of an increase in the area under young growth and forest expansion. According to the European Forest Sector Outlook Study (UN, 2012), the average age of Europe's forests (without Russian Federation forests) will decrease from 54 years in 2010 to 50 years by 2030.

3.4 CARBON STOCK

Real average carbon increment in wood is called "net ecosystem production" (NEP) in ecology. NEP is determined as a sum of the increment of live phytomass (net biome production) and the loss of dead phytomass. NEP related to all of Russia's forests was

TABLE 3.4
Forecast of carbon stock and increment

Year	Carbon stock in forest land (million tonnes)					Age of standing wood and shrubbery (years)	Net ecosystem production per year (million tonnes)
	Above ground biomass	Underground biomass	Dead and fallen wood	Forest floor	Total stock, soil organic matter excluded		
1990-2010							
1990	26 277	6 562	7 432	9 715	49 986	99	505
2000	25 936	6 521	7 328	9 600	49 385	95	520
2005	26 012	6 533	7 313	9 610	49 468	90	550
2010	26 250	6 620	7 525	9 725	50 120	82	611
Inertial							
2015	26 362	6 732	7 656	9 769	50 519	81	624
2020	26 479	6 759	7 686	9 807	50 730	80	634
2025	26 613	6 785	7 716	9 845	50 960	79	645
2030	26 682	6 811	7 746	9 883	51 122	78	655
Moderate							
2015	26 447	6 764	7 629	10 019	50 860	81	628
2020	26 684	6 825	7 697	10 109	51 315	80	641
2025	26 858	6 869	7 747	10 175	51 650	79	654
2030	26 968	6 898	7 779	10 217	51 861	78	665
Innovation							
2015	26 606	6 805	7 675	10 079	51 165	81	632
2020	26 938	6 890	7 771	10 205	51 804	80	648
2025	27 164	6 948	7 836	10 291	52 238	79	661
2030	27 286	6 979	7 871	10 337	52 473	78	673

approximately calculated by dividing the total stock of live and dead phytomass, soil organic matter excluded, by the average age of standing timber (Table 3.4, Figure 3.4).

According to the inertial scenario, NEP in the Russian Federation forests will increase from 611 million to 655 million tonnes of carbon in 2030 with an average increment of 2.2 million tonnes of carbon per year. It is impossible to calculate the carbon balance of a region or country without reference to the NEP. It is recommended that this indicator be used in FAO Global Forest Resources Assessments. To calculate the carbon balance at the level of total forest biome, it is also necessary to know carbon losses as a result of fires, felling, pests and diseases. Calculations of carbon losses include significant levels of uncertainty, however, and require further research.

3.5 FOREST DAMAGE

The past 40 years have seen a stable increase in the forest area damaged by and losses of forest resources due to fires, pests and diseases. Total damaged forest area in 2010 amounted to about 7.2 million ha. Changes in areas of forest fires, outbreaks of forest pests and diseases occur in waves, which noticeably hinder the forecasting process. Expert assessments, which do not claim to be high-precision forecasts, are indicated in Table 3.5 and Figure 3.5.

3.6 REGENERATION

A decrease in the amount and quality of forest regeneration creates a real threat for the future. Over the last two decades, areas of forest regeneration countrywide almost halved, while tree planting declined 2.5 times. Over the last five years, the area of forest plantations remained practically stable, amounting to about 17 million hectares.

TABLE 3.5
Forecast of damaged forest area (thousand ha)

Year	Forest pests and diseases	Windfall and snowbreakage	Forest fires	Total damaged area
1990-2010				
1990	1 841	174	681	2 696
2000	5 909	508	1 267	7 685
2005	2 800	1 351	1 081	5 233
2010	4 293	378	2 500	7 172
Inertial				
2015	3 600	480	1 800	5 880
2020	6 000	500	3 000	9 500
2025	4 300	540	2 400	7 240
2030	6 600	600	3 600	10 800
Moderate				
2015	3 300	440	1 650	5 390
2020	5 500	450	2 750	8 700
2025	3 850	520	2 200	6 570
2030	5 150	550	300	9 000
Innovation				
2015	3 000	400	1 500	4 900
2020	5 000	400	2 500	7 900
2025	3 500	500	2 000	6 000
2030	4 500	500	3 000	8 000

TABLE 3.6
Forecast of areas of natural forests and forest plantations

Year	Natural forests (1 000 ha)	Forest plantations (1 000 ha)	Forest land (1 000 ha)	Forest plantations transferred to forest land (1 000 ha/yr)
1990-2010				
1990	796 298	12 651	808 950	430*
2000	793 908	15 360	809 269	402*
2005	791 827	16 962	808 790	250*
2010	792 099	16 990	809 090	181*
Inertial				
2015	802 060	17 940	820 000	190
2020	803 060	18 940	822 000	200
2025	804 010	19 990	824 000	210
2030	803 910	21 090	825 000	220
Moderate				
2015	802 984	18 016	821 000	205
2020	805 400	18 100	823 500	220
2025	807 825	18 175	826 000	235
2030	809 250	18 250	827 500	250
Innovation				
2015	803 900	18 100	822 000	220
2020	806 800	18 200	825 000	240
2025	809 700	18 300	828 000	260
2030	811 600	18 400	830 000	280

* Mean values over five years.

FIGURE 3.5
Forecast of damaged forest area (thousand ha)

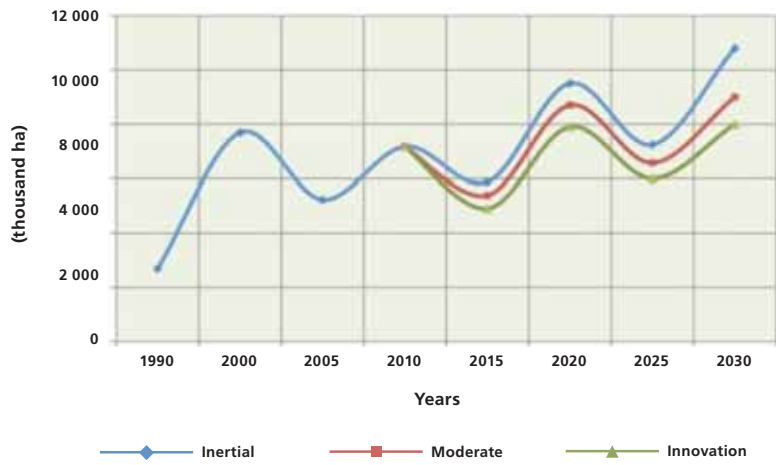
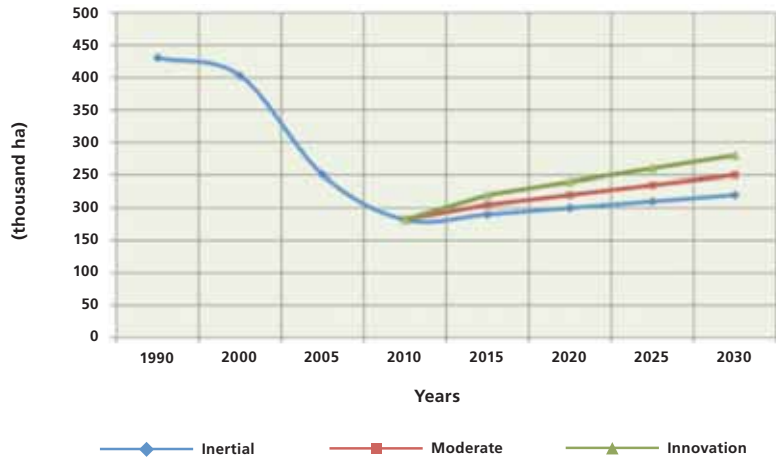


FIGURE 3.6
Plantations annually transferred to forest land (thousand ha)



By 2030, the annual area of forest plantations transferred to forest land area will have increased from 180 to 220 000-280 000 hectares (Table 3.6, Figure 3.6).

3.7 INCREMENT AND FELLING

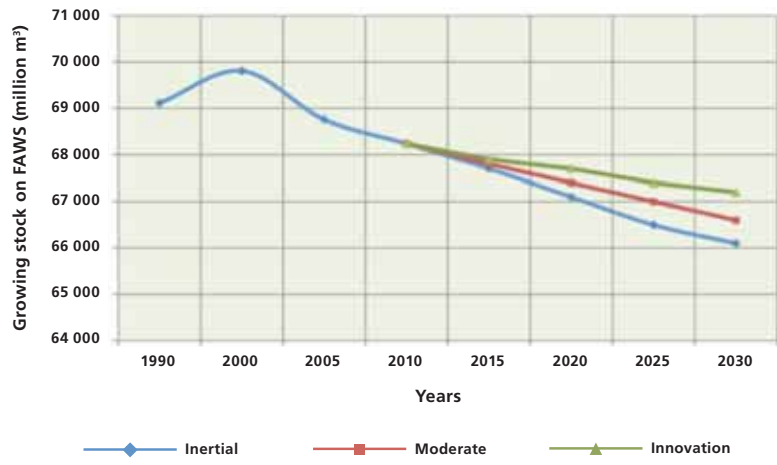
The concept of development of protected areas of federal significance until 2020 (Governmental Executive Order, 2011) envisages the creation of 11 natural reserves, 20 national parks and three federal reserve forests. In this case, the total growing stock of forest land available for wood supply will decrease from 68.2 to 67.2 billion cubic metres in 2030 according to the innovation scenario (Table 3.7, Figure 3.7).

According to the inertial forecast, the annual increment on forest land available for industrial wood supply will gradually decrease from 853 to 844 cubic metres per year by 2030, or by about 1 percent. According to the innovation forecast, the annual increment by 2030 will increase to 858 cubic metres per hectare (Figure 3.8).

TABLE 3.7
Forecast of area, growing stock and increment of wood on forest land available for wood supply

Year	Forest available for wood supply (FAWS) (thousand ha)	FAWS share of forest land (%)	Growing stock (million m³)	Net annual increment (NAI) (million m³)	Annual allowable cut (AAC) (million m³)	AAC share of NAI (%)
1990-2010						
1990	698 527	86	69 114	833	570	68
2000	703 781	87	69 807	841	552	66
2005	690 978	85	68 756	849	571	67
2010	677 204	84	68 234	853	633	74
Inertial						
2015	670 297	82	67 700	853	640	75
2020	664 356	81	67 100	852	642	75
2025	658 416	80	66 500	849	647	76
2030	654 455	79	66 100	844	650	77
Moderate						
2015	671 287	82	67 800	855	660	77
2020	667 327	81	67 400	855	670	78
2025	663 366	80	67 000	854	673	79
2030	659 406	80	66 600	851	677	80
Innovation						
2015	672 277	82	67 900	857	680	79
2020	670 297	81	67 700	859	700	81
2025	667 327	81	67 400	860	704	82
2030	665 347	80	67 200	858	710	83

FIGURE 3.7
Growing stock on forest land available for wood supply (million m³)



The annual allowable cut has a tendency to increase under all scenarios (Figure 3.9). The share of the annual allowable cut (AAC) in relation to the net annual increment (NAI) of the territory of forest available for wood supply (FAWS) will increase by up to 83 percent in 2030 according to the innovation scenario.

FIGURE 3.8
Annual increment on forest land available for wood supply (FAWS) (million m³)

FIGURE 3.9
Changes in annual allowable cut (million m³)

According to expert assessments, the annual allowable cut in the area of priority exploitation in the Russian Federation is estimated at 390 million cubic metres, including the unleased area of 200 million cubic metres, mostly in the Northwestern (54 million cubic metres) and Siberian (40 million cubic metres) federal districts.

Practice shows that the annual allowable cut in some territories of extensive forest exploitation may be significantly overestimated. It is necessary to calculate the *economically accessible* volumes of wood harvesting, which would exclude low stock wood stands and remote forests, where exploitation is not possible without considerable investment in the development of transport infrastructure.

4. Demand for wood products

The assessment of domestic market demand for forest products was calculated in accordance with the methodological recommendations detailed in section 2. Demand for forest products was formed on the basis of macroeconomic forecasts of the development of the Russian Federation from 2011 to 2030 (Table 4.1).

At present, no federal institutions in the Russian Federation conduct scientific forecasts of demand for forest products. Consequently, demand assessments are conducted mainly by large, integrated timber companies, supplying their produce to domestic and external markets. State participation in the formation of domestic market demand for forest products is limited to public support measures for the development of national economic sectors through relevant regulations and development programmes.

Demand for many forest products was discouraged by the low purchasing power of the general population. A primary impact was wooden housing construction and industries supplying basic materials, such as sawnwood, plywood, fibres, plastics, and so on. With various forms of state support, the development of wooden housing construction is able to achieve high production rates on all types of wood-based panels. At present, wooden housing is characterized by low construction volumes, as illustrated by the data in Table 4.2.

In 2010, the total amount of housing construction in the Russian Federation accounted for 58.4 million square metres, of which the individual housing construction share accounted for 43.6 percent. Over 80 percent of housing construction took place in the European part of the Russian Federation. The biggest wooden housing markets were Moscow, the Moscow Region, Saint Petersburg and the Leningrad Region.

TABLE 4.1
Macroeconomic indicators of the Russian Federation

Indicators	Annual growth of indicators compared to the previous period (%)			
	2011–2015	2016–2020	2021–2025	2026–2030
Gross domestic product	104.5	103.4	105.1	104.0
Industrial output	104.5	103.4	104.9	103.8
Investments	107.7	105.4	109.0	105.0
Labour efficiency	104.7	104.1	105.3	104.0
Export of products and services	102.2	102.2	103.8	104.2
Import of products and services	109.6	104.5	109.0	105.8
Real wages	104.5	104.0	106.1	104.7
Energy intensity of gross domestic product	97.2	98.1	96.6	97.5
Real household disposable income	104.2	103.6	105.5	104.1

TABLE 4.2
Volumes and structure of housing construction in the Russian Federation

Construction categories	2007	2008	2009	2010	2010 to 2007 %
New housing construction in total (million m²)	61.2	64.1	59.9	58.4	96.0
Low-rise residential housing construction (million m²)	26.0	27.4	28.5	25.5	98.1

TABLE 4.3
Housing construction in the Russian Federation

Indicators	2010	2015	2020	2025	2030
Housing construction in total (million m²)	58.4	90.3	120.0	145.0	170.0
Low-rise construction (million m²)	25.5	47.0	85.5	95.0	105.0
Including low-rise wooden houses (million m²)	8.0	17.8	32.8	50.0	69.0
Share of residential wooden houses in low-rise construction (%)	31.1	40.4	56.5	70.4	84.1

In order to resolve the problems of housing construction, the Government of the Russian Federation adopted a series of measures. Housing construction has begun to develop along two relatively independent lines: public social housing construction in accordance with the national project, "Available and comfortable housing for Russian citizens", and regulated suburban housing construction. Furthermore, the "Strategy for developing the building materials industry until 2020" envisages increasing the output of prefabricated wooden houses to 2.9 million cubic metres. The total amount of housing construction in the Russian Federation in 2030 must encompass 170 million cubic metres, that is, over 1 square metre per citizen, which corresponds to indexes of developed European countries (Table 4.3).

Factors impacting the development of the wooden housing market in the Russian Federation until 2030 will be: (1) public support of individual construction, and realization of the national project "Available and comfortable housing for Russian citizens" and the sub-programme "One's own house"; (2) facilitation of the lease of allotments of public land parcels for low-rise wooden housing construction; (3) development and implementation of technologies for wooden housing construction; and (4) realization of priority investment projects related to prefabricated wooden housing construction by 2020 with an annual production output of 300 000-320 000 houses. The amount of wooden housing construction and low-rise housing construction forecast for 2010–2030 is shown in Figure 4.1 and Figure 4.2.

The transition to wooden housing construction will enable a 40 percent reduction in cost per square metre and decrease the construction period by 1.5 times. Fuel and

FIGURE 4.1
Wooden housing construction in the Russian Federation (million m²)

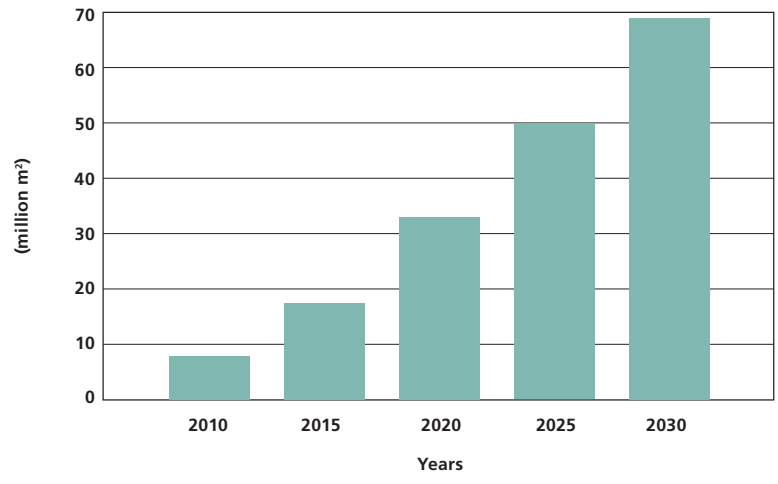


FIGURE 4.2
Low-rise housing construction in the Russian Federation (million m²)

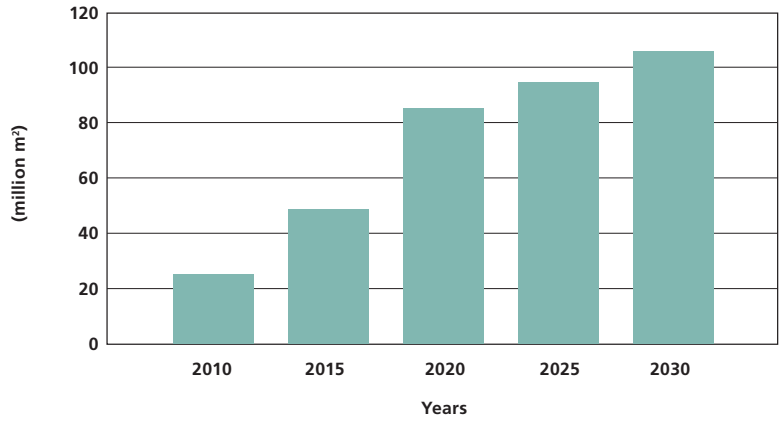


TABLE 4.4
Demand for forest products by spheres of consumption under the innovation scenario

Indicators	2010	2015	2020	2025	2030
Sawnwood (million m³), including:	7.0	23.5	34.0	37.0	40.0
Housing construction	4.3	17.5	24.0	26.4	28.8
Building and edifice restoration	0.4	2.4	4.1	4.5	4.8
Furniture production	0.7	2.5	3.5	4.5	4.6
Automobile, railway coach and container manufacturing	1.0	0.3	1.5	0.4	0.4
Other spheres	0.6	0.8	0.9	1.2	1.4
Plywood (thousand m³), including:	1 220	1 718	2 108	2 679	3 472
Housing construction	410	700	800	1 100	1 340
Building and edifice restoration	340	518	600	840	1 000
Furniture production	195	200	390	400	710
Automobile, railway coach and container manufacturing	150	150	160	180	262
Other spheres	90	150	158	159	160
Particle board (thousand m³), including:	5 505	7 633	8 576	10 120	12 002
Housing construction	190	1 410	1 960	2 060	2 170
Building and edifice restoration	210	470	490	600	790
Furniture production	4 910	5 250	5 559	6 770	8 241
Automobile, railway coach and container manufacturing	20	200	200	240	300
Other spheres	165	303	367	450	501
Fibreboard (thousand m³), including:	1 650	2 313	2 733	3 316	4 086
Housing construction	570	1 242	1 502	1 896	2 295
Building and edifice restoration	490	330	453	590	800
Furniture production	550	700	700	750	880
Automobile, railway coach and container manufacturing	30	30	40	40	61
Other spheres	10	11	38	40	50

energy savings will make up 15-20 percent due to cost reductions for cement, concrete and reinforced concrete structures. Increased demand for the final products will increase demand for wood-based construction materials (Table 4.4.)

In accordance with the innovation scenario, demand for sawnwood in 2030 will amount to about 40.0 million cubic metres. At the same time, the quality and consumption structure will also improve. Generic sawnwood is mostly produced at present, but by 2030 construction, molding, bioprotective, joiner's materials and special sawnwood will account for over 50 percent of production. The consumption structure of sawnwood will also improve, 70 percent of which will be used for wooden housing construction.

Demand for wood-based panels, such as plywood, particle board and fibreboard, is progressively increasing in the Russian Federation and worldwide. This tendency will not change over the prospective period to 2030.

Demand for plywood by 2030 in the Russian Federation, compared to 2010, will double, and will increase for particle board by 1.6 times. This will have a considerable impact upon the production and consumption of large-size plywood sheets, oriented strand board (OSB) and medium density fibreboard (MDF). While the share of large-size plywood in the Russian Federation is insignificant at present; and OSB is not produced at all, production of MDF in 2030 will increase 2.2 times and production of OSB will exceed 2 million cubic metres. The main spheres of consumption of MDF and OSB will be construction, furniture, advertising, exhibitions, the machine-building industry and container manufacturing.

Demand for paper and paperboard in 2030 is estimated at 20 million tonnes, which exceeds the 2010 level threefold. Following quantitative index changes, qualitative indexes will also change. The structure of pulp and paper products output will improve. Production capacities for coated paper will also be put into operation. In 2010 such production did not exist at all.

Demand for tissue paper and for packaging materials will increase considerably. Demand for high-quality printing paper will also increase. Per capita consumption of paper and cardboard should reach 143 kg in 2030.

During the prospective period, external demand for forest products manufactured in the Russian Federation will not experience a marked change, amounting to: round timber, 22.8 million cubic metres; sawnwood, 26.3 million cubic metres; plywood, 2.1 million cubic metres; particle board, 578 000 cubic metres; fibreboard, 394 000 cubic metres; pulp, 3 million tonnes; and paper and cardboard, 9 million tonnes. The major importers of forest products from the Russian Federation will be China, Finland, France, Germany, Italy, Japan, the Republic of Korea, Sweden, Turkey and CIS countries.

5. Forest industry sector development

During the forecasting time horizon, within the next twenty years the forest industry sector should obtain the following results: (1) increased wood harvesting for meeting domestic and external demand; (2) improved structure of wood consumption through the use of breakthrough and innovative technologies; (3) improved regional distribution of forest sector branches through the development of new forest territories on the basis of state and private partnerships; and (4) the development of resource-saving and waste-free environmentally friendly wood-processing technologies to meet increasing ecological requirements. The forest sector development forecast includes: (1) product manufacturing, (2) export and import, (3) consumption, and (4) demand for investment. The forecast comprised three scenarios: inertial, moderate and innovation.

5.1 ROUNDWOOD

The logging industry is the primary branch of the forest industry sector, providing the supply of raw materials for wood processing. The wood-harvesting forecast is based upon the principles of sustainable forest management.

Increased forest use will be attained through the exploitation of new, previously unexploited forest areas, intensification of already exploited forests, and improved access to previously inaccessible forest areas. The share of wood harvesting will increase through intermediate felling. The State will support intensive sanitary harvesting of windfall, burnt and dry-standing wood, which would otherwise increase fire and phytopathological risks. An efficient system of collection, transportation and processing of felling waste for technological and energetic purposes is to be developed.

The following factors will ensure logging development: (1) the creation of a system of machinery for the collection, transportation and processing of logging waste; (2) increase in the mechanization level of production processes for wood harvesting and forest

FIGURE 5.1
Roundwood production (million m³)

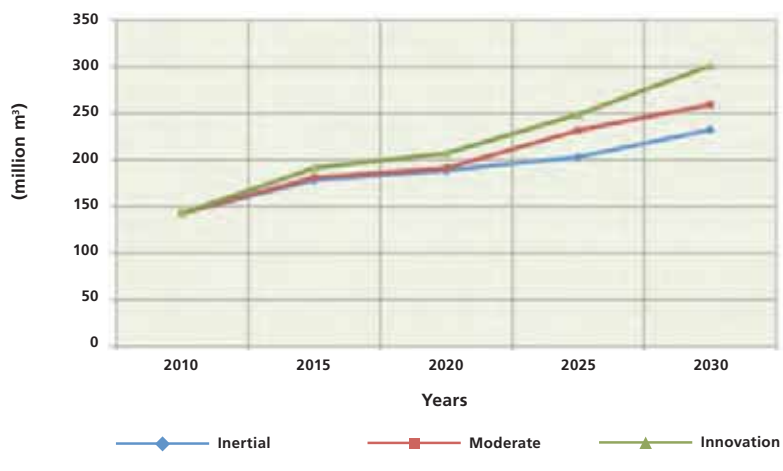


TABLE 5.1
Roundwood (million m³)

Indicators	2010	2015	2020	2025	2030
Production					
Innovation	142.9	191.3	207.1	248.8	301.2
Moderate	142.9	181.2	191.0	231.8	259.4
Inertial	142.9	178.5	188.7	203.1	232.4
Export					
Innovation	21.2	21.6	22.0	22.4	22.8
Moderate	21.2	22.3	23.4	24.6	25.8
Inertial	21.2	22.9	24.0	26.2	28.6
Consumption					
Innovation	121.7	169.7	185.1	226.4	278.4
Moderate	121.7	158.9	167.6	207.2	233.6
Inertial	121.7	153.6	164.7	176.9	203.8

regeneration; (3) improvement in the forest structure achieved through conducting forest regeneration on the basis of modern technologies; (4) the elaboration and implementation of resource-saving and environmentally sound technological processes; and (5) the creation, production and mastering of a competitive new generation of forest machinery for logging technologies. Roundwood dynamics until 2030 are presented in Table 5.1.

According to the innovation scenario, roundwood production will increase by 158.3 million cubic metres by 2030, or by 2.1 times, and will amount to 301.2 million cubic metres (Figure 5.1).

Taking into consideration state policy on developing technologically advanced wood processing, roundwood exports will be insignificant. According to the innovation scenario, export of roundwood by 2030 will increase by 1.6 million cubic metres, or by 7.5 percent, reaching 22.8 million cubic metres.

By 2030, consumption of roundwood, according to the innovation scenario, will increase by 156.7 million cubic metres, or 2.3 times, amounting to 278.4 million cubic metres. The expansion of domestic roundwood consumption will be supported by governmental measures to stimulate national wood markets, primarily through an increase in low-rise wooden housing construction.

5.2 SAWNWOOD

The following factors during the prospective period will ensure sawnwood industry development: (1) the transition from worn out and obsolete sawmilling to new technologies; (2) an increase in non-coniferous sawnwood; (3) an increase in the share of sawnwood with normative humidity; (4) a switch to certified production; (5) an increase in modern high-quality products and materials; and (6) the increased use of sawmilling waste for the manufacturing of wood composite materials and bioenergy. An improvement in state accounting and forest certification will play an important role in sawmilling. Table 5.2 shows trends in sawnwood production until 2030.

Under the innovation scenario, sawnwood production will increase by 41.5 million cubic metres, or by 2.7 times, and will amount to 66.2 million cubic metres by 2030 (Figure 5.2).

The forecast predicts an increase in sawnwood export without negative impact on domestic demand. The export share of construction materials and sawnwood with normative humidity will grow. The export of sawnwood production by 2030 will increase by 8.6 million cubic metres, or by 48.5 percent, reaching 26.3 million cubic metres. The consumption of sawnwood production will increase in 2030 by 32.9 million cubic metres, or by 5.6 times, and will reach 40.0 million cubic metres per year. This

FIGURE 5.2
Sawnwood production (million m³)

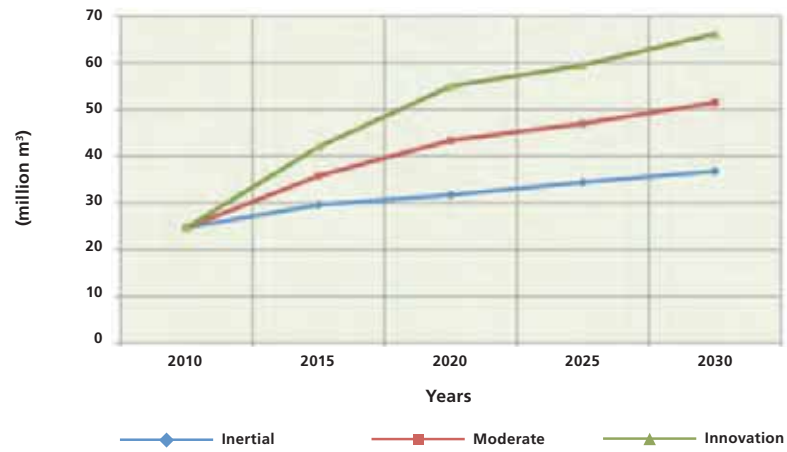


TABLE 5.2
Sawnwood (million m³)

Indicators	2010*	2015	2020	2025	2030
Production					
Innovation	24.7	42.0	55.0	59.5	66.2
Moderate	24.7	35.8	43.4	47.0	51.5
Inertial	24.7	29.6	31.7	34.4	36.8
Export					
Innovation	17.7	18.6	21.1	22.6	26.3
Moderate	17.7	19.0	19.9	22.4	24.9
Inertial	17.7	19.5	20.8	22.8	24.5
Consumption					
Innovation	7.1	23.5	34.0	37.0	40.0
Moderate	7.1	16.9	23.6	24.7	26.7
Inertial	7.1	10.2	11.0	11.7	12.4

* Taking into consideration activity unaccounted for in official statistics.

consumption growth rate was determined by expected growth of housing construction, and civil and industrial construction in the Russian Federation. The level of housing construction should reach 1 square metre per resident citizen.

5.3 PLYWOOD

The following factors will ensure the development of the plywood industry during the prospective period: (1) the realization of priority investment projects and the implementation of new production capacities; (2) the expansion of products with improved consumer qualities, increased fire-resistance and biostability; (3) an increase in large-size plywood production; (4) the mastering of new technologies, including larch plywood production; (5) the use of ecologically friendly binding substances; and (6) factory processing of plywood to final products. Plywood trends until 2030 are indicated in Table 5.3.

By 2030 plywood production will increase by 2.84 million cubic metres, or by 2.1 times, amounting to 5.53 million cubic metres (Figure 5.3).

FIGURE 5.3
Plywood production (thousand m³)

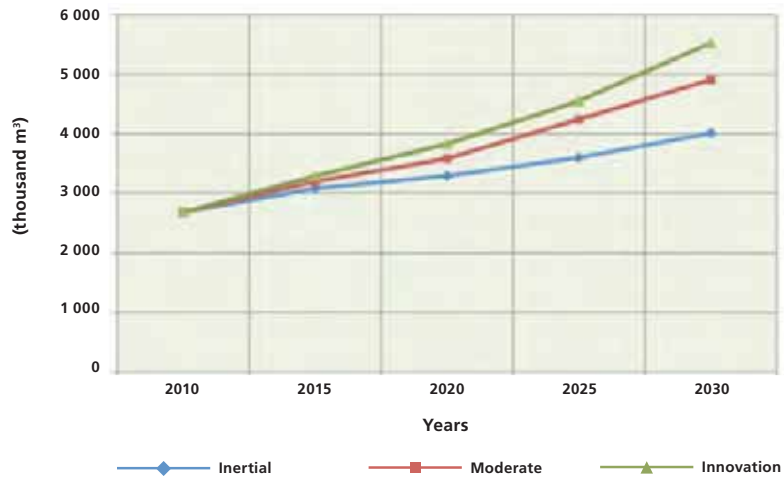


TABLE 5.3
Plywood (thousand m³)

Indicators	2010	2015	2020	2025	2030
Production					
Innovation	2 688	3 288	3 827	4 551	5 530
Moderate	2 688	3 197	3 580	4 244	4 908
Inertial	2 688	3 081	3 292	3 596	4 010
Export					
Innovation	1 512	1 652	1 801	1 963	2 140
Moderate	1 512	1 591	1 670	1 754	1 842
Inertial	1 512	1 546	1 577	1 609	1 691
Import					
Innovation	42	82	82	91	82
Moderate	42	112	198	189	406
Inertial	42	82	82	82	82
Consumption					
Innovation	1 218	1 718	2 108	2 679	3 472
Moderate	1 218	1 688	1 992	2 572	3 148
Inertial	1 218	1 617	1 797	2 069	2 401

Plywood export growth rates were calculated considering major export markets, including Egypt, the European Union and the United States. In accordance with the innovation scenario, plywood export will increase by 0.6 million cubic metres by 2030, or by 41.5 percent, amounting to 2.1 million cubic metres. The consumption forecast assumes that domestic demand will be met mainly through national production with relatively low imports. The plywood consumption in 2030 will increase by 2.25 million cubic metres (by 2.9 times), and will reach 3.47 million cubic metres.

5.4 PARTICLE BOARD

Particle board production is one of the fastest developing branches of the forest industry. The following measures should ensure the development of particle board production:

(1) priority investment projects on the basis of breakthrough technologies; (2) a switch to continuous flow production technologies; (3) the new generation of resins; and (4) an increased share of oriented strand boards (OSB) and other new products in the production structure. Table 5.4 indicates the particle board trend for the forecasting period until 2030.

Particle board production will increase by 6.24 million cubic metres by 2030, or by 2.1 times, amounting to 11.7 million cubic metres (Figure 5.4).

The export forecast presumes the current geographical trends of particle board trade. CIS member states remain the major importers of Russian particle board. Part of domestic market demand will be met through the import of high-quality particle boards, which will not be produced locally. By 2030, particle board exports will increase by 88 000 cubic

FIGURE 5.4
Particle board production (thousand m³)

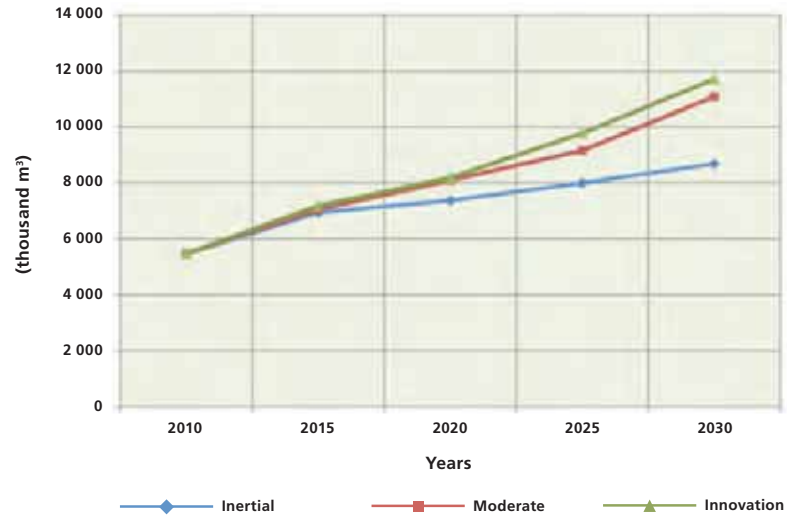


TABLE 5.4
Particle board (thousand m³)

Indicators	2010	2015	2020	2025	2030
Production					
Innovation	5 466	7 182	8 182	9 774	11 706
Moderate	5 466	7 045	8 087	9 154	11 086
Inertial	5 466	6 938	7 372	7 994	8 678
Export					
Innovation	490	496	515	545	578
Moderate	490	476	495	515	536
Inertial	490	467	477	486	496
Import					
Innovation	529	947	909	891	874
Moderate	529	947	947	947	947
Inertial	529	956	966	976	986
Consumption					
Innovation	5 505	7 633	8 576	10 120	12 002
Moderate	5 505	7 516	8 539	9 586	11 497
Inertial	5 505	7 427	7 861	8 484	9 168

metres, or 17.9 percent, and will amount to 578 000 cubic metres. By 2030, domestic particle board consumption will increase by 6.5 million cubic metres, or 2.2 times, amounting to 12 million cubic metres.

5.5 FIBREBOARD

During the forecast period, fibreboard production will develop through technical renovation, wet-process methods and ecologically clean production. Continuous flow technologies will spread. The obtained fibreboard will have two smooth surfaces and be more resistant in comparison with wet-processed fibreboard. This technology will result in the production of thin 2.5 7 mm fibreboards, and the share of medium density fibreboards (MDF) will increase. Table 5.5 shows the fibreboard trend until 2030.

FIGURE 5.5
Fibreboard production (thousand m³)

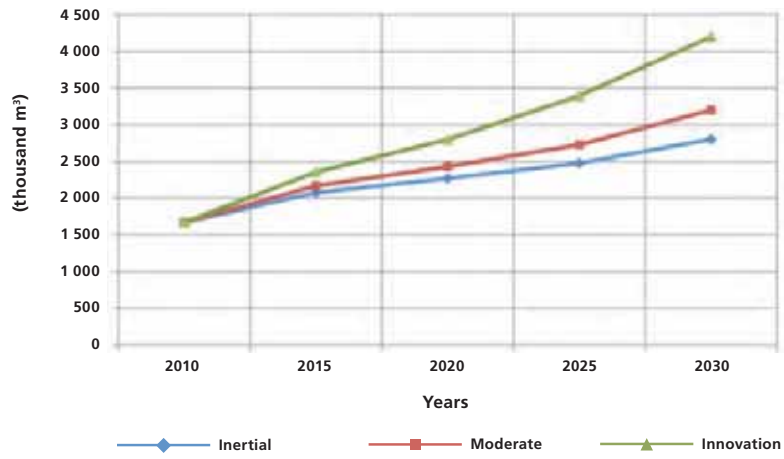


TABLE 5.5
Fibreboard (thousand m³)

Indicators	2010	2015	2020	2025	2030
Production					
Innovation	1 670	2 355	2 797	3 393	4 200
Moderate	1 670	2 167	2 430	2 726	3 200
Inertial	1 670	2 075	2 270	2 476	2 800
Export					
Innovation	277	310	336	354	394
Moderate	277	295	304	312	344
Inertial	277	289	292	295	320
Import					
Innovation	256	268	272	277	280
Moderate	256	270	277	282	290
Inertial	256	279	282	289	300
Consumption					
Innovation	1 649	2 313	2 733	3 316	4 086
Moderate	1 649	2 142	2 403	2 696	3 146
Inertial	1 649	2 065	2 260	2 470	2 780

Fibreboard production by 2030 will increase by 2.53 million cubic metres, or 2.5 times, amounting to 4.2 million cubic metres per year (Figure 5.5).

The availability of inexpensive low-quality wood raw materials and efficient technologies will enable the rapid increase of fibreboard production output in Russia. Such an increase, however, will be restricted to domestic market demand. The export forecast is calculated on the basis of current growth rates and geographical distribution of export deliveries. Fibreboard export by 2030 will increase by 117 000 cubic metres, or 42.2 percent, and will amount to 394 000 cubic metres. Fibreboard imports will increase at relatively slow rates due to the growth of national production. The increase in fibreboard imports will amount to 24 000 cubic metres or 9.4 percent. Domestic market fibreboard consumption will increase by 2.4 million cubic metres, or by 2.5 times, and will amount to 4 million cubic metres per year.

5.6 PULP AND PAPER

Commercial pulp

The pulp forecast assumes that 62.5 percent of total pulp production will be used by producers for higher value-added paper and paperboard products. The remaining pulp (37.5 percent) will be sold in domestic and international markets. Table 5.6 presents the forecast of pulp dynamics.

By 2030 pulp production must increase by 1.9 times, and will amount to 3.9 million tonnes per year (Figure 5.6).

Considering the self-sufficiency of the domestic pulp market, the forecast foresees an increase in exports and insignificant imports. In all the scenarios, pulp export growth rates will correspond to production growth rates. Under the innovation scenario, the growth rate will amount to 180 percent; in the moderate scenario, 160 percent; and in the inertial scenario, 157 percent. By 2030 the annual domestic consumption of commercial pulp will double, amounting to 1 million tonnes.

Paper and paperboard

Prospects for the pulp and paper industry until 2030 depend on the expansion of domestic market capacity and external market trends related to fibres, newsprint paper and

FIGURE 5.6
Pulp production (thousand tonnes)

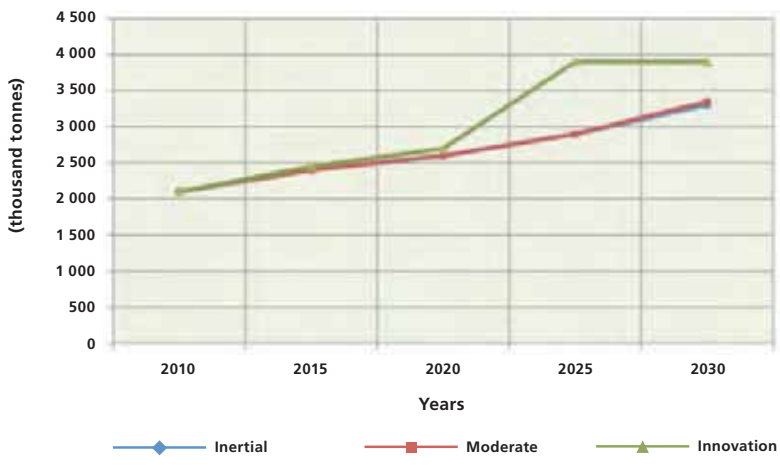


TABLE 5.6
Pulp (thousand tonnes)

Indicators	2010	2015	2020	2025	2030
Production					
Innovation	2 100	2 450	2 700	3 900	3 900
Moderate	2 100	2 400	2 600	2 900	3 350
Inertial	2 100	2 400	2 600	2 900	3 300
Export					
Innovation	1 650	1 900	2 100	2 500	3 000
Moderate	1 650	1 850	1 950	2 300	2 700
Inertial	1 650	1 900	2 100	2 300	2 600
Import					
Innovation	50	50	100	100	100
Moderate	50	50	100	100	100
Inertial	50	50	100	100	100
Consumption					
Innovation	500	600	700	800	1 000
Moderate	500	600	650	700	750
Inertial	500	550	600	700	800

kraft liner, traditionally produced by Russian manufacturers. The paper and paperboard trends are reported in Table 5.7.

By 2030 paper and paperboard production must increase by 3.3 times, and will amount to 25.5 million tonnes. State economic policy aims to significantly increase domestic market of paper and paperboard production and will impact the exports and imports of these products. Exports will increase under the innovation scenario by 2.3 times, in the moderate scenario by 1.7 times, and in the inertial scenario by 1.5 times. State economic policy envisages decreasing domestic market imports. Primarily, this concerns high-quality types of paper and paperboard for the printing industry, food packaging, tissue paper and tissue fibres. By 2030 domestic consumption of paper and paperboard will increase up to 20 million tonnes. Per capita consumption of these products will increase by three times from 46.8 kg to 141 kg. This growth will allow

FIGURE 5.7
Per capita consumption of paper and paperboard (kg per capita)

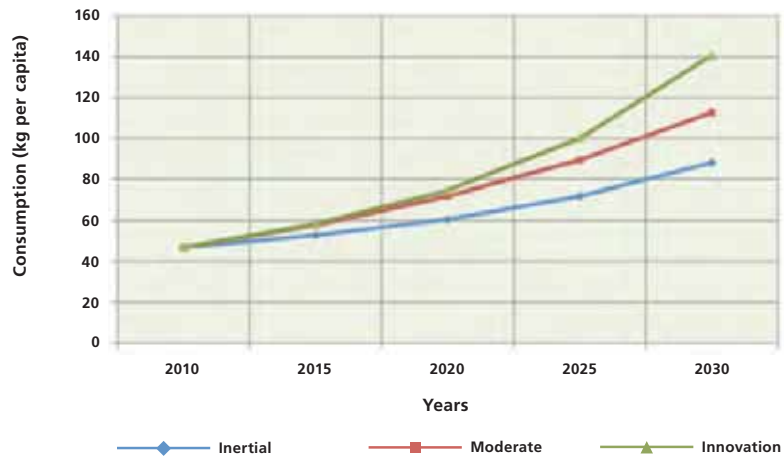


TABLE 5.7
Paper and paperboard (thousand tonnes)

Indicators	2010	2015	2020	2025	2030
Production					
Innovation	7 750	9 600	13 000	18 200	25 500
Moderate	7 750	9 500	11 800	14 300	18 800
Inertial	7 750	8 400	9 800	11 700	14 700
Export					
Innovation	2 600	3 000	4 000	5 000	6 000
Moderate	2 600	3 000	3 400	3 700	4 300
Inertial	2 600	2 600	3 000	3 500	4 000
Import					
Innovation	1 500	1 700	1 600	1 000	500
Moderate	1 500	1 700	1 800	1 700	1 500
Inertial	1 500	1 700	1 800	2 000	1 800
Consumption					
Innovation	6 650	8 300	10 600	14 200	20 000
Moderate	6 650	8 200	10 200	12 300	16 000
Inertial	6 650	7 500	8 600	10 200	12 500

Russia to reduce the gap in per capita paper and paperboard consumption as compared to countries with developed forest industries (Figure 5.7).

5.7 REGIONAL DISTRIBUTION

The forecast foresees the improvement of regional distribution of wood and paper-based production through development of technologically advanced wood processing in the richly wooded regions of Siberia and the Far East. The construction of big wood-processing factories is envisaged in the Karsnoyarsk, Zabaikalye and Khabarovsk territories, and the Tomsk and Amur regions. Especially fast growth in production of roundwood, sawnwood and particle board is foreseen in the Siberian and Far Eastern federal districts. New production facilities for the manufacturing of plywood, fibreboard, pulp, paper and paperboard will be created in the Far Eastern federal district.

The following production facilities are predicted in the Siberian federal district: sawnwood (5.6 million cubic metres), wood-based panels (2.0 million cubic metres), wood pulp (2.9 million tonnes), and paper and paperboard (2.8 million tonnes). Forest industry production capacity distribution by federal districts takes into consideration the following factors: (1) availability of forest resources and markets for pulp and paper products; and (2) state prospects for railways, waterways and automobile transport routes, gas pipelines and energy generating capacities.

5.8 WOOD BIOFUEL

The strategic objectives for renewable energy development are as follows: (1) the substitution of mineral fuel; (2) a reduction in environmental pressures from the fuel and energy sector; (3) the continuous supply of fuel to public utilities in regions with long-distance and seasonal deliveries; and (4) a reduction in fuel supply cost. Non-standard wood and wood-processing residues represent sources for wood energy. The domestic market remains the main consumer of wood-based biofuel for the forecast horizon. Export is only envisaged for pellets originating from regions where the necessary economic and transport conditions are available.

Fuelwood and industrial wood residue will be mostly utilized as raw and fuel materials in regions with high forest cover where delivery of mineral energy sources is complicated or requires seasonal supplies. Energy sources of high energy value will be produced in

FIGURE 5.8
Consumption of wood raw materials for biofuel (million m³)

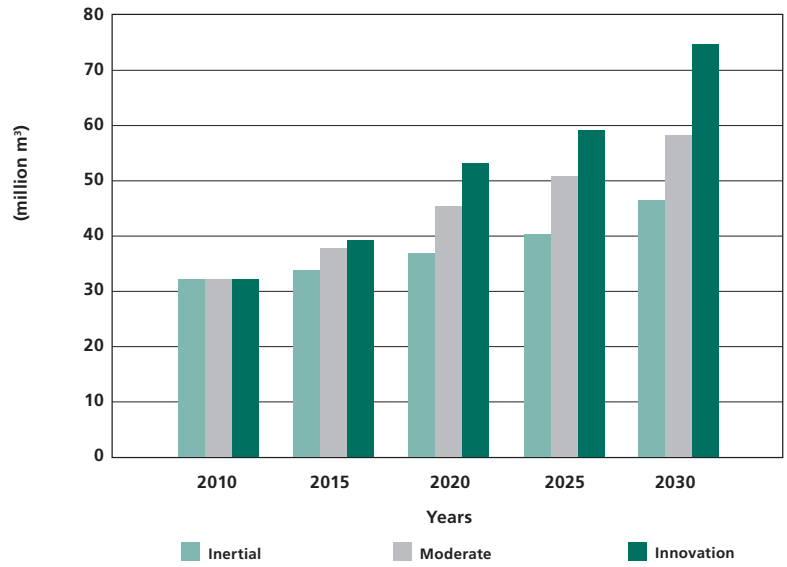


TABLE 5.8
Wood fuel products (thousand tonnes)

Production	2010	2015	2020	2025	2030
Charcoal	44	50	72	95	120
Briquettes and pellets	800	1 600	4 000	8 000	8 500
Wood-based liquid fuel	0	44	200	305	405

the form of charcoal, briquettes and pellets, wood chips and wood-based liquid motor fuel (Table 5.8).

The forecast period will also see an essential increase in the use of non-standard wood, fuelwood and wood residues for energy production (Figure 5.8).

5.9 INVESTMENTS

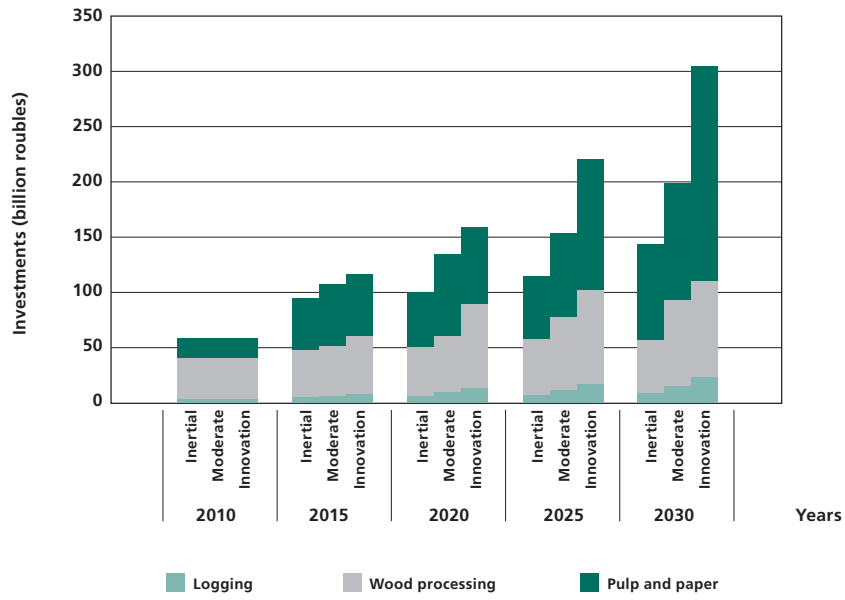
Development of the forest industries will require large and intensive investments, first of all in logging, wood processing and pulp and paper production (Table 5.9 and Figure 5.9).

Increased investment will ensure logging development, including new forests and priority investment projects. The most important investment is construction of an adequate road network on forest land. To ensure logging output in 2030 investments should increase 5.6 times to reach 22.7 billion roubles.

The wood-processing sector will require larger investments. The main sources of such investments will be loans from Russian and foreign banks. State-private partnership mechanisms including the provision of state guarantees for investors, the creation of favourable investment conditions, and easy credit access must be actively used. The innovation scenario will require an increase in investment in wood processing up to 94 billion roubles, or by 2.9 times.

To ensure pulp and paper production output under the innovation scenario, investment should grow by 7.0 times and reach 188 billion roubles by 2030. The following measures must be taken to improve the investment climate in the pulp and paper industry:

FIGURE 5.9
Investments in the forest industries (billion roubles)



(1) improve investment conditions for capital-intensive projects; (2) introduce taxes, credits and other benefits for the whole period of construction and normative return on investments; and (3) ensure state guarantees for investors.

Large investments and radical progress in the investment climate would be necessary to materialize the innovative development of the forest sector. This problem stretches far beyond the area of influence of the forest sector. According to the World Bank index of ease of doing business, Russia ranks 120 in the list of 183 countries of the world

TABLE 5.9
Investments in the forest industry (million roubles)

Development scenario	2010	2015	2020	2025	2030
Logging					
Innovation	4 030	9 845	14 768	19 691	22 736
Moderate	4 030	6 868	9 707	12 546	14 817
Inertial	4 030	6 061	8 094	9 641	11 189
Wood processing					
Innovation	32 370	52 580	69 199	84 130	94 030
Moderate	32 370	48 153	57 591	66 614	75 284
Inertial	32 370	43 426	43 011	47 233	51 667
Pulp and paper					
Innovation	26 845	53 965	76 734	117 263	188 312
Moderate	26 845	52 485	62 818	74 116	108 085
Inertial	26 845	39 205	48 107	59 805	80 480
Total					
Innovation	63 245	116 390	160 701	221 084	305 078
Moderate	63 245	107 506	130 116	153 276	198 186
Inertial	63 245	88 692	99 212	116 679	143 336

(World Bank, 2012). The Government of the Russian Federation has pledged to lift the Russian rank up to the twentieth position within the next six years. This achievement would be an important precondition for the gradual transition from the inertial to moderate to innovation scenarios of development, presented in this Outlook Study.

6. Forest regeneration, conservation and protection

The **inertial scenario** resolves traditional problems of forest protection against fires, pests, diseases and illegal activities, but does not address broader issues. The **moderate scenario** resolves higher-level problems, stressing balanced forest harvesting and regeneration within the established framework of spatial distribution of the forest sector. The moderate scenario is directed at the prevention of undesirable stand succession and qualitative improvement of forest resource potential on the basis of regional forestry management systems. Conditions for this scenario form the basis of the draft programme "Development of forestry for the period of 2012-2010" (Rosleshoz, 2012a).

The correlation between felling methods and forest regeneration will vary for different regions. For the moderate scenario, expert assessments and past experience suggest using the following correlation between felling methods and forest regeneration for sparsely, moderately and richly wooded regions. In sparsely and moderately wooded regions, the proportion of gradual and selective forestry felling must reach 20-40 percent, taking into consideration the preservation of reliable undergrowth and secondary growth of economically valuable species. The remaining 60-80 percent of forest-felled areas should be used to artificially regenerate economically valuable forestry crop plantations, taking into consideration the targeted use and habitat conditions of the forest. The entire area of forest regeneration must be thinned twice (200 percent) for young growth (first cleaning and early thinning). Where these proportions have been maintained, they show positive results. In richly wooded regions under the moderate scenario, recommended proportions include: 50 percent of assisted natural regeneration (including about 20 percent of gradual and selective felling and 30 percent of clear cut with undergrowth preservation), 30 percent of artificial regeneration by direct tree planting, and 20 percent of natural regrowth by mainly deciduous species. Table 6.1 presents the scenarios in terms of the proportions of harvesting and regeneration.

The balance between forest harvesting and regeneration cannot be reached immediately due to the absence of appropriate industrial processing and qualified staff. Creation of these preconditions will be possible during the course of 2015–2020.

The **innovation scenario** of forest sector development represents a *spatial-structural reorganization* of the forest sector. The following priorities shall be given preference: (1) employment growth; (2) production proximity to consumption centres; (3) wood-processing development; (4) cooperation between small, medium and big businesses; (5) organization of multi-resource forest management; (6) strategic expansion of protective afforestation; (7) strengthening of the role of state and society in forest management;

TABLE 6.1
Regeneration methods in the moderate scenario (% of regeneration area)

Regeneration methods	Sparsely and moderately wooded regions	Richly wooded regions	Countrywide
Gradual and selective felling	30.0	20.0	23.3
Undergrowth preservation	-	30.0	20.0
Forest plantations	70.0	30.0	43.4
Natural regeneration	-	20.0	13.3
Young growth thinning	200.0	200.0	200.0

and (8) improvement of the economic mechanism for implementing federal and special programmes.

Within the framework of the innovation scenario, the forest sector should recover its lost positions in sparsely and moderately wooded regions, which represent the "epicentre of consumption" of domestic forest products. This does not contradict forest sector development in richly wooded regions, which is oriented predominantly to external markets.

The currently under-utilized annual increment in the "epicentre" of domestic forest products consumption amounts to over 250 million cubic metres per year. It exceeds by half total wood harvesting in the whole of Russia. These regions have all the necessary conditions for forest sector intensification: demand, forest resources, staff and infrastructure. The only "barrier" is inadequate legislation prohibiting timely forest renewal. Expansion of advanced processing and bioenergy production will allow the use of wood from intermediate felling and the substitution of low-grade forest stands with economically valuable species.

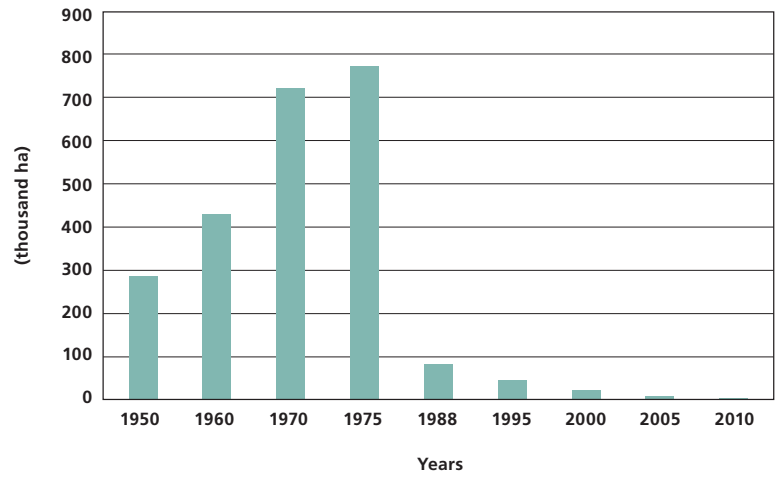
Under the innovation scenario, any wood-harvesting increase would be supported principally through the use of the under-utilized annual wood increment in moderately wooded regions of Russia. This will allow the recovery, renewal and reconstruction of forests in the region. It would also result in the doubling of present volumes of wood harvesting by 2020 and their tripling by 2030. In this way, only half of the under-utilized annual increment will be used. According to the innovation scenario, the share of forest tree planting in forest regeneration should increase up to 50 percent by 2030.

Protective afforestation remains a major problem for the Russian Federation. In the past, Russia was the leader in protective afforestation (Figure 6.1).

Currently 126 million hectares, or 75 percent of all agricultural land, are exposed to different types of erosion. One of the main causes of erosion is the shortage of forests in the main agricultural regions. Over recent years, about 5 million hectares of protective stand have been planted, of which no more than 3 million hectares have been preserved. In order to ensure the forestry protection of agricultural land, the Russian Federation must plant 11 million hectares of various types of protective forest belts and stands.

The transition to the moderate and innovation scenarios will require a series of institutional changes, including strengthening of the state forest service and the

FIGURE 6.1
Protective afforestation (thousand ha)



harmonizing of forest relations. For the Russian Federation, the richest forest country in the world, the creation of a Ministry of Forests would greatly assist the innovative development of forestry.

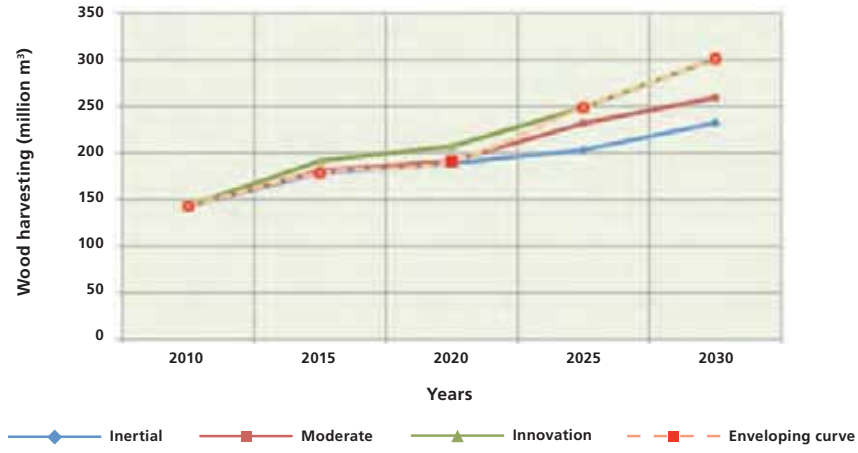
In practice, the three forecasting scenarios should be interconnected. During the first stage, the inertial scenario will inevitably prevail. The moderate scenario should be completed during the second stage (by 2020–2025), and the transition to the innovation should occur during the third stage (by 2030). The principle of an "enveloping curve", linking together the three scenarios, must become the guideline for developing state forestry programmes (Figure 6.2).

The inertial and moderate options are applicable under the existing spatial and structural distribution of the forest sector, where two-thirds of wood is harvested in richly wooded regions. The innovation option is designed for the spatial and structural

TABLE 6.2
Forest harvesting and regeneration under different scenarios

Regeneration indicators under different scenarios	2010	2015	2020	2025	2030
I. Inertial scenario with the existing spatial-structural distribution of the forest sector with two-thirds of wood harvested in the richly wooded regions					
Roundwood production (million m³)	142.9	178.5	188.7	203.1	232.4
Forest regeneration (thousand ha)	819.0	901.0	1 038.0	1 205.0	1 457.0
Tree planting (thousand ha)	171.0	201.0	227.0	265.0	320.0
Young stands thinning (thousand ha)	323.0	402.0	414.0	482.0	583.0
Tree planting as percentage of forest regeneration (%)	20.9	22.3	21.9	22.0	22.0
Young growth thinning as percentage of forest regeneration (%)	39.4	44.6	39.9	40.0	40.0
II. Moderate scenario with the existing spatial-structural distribution of the forest sector					
Roundwood production (million m³)	142.9	181.2	191.0	231.8	259.4
Forest regeneration (thousand ha)	819.0	1 017.0	1 205.0	1 442.0	1 673.0
Tree planting (thousand ha)	171.0	325.0	518.0	620.0	719.0
Young stands thinning (thousand ha)	323.0	1 017.0	1 807.0	2 884.0	3 346.0
Tree planting as percentage of forest regeneration (%)	20.9	32.0	43.0	43.0	43.0
Young growth thinning as percentage of forest regeneration (%)	39.4	100.0	150.0	200.0	200.0
III. Innovation scenario with the spatial-structural transformation of the forest sector					
Roundwood production (million m³)	142.9	191.3	207.1	248.8	301.2
Forest regeneration (thousand ha)	819.0	1 027.0	1 277.0	1 589.0	2 007.0
Tree planting (thousand ha)	171.0	442.0	638.0	795.0	1 003.0
Young stands thinning (thousand ha)	323.0	1 027.0	2 554.0	3 178.0	4 014.0
Tree planting as percentage of forest regeneration (%)	20.9	43.0	50.0	50.0	50.0
Young growth thinning as percentage of forest regeneration (%)	39.4	100.0	200.0	200.0	200.0
IV. Enveloping curve					
Roundwood production (million m³)	142.9	178.5	191.0	248.8	301.2
Forest regeneration (thousand ha)	819.0	901.0	1 025.0	1 589.0	2 007.0
Tree planting (thousand ha)	171.0	201.0	518.0	795.0	1 003.0
Young stands thinning (thousand ha)	323.0	402.0	1 537.0	3 178.0	4 014.0
Tree planting as percentage of forest regeneration (%)	20.9	22.3	43.0	50.0	50.0
Young growth thinning as percentage of forest regeneration (%)	39.4	44.6	150.0	200.0	200.0

FIGURE 6.2
Connection of the three scenarios by the "enveloping curve"



transformation of the forest sector in Russia and sustainable forest management in sparsely and moderately wooded regions with major demand for forest products in the country. Forest harvesting and forest regeneration under different scenarios are presented in Table 6.2.

The forestry sector development scenarios presented above reflect a process of gradual intensification and ensure the balance between forest harvesting and regeneration. The increase in active forest management measures, including artificial reforestation methods and young growth thinning, will prevent unfavourable forest succession and ensure sustainable forest management in the country.

7. Forest resources and climate change

According to available forecasts, the most significant climatic changes on the planet are expected in the territory of the Russian Federation. According to the scenarios of the Intergovernmental Panel on Climate Change (IPCC), by the end of the twenty-first century, the following changes will take place in Russian Federation territory:

- Probable annual temperature increases will range from 4 to 12 °C. Average temperature increase will be around 4-4.5 °C.
- Precipitation will increase on average by 11-18 percent, mostly in winter.
- Climate variability will increase significantly.
- Generally, the climate of the Russian Federation will be warmer and drier. Frequent summer dry periods are expected over a large part of the country. Forests will be subject to strong water stress, especially in the southern and south-western parts of the country.
- Considerable disruption of permafrost, covering over two-thirds of the area of the country, is expected. Permafrost thawing will essentially intensify the greenhouse effect, because permafrost at high latitudes contains over 500 billion tonnes of carbon, mostly in the form of methane and hydrates. The thawing of the permafrost soil will result in irreversible damage to forest hydrological regimes, especially in low rainfall areas.

7.1 IMPACT OF CLIMATE CHANGE ON FORESTS

The impact of climate change on Russia's forests can be both positive and negative, depending on the region. Current views on the impact of climate change on the forest sector lead to the following basic conclusions:

- Radical changes in the forest ecosystems of Russia due to the impact of climate change are not expected over the next 20 years. Essential changes are expected to occur over a longer time frame, beyond the time horizon of the present Outlook Study.
- Climatic change over the next two decades will likely contribute to increased average forest productivity countrywide. More favourable growth conditions are predicted for deciduous species.
- Intensification of negative processes is expected. Examples include the drying out of spruce-fir forests in the Far East and in the European North, and higher dieback of cedar forests in Siberia. The timber quality of mature forests will gradually deteriorate.
- A high probability exists that permafrost thawing followed by drying out will result in the degradation and destruction of coniferous, particularly dark coniferous forest. Intensive physical destruction of permafrost landscapes will also have a negative impact on forests. Strengthening of these trends is expected beyond the 2030s.
- Climate change will result in the escalation of biotic (pests and diseases) and abiotic (fires and whirlwinds) disturbances. Catastrophic fires have already resulted in the degradation of millions of hectares in the north of Siberia and the Far East. Two-thirds of this area of natural fires is located in forests. By the end of the twenty-first century, the number of forest fires will double and their intensity will increase. An increase in the frequency and intensity of forest pest outbreaks is also expected.

- Large forest areas in high latitudes will become the object of intensive industrial development. The development of new regions will substantially increase the negative impacts on forest.
- Particular risks are expected for the southern regions and forest steppe where forest fragmentation and vulnerability is high.
- It is highly probable that climate change in the second half of the twenty-first century will have a strong impact on forests. Warming by 5–6 °C may become critical for boreal forests and may result in mass destruction of forest stands. If the stability threshold is exceeded, the transformation of boreal forests will happen quickly, over a period of 50 years. Higher forest mortality is already being observed in practically all areas of the boreal belt.
- The impact of climate change on the logging industry will vary in different regions. Mitigation of winter severity in the northern regions will contribute to the improvement of working conditions in the forests. In the southern part of the forest area, deterioration of timber transportation conditions will be expected. Ice melting will improve conditions of timber transportation along the Northern Sea Route. The volume of shipments will increase from the current annual level of 1.5 million to 40 million tonnes by 2020, leading to a decrease in forest product transportation costs.

It is vital that climate change be taken into account in Russia's long-term forest sector development scenarios. The **inertial** long term scenario assumes that overall losses owing to climate change will exceed additional growth. Likely, the substantial decrease in carbon stock will not take place before 2030, but this tendency is highly probable from a longer-term perspective.

The **innovation** scenario, in terms of climate change, assumes: (1) a transition to landscape ecosystem management and adaptive forestry; (2) the implementation of efficient conservation and forestry protection measures to keep the level of forest losses low; and (3) the reconstruction of forest governance. Under these conditions, an increase of current forest growth from 0.4 to 0.6 percent per year can be expected over the next twenty years.

The use of the mean increment indicator is less convenient than gross and net growth indices for the assessment of climate change impacts on forest trends. These indices are more suitable for this purpose, but they are not determined by contemporary practices of forest inventory. According to expert estimates, from 2005–2010, the total growth in Russian forests amounted to 1 600 million cubic metres, including 950 million cubic metres of net growth and 650 million cubic metres of wood mortality. However, the uncertainty of these assessments is considerable.

There are several assessments of the full carbon balance of Russian Federation forests. These assessments oscillate between 200 and 1 000 million tonnes of carbon sink per year. The most probable carbon sink size in Russian Federation forests over the last 10 years (with a probability of 0.9) amounts to 500–700 million tonnes of carbon per year. Interannual variability of the net biome production (NBP), indicating the forest carbon budget, averages 10-20 percent, depending on the climate pattern and annual disturbances.

Over 2000–2007, Russia's forests provided about 90 percent of the carbon sink created by boreal forests, including Canada and Scandinavia. However, disturbed and burned-out forests often become sources of carbon emissions into the atmosphere. There is a high probability that the "switching" of high-latitude ecosystems from carbon sink to carbon source is a consequence of warming.

In the last decade, direct forest carbon emissions due to forest disturbances were estimated at 250-300 million tonnes of carbon per year, including 79±18 million tonnes from fires, 53±14 million tonnes from pests and pathogens, 110±38 million tonnes from wood decomposition of stands destroyed in the previous years by fires, pests and pathogens, and 25 million tonnes of carbon from annual wood harvesting.

The reported data do not take into account methane emissions, which are second in importance to greenhouse gases. According to the latest estimates, Russia's forest is the source of 1.26 million tonnes of carbon per year through methane emissions. Out of total emissions, fires produce 0.56 million tonnes of carbon, and forests growing on waterlogged soil produce 0.70 million tonnes of carbon. Methane emissions from woodless bogs located on forest land comprise about 9.9 million tonnes of carbon.

There are several forecasts of climate change impacts on forest carbon balance for 2015–2030. However, all assume some decrease of carbon sink in the forests by 2030 owing to climate change, the strengthening of disturbance regimes, and an increase in timber harvesting. According to the **innovation** scenario, the decrease will be small amounting to 50–70 million tonnes (10-15 percent), on the condition that the Russian forest sector programme for the transition to sustainable development and adaptive forestry is realized. According to the **inertial** scenario, the decrease in the carbon sink will be considerable and will exceed 150-200 million tonnes (30 percent). If IPCC climate forecasts prove correct, there is a higher probability that under the inertial scenario, Russian Federation forests will become a source of carbon emissions into the atmosphere by the end of this century.

7.2 FOREST ADAPTATION

Although the climate change process subjects forests to stress, they have the ability to adapt to these changes, and also to resist them. The adaptation of forests to climate change is a pressing problem for forestry. The state of knowledge regarding adaptive potential and the regional vulnerability of forests to climate change is insufficient. It is evident that climate change will have an impact upon all forest services and utilities, but assessment of this impact is impeded owing to the unavailability of reliable research.

To facilitate better adaptation and resistance of forests to climate change, the following actions are required: (1) selection of tree species adapted to the expected climate change; (2) possible reduction of the interval between fellings for accelerated development of adaptive qualities of tree species; (3) the use of mixtures of germ plasm with a high level of genetic variability; and (4) long-term experiments with genotypes from different climatic conditions.

Actions for climate change mitigation can be divided into the following main groups: (1) reforestation and forest planting; (2) reduction of deforestation and forest degradation; (3) establishment of forest plantations with short rotation periods, for example, for paper production and energy generation; (4) growth of the carbon content of forests, for example, by increasing growing stock and decreasing non-forested areas; (5) reduction of carbon emissions into the atmosphere, for example, through reduction of disturbance impacts; and (6) increase of the carbon store in forest products and the substitution of fossil fuels by wood.

Russian Federation participation in international negotiation processes on climate change has set on the agenda an objective of ensuring a transition towards a *fully verifiable* accounting of the greenhouse gas budget in the biosphere. It assumes the accounting of all greenhouse gases, ecosystems, processes and national particularities in the country. Scientific research shows that assessment of the fully verified forest carbon budget is possible. The level of accuracy could be made acceptable for the purposes of decision-making.

Climate change poses a further global problem related to the thawing of permafrost, two-thirds of which is located on the territory of the Russian Federation. The global community has not yet completely realized the extent and importance of this problem and its impact on global climate. If the predicted warming becomes a reality by the end of the century, then carbon emissions from permafrost zones of the Russian Federation will likely reach several billion tonnes of carbon per year and might exceed current emissions from tropical deforestation (2.2–0.9 billion tonnes of carbon per year) by

several times. A significant part of these emissions will be methane. This will determine the essential acceleration of global warming rates. At the same time, the adaptation of high-latitude landscapes to climate change will be complicated in many respects, including ecological, technical, economic and social. It is evident that the vast areas of permafrost must become the object of profound scientific research and must form an integral part of the international negotiation process on climate change.

8. Forest certification

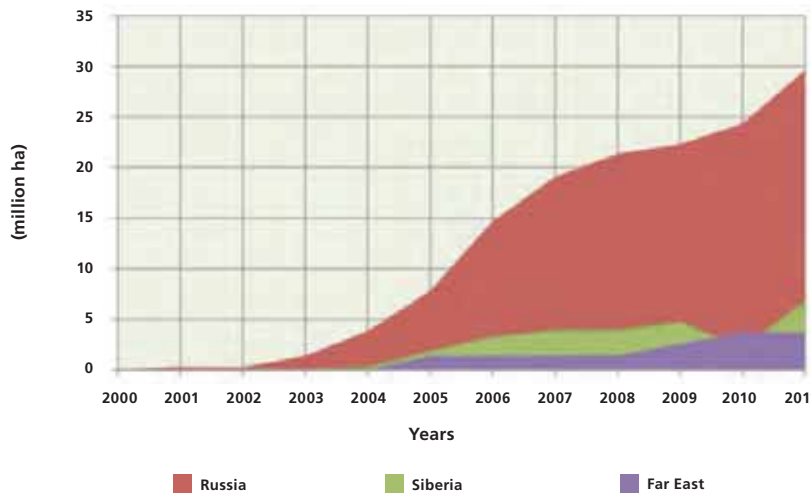
At present, forest certification is widespread across the Russian Federation. It is represented by two major schemes: the Forest Stewardship Council (FSC) and the Russian National Council on Forest Certification (RNCFC), which obtained accreditation within the international Programme for the Endorsement of Forest Certification (PEFC). The FSC scheme prevails in Russia.

The first FSC forest management and supply chain certificates were issued in Russia in 2000. By the end of 2011, FSC-certified forest land reached almost 30 million hectares. By this indicator, the Russian Federation ranks second in the world after Canada. The total number of issued certificates (forest management and supply chain) amounted to almost 300, of which about 70 are forest management certificates (115 together with controlled wood certificates); the rest are chain of custody certificates. About 177 000 hectares have been certified and five certificates have been issued according to the PEFC scheme, including one forest management certificate. All five PEFC-certified companies also have FSC certificates. Certified forests are located in 17 federal subjects of the Russian Federation. Their area amounts to 26 percent of the total forest area of the Russian Federation transferred on lease for timber harvesting.

Unfortunately, at present there is no data available related to timber harvesting in the certified forests. In 2010, leaseholders harvested 123 million cubic metres of timber out of a total of 174 million cubic metres, by all types of felling. It can be conditionally assumed that a quarter of the timber harvested by leaseholders comes from certified forests. This accounts for about 30 million cubic metres of wood or about one fifth of the total wood harvesting in the country.

About 63 percent of the certified forest land is located in the European part of the Russian Federation, some 23 percent in Siberia, and 13 percent in the Far East (Figure 8.1).

FIGURE 8.1
FSC certification in the Russian Federation (million ha)



Three forecast options have been considered for certification development in the Russian Federation until 2030: inertial, moderate and innovation (Figure 8.2).

The **inertial** scenario is based upon the preservation of current certification development trends in the Russian Federation. The **moderate** scenario is linked to an increase in demand for certified products from environmentally sensible markets. The **innovation** scenario envisages the formation and increase of domestic demand for certified wood products.

The **inertial** scenario is based upon the following assumptions: (1) prevailing forest sector export orientation towards ecologically sensible international markets; (2) the intention of forest industry and trading organizations to secure their businesses by means of certification; (3) the actions of Russian and international non-governmental organizations; (4) the availability of companies to pass certification; and (5) the general compliance of the forest management in Russia with international certification requirements. The totality of all these factors will ensure the increase of forest certification. No other sector of the Russian economy can compete with the forest sector in terms of scale of adaptation of international certification schemes.

Certification leads to: (1) improvements in forest management and environmental protection indicators; (2) the resolution of important social issues in the forest sector of the economy; (3) improved sales of products and economic efficiency of forest companies; and (4) increased social and ecological responsibility among related businesses.

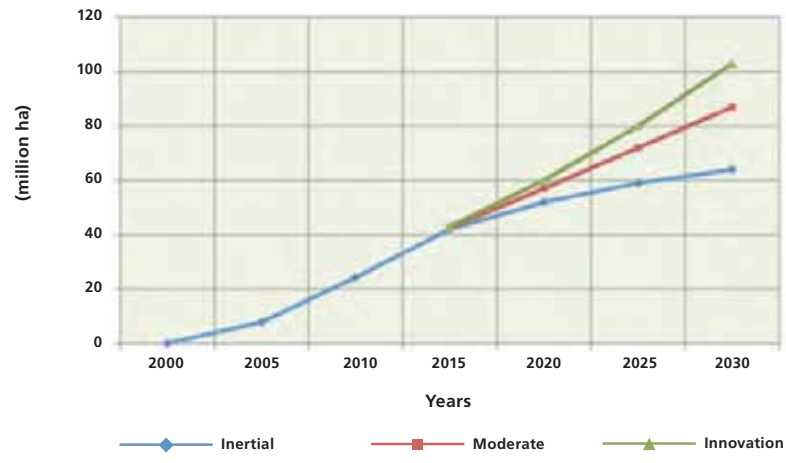
The prospects for voluntary certification are reflected in the following documents: (1) the national action plan for the prevention of illegal logging; (2) strategies for the forest sector development; (3) forest plans and forestry regulations; and (4) forest exploitation projects.

If the current growth rate persists, the FSC certified forest area in the Russian Federation will increase by the end of 2012 to 32-33 million hectares. By 2015 an annual growth rate is expected of 3 million hectares. Thereafter, growth rates may decrease although absolute growth will remain.

The **moderate** scenario is built upon the assumed expansion of ecologically sensible markets in China, Europe, the United States, and the Russian domestic market. In this case, Russia will maintain its current high growth rates of FSC certification.

The Russian forest sector is export oriented. According to the Federal Customs Service of Russia, exports make up two-thirds of the total forest sector sales value.

FIGURE 8.2
FSC certification forecast (million ha)



A major portion of exported wood products is delivered to the markets of economically developed countries. The main importers of Russian Federation forest products in 2010 were China (31 percent), European Union members (21 percent), Egypt (5.5 percent) and Japan (4.3 percent).

Ecologically sensible markets are growing worldwide. According to surveys, over 66 percent of Europeans are seriously concerned about the state of the environment. Over 80 percent of consumers in Japan believe that the state of the environment is very bad. In the United States and the United Kingdom, 54 percent of customers say that ecological sustainability is a major factor in the process of decision-making related to the purchase of commodities. In spite of the financial crisis, over one third of consumers are ready to pay the 5-10 percent premium for green commodities.

Responsible purchasing policies (RPP) implemented in a number of European Union member states, Japan and other countries play a key role in the formation of the forest product market. The list of these countries is constantly growing. In the European Union, the share of state purchase in the total amount of pulp and paper products accounts for 16-18 percent. These facts represent a strong argument in favour of forest certification.

Currently in the Russian Federation, the largest exporters of forest products are certified. All ten leading Russian wood product exporters, which account for almost 20 percent of wood product exports, either already have FSC certificates or are in the process of certification. Out of the next 40 biggest exporters, providing for an additional 20 percent of export, 24 companies have FSC certificates. Eight leading exporters of pulp and paper, covering two-thirds of total export of these products, also have FSC certificates.

China is the largest importer of Russian wood, usually processing the wood on its own territory and then selling the finished products mostly to member states of the European Union and the United States. Thus, the majority of Russian forest products, sold to China, end up on ecologically sensible markets. Due to the environmental standards of EU and US markets, Chinese companies have begun to request wood products certificates from Russian exporters. This has triggered interest in certification in the Far East and in Siberia.

In March 2013, the European Union will implement a new regulation (no. 995/2010 of 20 October 2010) that will further stimulate certification of exporters from the north-west of the Russian Federation. Finland is the largest purchaser in Europe of wood products from the Russian Federation. Finnish companies are among the leaders of PEFC certification in Europe. However, in Russia they prefer Russian FSC standards. Harmonization of both standards (PEFC and FSC) is possible and advisable.

Japan is an important market of certified forest products. Five major Russian exporters to Japan, accounting for over one third of Russian exports, are either already certified or are in the process of certification. Smaller exporters from the Russian Far East are gradually becoming involved in the certification process.

The United States consumes 13 percent of Russian plywood exports. Amendments to the Lacey Act foresee criminal punishment for the import of illegally logged timber to the United States. Four of the five leading Russian exporters of plywood to the United States have FSC certificates. Their share accounts for about 40 percent of the total Russian plywood export.

The **innovation** scenario foresees the increased growth of FSC-certified areas owing to the support of FSC-certified products on the domestic market. According to this scenario, the certified area will reach three-quarters of forests transferred on lease for timber harvesting within the next 20 years.

The Russian domestic market represents a major potential market for FSC-certified products. The first stage of the joint campaign by WWF Russia and the FSC for the promotion of FSC-certified products on the domestic market has already led to the certification of many producers and suppliers of forest products. FSC certification

continues in the European part of the Russian Federation, predominantly in the north-west. Regions of the central European part of the Russian Federation and the Volga region, mostly oriented to the domestic market, will also adopt certification. In Siberia and the Far East, certification will gradually expand to neighbouring regions adjacent to current certification centres, including the Amur Region, the Zabaikalie Territory, Khakassia, the Altai Territory and so on.

Currently, the only region in the Russian Federation still untouched by forest certification is the Caucasus. This region's export is oriented towards the markets of Turkey (65 percent) and Azerbaijan (10 percent). The European Union and the United States, which purchase products from the region, must become a driving force towards certification in the Caucasus. Other Russian markets, accounting for a considerable share of wooden floor covering from the region, will also stimulate certification in the region. The first FSC certificates in the Caucasus are expected in the next two to three years.

For the time being, FSC certification is not present in the Kaliningrad Region in the Far West of the Russian Federation, whose exports are oriented towards EU member states. The biggest producer in the region has FSC certification for its supply chain, but the raw materials are delivered mostly from Siberia. It is expected that adoption of new forest legislation by the European Union will initiate forest certification in the region.

In the Russian Federation, the first campaign for promotion of certified products was launched by the national office of the Forest Stewardship Council (FSC) and WWF Russia in 2009. Regular campaigns to raise awareness of the FSC logo among consumers of final products are planned for the next 20 years.

To date, most examples of forest certification are Russian subsidiaries of international companies that manufacture products with the FSC logo. They are primarily producers of certified paper packaging materials and office paper that, at present, account for about 50 percent of the total Russian market.

FSC requirements related to the certification of materials are included in the following green construction standards: Building Research Establishment Environmental Assessment (BREEM) and Leadership in Energy and Environmental Design (LEED). These methods are actively disseminated throughout the Russian Federation. FSC certified sawnwood and wood-based panels must become the basis for green construction and thus will be in high and fast-growing demand. The requirement to use FSC-certified materials is included within the "green standards" of the Sochi 2014 Winter Olympic Games.

The Moscow Government and some subjects of the Russian Federation are currently developing ecologically friendly procurement policies, oriented towards the purchase of certified wood and pulp and paper products. This process is actively spreading to other regions of the country.

Company expenditure on certification includes two components: expenditure on preparation and expenditure on certification. These expenditures are not net production expenditures. In the process of preparation for certification, the companies improve forest management, bringing it up to world standards. The availability of certification thus becomes a mandatory condition for product access to ecologically sensible developed markets, justifying certification over the long term.

Average forest certification cost is US$0.10-15 per hectare per year in the case of certification of forest management; supply chain certification costs start at US$2 000 per company. Certification cost depends upon many factors, including the certification area, quantity, dispersion and remoteness of parcels, forest composition and so on. In the early years, certification in Russia was considered justifiable for forest areas over 30 000 hectares. Later on, this level decreased. Today, there are examples of certification of only several thousand hectares of forest. It can be expected that in the coming years, parcels of less than 1 000 hectares will be set out for certification. Certification costs are decreasing and will further decrease in the future. Competition between certification bodies plays an important role in reducing the certification price. Currently, three auditing

firms carry out certification in the Russian Federation, while there are ten accredited certification bodies. Over half of these accreditations were obtained recently. Competition will reduce the unit price and will increase the accessibility of forest certification.

9. Illegal wood

The problem of illegal logging and the trade of forest products of illegal or doubtful origin is one of the most pressing social, ecological and economic problems facing the world forest sector. Russia is no exception, but at present no methodology or assessment system exists to allow a reliable accounting of the amount of illegal logging in the Russian Federation. According to official Rosleshoz data, in 2011 illegal logging equalled 1.2-1.8 million cubic metres and over 21 000 offences were uncovered. In 2010 illegal logging totalled 1.3 million cubic metres and in 2009 about 1.5 million cubic metres. According to this data, illegal logging accounts for about 1 percent of the total amount of forest harvesting and corresponds to the best indicators of countries with strong law enforcement in the forest sector.

Official data differ from independent assessment. According to assessments made by WWF Russia and the World Bank, up to 20 percent of timber harvested in the Russian Federation (or about 35-40 million cubic metres) is of illegal origin. The total volume of timber harvesting in the Russian Federation in 2010 amounted to over 173 million cubic metres. Assessment by WWF Russia is based upon the balance method, which compares the harvesting and factual consumption. Assessment by the World Bank is based upon interviews with forest sector experts. The total cost of economic damage to the budget of the Russian Federation originating from illegal wood trade is estimated at 13 billion to 30 billion roubles per year.

The considerable difference between assessments is partly attributed to the lack of an official definition of illegal logging and the incompleteness of assessment methods. Official assessments use satellite data related to clear felling outside allocated felling areas and unauthorized large-scale clear felling. At the same time, illegal selective felling represents a great danger for biodiversity and forest ecology. In the latter case, illegal woodcutters remove selected trees, groups of trees, and parts of stems of the most valuable and rare species. Such fellings are unidentifiable on satellite imagery and are practically never included in assessments. Yet such types of illegal logging are prevalent. The unavailability of reliable official information on the volume of illegal logging complicates the efficient combating of this illegal activity. Open acknowledgement of the problem would induce regional government authorities to collect reliable information and to facilitate the efficient combating of the illegal wood trade.

Illegal logging is more widespread in the export-oriented forest regions of the Russian Federation, especially along the border with China and, in particular, in the Irkutsk Region and the Primorye Territories. According to assessments by non-governmental organizations, up to 50 percent of the harvested timber in these regions may be of illegal or "doubtful" origin.

9.1 TYPES OF ILLEGAL LOGGING

The most widespread offences in the sphere of timber harvesting and the wood trade are: logging of rare and endangered tree species; logging in protected areas; commercial logging disguised as sanitary and intermediate felling; timber harvesting in violation of rules and technologies; the illegal wood trade and corruption; smuggling and legalization of illegally logged wood; and commercial logging by the local population on the pretext of personal use.

Basic factors that condition widespread illegal logging and trade in the Russian Federation are: (1) non-transparent relationships in the forest sector; (2) the high level of corruption and low level of interdepartmental cooperation; (3) the absence of legal

definitions of "illegal logging" and "illegal wood trade", and the difficulties in uncovering offenders, recovering damage and holding offenders liable; (4) the non-transparency of wood supply chains, especially from Russia to China; (5) the low living standards in rural areas, inducing the population to undertake illegal activities; and (6) the strong domestic and external market demand for wood, independent of its origin.

The problem of illegal logging has been acknowledged at the federal level and efforts have been undertaken to combat it. The Russian Federation actively participates in Europe and North Asia Forest Law Enforcement and Governance (ENA FLEG) processes. Russia, within the framework of its commitments, is undertaking actions to ensure the legality of wood, including: (1) adoption of the Plan for the Prevention of Illegal Logging and Illegal Wood Trade in the Russian Federation for 2009-2011; (2) institution of the Commission and working group for the prevention of illegal logging and the illegal wood trade; (3) the intensification of Rosleshoz activity related to distant forest monitoring with the application of aerospace methods; (4) verification of the state of forest land and the use of forests in the 83 subjects of the Russian Federation; and (5) the elaboration of regulatory legal acts to combat illegal logging and the informal wood trade.

To date, these actions have not had a significant effect and are unlikely to reverse the spread of illegal logging and the informal wood trade in the country. At the regional level some subjects of the Russian Federation have initiated local efforts to combat illegal logging and trade. In 2009, for example, the Arkhangelsk Region adopted a law "On regulation of certain relations in the sphere of wood trade". The law requires that the seller and buyer of wood present a list of documents for validation of the transaction. Business initiatives on wood voluntary certification and traceability play an important role in combating the illegal wood trade. These are of primary interest to international brand enterprises and holding companies with a prevalence of foreign capital.

9.2 ILLEGAL LOGGING SCENARIOS

The problem of illegal logging in the Russian Federation bears a systematic and stable character, conditioned by certain socio-economic, regulatory and political factors. Under any scenario, the volume of illegal wood will decrease. The probable trend of illegal logging volume by 2030 appears as follows.

Inertial scenario. In the medium term, the situation can change considerably. The following factors will play key roles in combating illegal logging and the informal wood trade: (1) increased ecological awareness among external markets, including the European Union, the United States and, gradually, China; (2) strengthened legislative measures to ensure the legality of wood in EU and US markets; and (3) further evolution of the middle class in the Russian Federation, increased ecological awareness among the domestic market, and the promotion of voluntary forest certification.

In 2008, the United States Congress enacted amendments to the Lacey Act related to the origin and legality of wood products imported to the United States. At the same time, in 2010 the European Union validated a new regulation banning the import and sale of illegal wood to EU territory. Importers must request documentary evidence from suppliers that the purchased wood complies with the laws of the country where the timber was harvested.

New legislative initiatives on wood legality are also being promoted in the Russian Federation. At the end of 2011, the draft Federal Law "On state regulation of round timber trade", was presented for public hearing. The law states that all organizations and individual entrepreneurs trading any round timber on domestic and external markets are obliged to submit the appropriate declarations and register transactions on the unified state automated information system via the Internet.

Some experts fear that adoption of the law may produce a negative impact on small businesses and provisioning of the rural population with fuelwood. However, if these

issues are resolved, the law will have a significant positive impact on attempts to combat illegal wood.

The internal consumer market of the Russian Federation now lags far behind post-industrial countries markets in terms of ecological awareness. A recent WWF research study shows that the issue of timber legality is of extremely low level of significance for consumers. About 50 percent of respondents declared themselves indifferent to the legality of timber product origin. However, the study reported an increase in ecological awareness among the middle class. Growth in responsible consumption on the domestic market will enable a reduction in the illegal wood trade by an additional 5 percent by 2030.

Thus, the inertial scenario assumes that there will be no significant increase in certified forest areas. National and regional initiatives for combating illegal wood will not lead to considerable reinforcement of state supervision over forest management. Foreign initiatives will not be able to create sufficient economic incentives for stimulating legality. A slow decrease in the real volume of illegal forest management will take place. By 2030, illegal logging in the Russian Federation will have decreased by 5-10 percent due to a gradual increase in ecological awareness in the country, and the development of voluntary forest certification.

Moderate scenario. If the declared measures are efficiently implemented by the European Union and the Unites States, Russian producers will be obliged to prove the legality of about one third of export volumes. A whole series of mechanisms already exist in the Russian Federation to ensure the legality of timber products: corporate traceability systems, voluntary forest certification, and legislative initiatives of federal and regional government authorities. About 15 percent of market share already comprises certified products and products traceable by corporate systems. In all likelihood, a considerable part of large producers will have to exclude illegal timber from their deliveries. In the medium term, this could reduce the illegal wood trade in the country by 20-30 percent.

The moderate scenario under efficient international legislation assumes the impossibility of trade of forest and wood-based products of illegal and doubtful origin on European and US markets, excluding through third-party countries. It is assumed that the Federal Law "On state regulation of round timber trade" and other Russian initiatives aimed at legalization of wood supply will gain maximum efficiency by 2030. All these conditions will lead to a decrease in illegal wood activities by 30-40 percent.

Innovation scenario. The most optimistic scenario envisages the restoration of efficient forest guard service in Russia and the success of international initiatives for combating illegal logging. In this case, a drastic reduction in the real volume of illegal logging by 70-80 percent could be expected by 2030. It is not realistic under any scenario to expect a reduction in illegal logging volume over 80 percent by 2030.

In order to ensure efficient reduction of illegal logging, the following measures must be adopted: (1) create an efficient system to supervise forest management, based upon an effective forest guard service that will enable control of document flow and forest management practices; (2) enact a legal definition of the concept of "illegal logging"; (3) ensure efficient law enforcement; (4) introduce more severe penalties for illegal logging, especially for large companies, groups and people acting in collusion; (5) promote a policy of public and municipal purchases, voluntary mechanisms and voluntary forest certification; (6) promote targeted information and publicity; and (7) raise awareness of the negative effects of irresponsible and illegal purchase of forest products.

The efficiency of the above measures depends on the resolution of complex problems that extend beyond the forest sector, in particular, the low living standards of the rural population, unemployment and corruption.

10. Forest ownership

The development of a long-term strategy for the forest sector necessarily foregrounds the important political and economic issue of forest ownership. Interests of the state, society and private business are exercised through ownership rights. State monopoly of forest estate land, comprising 97 percent of the total forest area in Russia, is fixed by federal forest laws (Osnovy lesnogo zakonodatelstva, 1993; Federal Law, 1997 and 2006).

Article 9 of the Constitution of the Russian Federation instituted the legal basis for reforming private ownership rights: "Land and other natural resources may be subject to private, State, municipal and other forms of ownership." Acting federal legislation implies some difficulties in the reform of ownership rights pertaining to forest land. Article 72 of the Constitution of the Russian Federation establishes the political basis of federal relations in the management of natural resources: "Issues of the possession, utilization and management of land, minerals, water and other natural resources are within the joint jurisdiction of the Russian Federation and subjects of the Russian Federation." The aforementioned principle of "joint jurisdiction" over land and natural resources is not common in universal practice, where each land parcel normally has only one owner.

Joint jurisdiction as a political instrument of forest relations determined the state forest management system at the end of twentieth century and the beginning of the twenty-first century through the distribution of authority among governmental bodies at federal, regional and municipal levels. During the course of administrative reform of the system of forest relations, several systems of state forest management have been tested. Under the monopoly of federal ownership on forests, these systems differ by the degree of centralization.

Basic Forestry Legislation (Osnovy lesnogo zakonodatelstva), introduced in 1993, transferred forest management under the jurisdiction of municipalities (administrative regions at that time). At the same time, forestry enterprises (*leshozy*) practising forestry, were granted the status of federal state institutions. This political decision resulted in the decentralization of forest management.

The Forest Code of 1997 transferred main forest administration functions to the 83 federal subjects of the Russian Federation. This decision did not produce the expected increase in forest profitability and investments in the forest sector. The mechanism of joint jurisdiction over forests through separation of plenary powers between the Russian Federation and its federal subjects did not create the appropriate balance of interests among the participants in forest relations. Instead, it led to conflict situations, growth of the informal economy and increased risk of corruption.

The Forest Code of 2006 maintained the monopoly of federal state ownership of forests and continued the decentralization process in forest management systems. The Code: (1) transferred principal powers to governmental bodies of the 83 subjects of the Russian Federation; and (2) conferred responsibility for forest management of leased lands to leaseholders, in other words, private business. The Forest Code of 2006 did not ensure innovative development of the forest industry and forestry on the condition of state-private partnership. It is necessary to undertake further institutional transformation of the forest management and ownership system. The following scenarios are possible.

10.1 JOINT JURISDICTION

Scenario 1 is the realization of the constitutional principle of "joint jurisdiction" through transfer of ownership of a portion of forest land to the subjects of the Russian Federation. This scenario concerns the delimitation of forest management between the Russian

Federation and its subjects, but not through the distribution of powers as it is currently conducted. Delimitation of responsibility must be conducted through the distribution of forest land between the two owners, as is done in other federal states, such as Germany and the United States, for example.

For the realization of this scenario, the state must implement the following arrangements via a legal framework: (1) Create conditions under which the transfer of ownership of forest land to the subjects of the Russian Federation ensures more efficient forest management in comparison with existing forms of ownership. A considerable period of time will be required for the objective assessment of such conditions. During this period, government authority of the subjects of the Russian Federation must "demonstrate" the efficient realization of powers transferred by the Forest Code. (2) Approve the criteria pertaining to the delimitation of forest land by two types of state ownership: federal and regional.

Considering the existing state of forests in Russia and their low economic and transport accessibility, federal ownership of forest land will likely remain predominant in the near term. Federal forests must include forest reserves and preserves of national significance, and the indigenous forests of the European North, Siberia and the Far East. The scenario preserves existing forms of state-private partnership based on forest leasing.

10.2 PRIVATIZATION

Scenario 2 is the realization of the provisions of Article 9 of the Constitution of the Russian Federation predetermining the privatization of forest land and the emergence of private forests through a system of forest relations. The existing Forest Code has already taken preparatory steps in this direction: (1) a forest parcel is declared a land property, meaning in practical terms the inclusion of forest land relations within a context of land relations where private land ownership has been recognized for the past 15 years; (2) leased forest parcels must pass state cadastre registration with boundary mapping; and (3) the application of the state registration of rights and transactions to leased forest parcels.

The next step on the agenda is political decision-making regarding the privatization of forests, which must be carefully prepared. The following must be taken into consideration: (1) risks that could lead to economic, ecological and social losses; (2) profits that state and private business could make through private forest management; and (3) legal, organizational and economic conditions for the adoption of the respective legislative acts on the privatization of forests.

The following conditions must be set forth for the privatization of forests: (1) Public opinion must be prepared, taking into consideration private experiences of forest ownership in Western countries, and ensuring toll-free access by the population for recreation, procurement and collection of edible non-wood forest products. This can be a difficult issue for Russia due to the historically negative perception by the population of private ownership of free goods that are used by citizens, such as land, forest and water. (2) The presence of government institutions capable of private forest management must be guaranteed to ensure budgetary revenues and to protect the rights and interests of owners. (3) Sufficient groups of population and entrepreneurs, capable of being private forest owners and conducting forestry management on the principles of sustainable forest management, must be available.

In relation to forest land, the formation of private forests can be conducted in accordance with two forms:

1. Natural persons will become forest owners – citizens of the Russian Federation or other countries depending upon legislative restrictions. Agricultural entrepreneurs and farmers must be granted preferential rights for the purchase of forests on the condition of private ownership. Priority targets of private forest ownership can be excluded from the agricultural land category and land suitable for forest growing.

Forest growing with subsequent transfer to forest land must be one of the conditions for privatization of forest land by natural persons (resident citizens). Development of agro-forestry farms will lead to increased employment, increased incomes, and improved working and living conditions in rural areas. Private forest ownership will create opportunities to promote economic activity in sparsely distributed forest plantations, previously subjected to intensive felling.

2. Legal persons become forest owners, primarily the leaseholders of forest parcels. The transition to private forest ownership, replacing the lease of forest parcels, must be carefully prepared. More than 15 years of the forest leasing system did not confirm its ability to efficiently manage forest resources.

The privatization of forests through buyout from the current leaseholders entails many risks: (1) market monopolization of wood raw materials; (2) the transformation of forest land into speculative capital; (3) difficulties in the implementation of forest administration for the management of private forests; (4) conflicts between government authorities and private forest owners; and (5) corruption.

A transition period will be required for the passage to private forest ownership. During this period, leases shall be substituted by concessions. The object of such forest concessions is forest land. The object of forest leases is the forest resources on the forest land. Unlike leases, concessions can create responsible private businesses in the forest sector over a relatively short period. Such businesses must become efficient forest owners.

The scale of forest privatization must not be administratively predetermined as was practised during the time of forest leasing development. Privatization of forests must be conducted exclusively for the benefit of society, taking into consideration the interests of the state, the population and private business. Private forest ownership must demonstrate its advantages in economic, social and ecological terms in competition with other forms of ownership of natural resources envisaged by the Constitution of the Russian Federation.

11. Forest policy

The Russian Federation started to elaborate the country's forest policy document at the end of 2011. Rosleshoz drew up the draft with the active participation of civil society and business. The document, entitled "Forest policy of Russia", was posted on the Rosleshoz web page for nationwide discussion in April 2012 (Rosleshoz, 2012). It is expected that the document will be adopted upon conclusion of public debate in the course of 2012 on condition of broad national acceptance. Upon approval, the policy must become the basis for improving the country's forest legislation and must ensure sustainable forest management involving both the public and business sectors.

The main objectives of the forest policy are: (1) ensuring sustainable forest management and conservation, and increasing the resource and ecological potential of forests; (2) increasing the contribution of forests to the socio-economic development of the country's regions; and (3) ensuring ecological safety and stability in meeting public demands for forest resources and services.

The goal of forest policy for the next 20 years until 2030 is to support the most favourable alternatives for forest sector development. In practical terms, this means that forest policy during the first decade (until 2020) must support the transition from the inertial to the moderate scenario. During the second decade (until 2030), forest policy must focus on completing the transition from the moderate to the innovation scenario.

11.1 FOREST POLICY IN TRANSITION TO THE MODERATE SCENARIO (2012-2020)

To ensure the smooth transition from the inertial to the moderate scenario until 2020, the following political support measures must be implemented:

1. The transition to sustainable forest management must be completed, supporting the resource and ecological potential of forests, and ensuring ecological safety and stability in meeting public demand for forest resources and services.
2. As regards property relations, forest policy must maintain the prevalence of federal forest ownership. Diversity of ownership can be only ensured through clear criteria delimiting forest land as federal, regional (subjects of the Russian Federation) and municipal.
3. The forest management system must be developed and improved through: (i) the creation of a basic forest management body and vesting it with necessary management authority; (ii) the restoration of the state forest guard service; (iii) the development of the forest planning system at federal, regional (subjects of the Russian Federation) and local (forestry district) levels; (iv) the creation of mechanisms for participatory forest management; (v) preservation, protection, management and regeneration of forests; (vi) the development of an information support system, including a forest-related information database; and (vii) the development of forest husbandry, forest inventory and a monitoring system.
4. Forest use must be improved through: (i) intensification and efficient use of forests; (ii) increased levels of advanced chemical, mechanical and energetic processing of wood raw material; (iii) improved structure and increased volumes of forest industry production; (iv) the use of available underused forest resources of the European-Ural part of the Russian Federation; (v) development of the multipurpose use of forests; (vi) widespread use of gradual, selective felling and green technologies for wood harvesting and processing; (vii) simplified public access to forest resources; and (viii) the creation of favourable conditions for small and medium businesses.

5. The preservation and protection of forests must be promoted through: (i) reduced scales of forest damage and dieback; (ii) division of responsibility for conservation and protection of forests between state, business and the public; (iii) geographic demarcation and zoning of forests by types and levels of conservation and protection; and (iv) improved coordination between government and businesses regarding fire prevention and forest protection.
6. Forest regeneration and reforestation must be enhanced through: (i) timely formation of young growth of economically valuable species on felled areas, in burned out forests, and in other categories of unused forest land; (ii) reaching a balance between forest regeneration and forest losses due to felling, forest fires, pests and other factors; (iii) increased active forest regeneration in the Russian European part and the Urals; (iv) reconstruction of low-value wood stands in the European part of the Russian Federation and the Urals; and (iv) the establishment of plant protection forest belts in the South-Eastern European part of Russia, the North Caucasus, South Urals, the Volga Region and Western Siberia.
7. The economic organization of forestry must be improved through: (i) the development of market economic mechanisms of management, conservation, protection and regeneration of forests; (ii) an improved system of forest use fees; (iii) the creation of an efficient forest financial mechanism; and (iv) guaranteed funding for the conservation and regeneration of forest resources.
8. Investments must be promoted through: (i) the alleviation of tax burdens on investments in advanced wood processing; and (ii) the crediting of forest users by deferring payment for forest utilization.
9. International cooperation must be enhanced through: (i) the creation of an attractive investment climate; (ii) the acknowledgement of forest-related international processes of vital importance to the country's economy and ecology; (iii) the development of cooperation in the sphere of inventory, conservation and protection of forests; (iv) the study and analysis of advanced foreign experience for the introduction of advanced technologies and methods of sustainable forest management; (v) the implementation of recommendations of international agreements, conventions and protocols ratified by the Russian Federation; (vi) the development of bilateral and multilateral agreements and cooperation programmes in the forest sector; and (vii) increase of the country's forest export potential.
10. Forest science and education must be improved through: (i) integration of research and development; (ii) the development of sectoral research; and (iii) the organization of fundamental research on pressing issues of forest science.
11. Scientific approaches must be enhanced through: (i) the scientific substantiation of Russia's forest policy; (ii) the elaboration of strategic measures to ensure sustainable forest management; (iii) improved methods of forest inventory and monitoring; and (iv) the development of long-term forecasts and the determination of sustainable, allowable levels of forest uses.

11.2 FOREST POLICY IN TRANSITION TO THE INNOVATION SCENARIO (2020-2030)

To ensure the transition from the moderate to the innovation scenario, covering the period from 2020 to 2030, the following political support measures must be implemented:

1. In general, the Russian Federation must ensure: (i) sustainable forest management and an increase in forest resources and ecological potential; (ii) leading positions on world pulp and paper markets; and (iii) the transformation of forestry from a subsidized sector to a profitable sector.
2. Property relations must be improved through: (i) an increase in the legal status of forests; (ii) the strengthening of legal protection of forests as a renewable

natural resource and the most important component of the biosphere; and (iii) the provision of various forms of forest and land property, while preserving predominant public property – both federal and of the subjects of the Russian Federation.

3. Forest management must be enhanced through: (i) the creation of a system of strategic planning and adaptive management of forests for all forms of ownership; (ii) the decentralization of state forest management and an increase in public participation in decision-making; (iii) increased state regulation of forest industry performance; and (iv) the restoration of vertically integrated structures of logging and wood-processing at the regional and federal levels.
4. Forest resources management must be promoted through: (i) intensification of the use of soft-leaved deciduous species, low-quality timber and wood wastes; and (ii) the integration of forest husbandry, forest inventory and forest monitoring in a unified forest management information system.
5. Conservation and protection of forests must be improved by: (i) ensuring the appropriate level of conservation and protection of forests, and a transition to forest fire management system; (ii) the creation of a centralized control system of aerial and terrestrial forest protection, and a network of forest fire management centres to assist regions in case of high risk and emergency fire situations; (iii) the creation of an integrated forest protection system on the basis of geographic demarcation, forecasts and assessment of work efficiency; and (iv) the development of methods for assessment and reduction of risks of catastrophic forest fires and expansion of forest pests and diseases.
6. Reforestation and regeneration of forest resources must be improved through: (i) the development of a permanent forest seed bank based on genetic selection; (ii) the development of a forest nursery network for the production of elite planting materials; (iii) an increase in artificial forest regeneration and the share of forestry crops with improved hereditary features; (iv) the creation of conditions for the natural regeneration of economically valuable tree species; and (v) the reduction of losses of valuable forest crops and young growth as a result of inadequate agrotechnics, infestation by low-value species, and other destructive factors.

11.3 FOREST POLICY, LEGISLATION AND INSTITUTIONS IN TRANSITION

Forest legislation must become a key instrument in forest policy implementation to ensure the transition from the inertial to the moderate and then to the innovation scenario. Forest legislation includes primary legislation (federal laws) and bylaws (instructions, decrees, etc.). Legislation that does not conform to Russia's forest policy must be repealed or revised.

The most important pre-condition for the implementation of forest policy and forest legislation during the transition period is the creation of an efficient economic mechanism in the forest sector. This mechanism must ensure the maximization of wood revenues and guarantee reimbursement of forestry expenditures. The market price of forest resources, including standing timber, must form the basis of the economic mechanism.

State forest ownership presumes that the state should manage forests and derive revenues from their exploitation. As the forest owner, the state must guarantee expenditure funding related to sustainable forest management and fulfilment of international obligations.

Decentralization of management is one of the most important trends of forest legislation in many countries, including the Russian Federation. Decentralization transfers decision-making authority closer to the people, helping to meet demand for public participation.

Legislation must contain a clear delimitation of authorities at the federal, regional and local levels. The balance of interests in forest management must be based upon the delimitation of forests by ownership forms. Authority must be transferred to the level

of executive power (federal, regional and local), at which it can be implemented in the best possible way.

A particular place in forest legislation must be reserved for public participation in forest management. The possibilities of public participation vary from simple notification to obtaining consent prior to decision-making. The most common forms of public participation are consultative councils of different levels. Membership and plenary powers of consultative councils can vary a great deal.

All the categories of stakeholders – government, non-governmental organizations, central and local institutions, business, communities and forest-dependent people – must be involved in drafting the country's forest policy and forest legislation. Such an approach will ensure the enactment of real laws that will be accepted.

The Forest Code of the Russian Federation must include implementation mechanisms for the fulfilment of obligations resulting from international agreements, conventions and protocols. It must set conditions to attract investment to the forest sector and promote international cooperation.

12. Education and staff, science and technology

12.1 EDUCATION AND STAFF

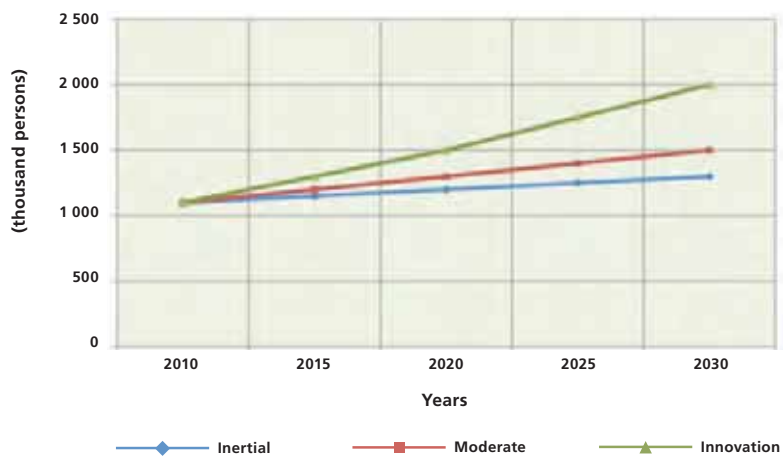
As of 1990, about 2.1 million people were employed in the forest sector of the former Soviet Union, including about 1.7 million people in the RSFSR (in 1991, the Russian Soviet Federative Socialist Republic was renamed the Russian Federation).

Over the last twenty years, the number of employees has decreased to 1 million due to the following reasons: (1) decrease in volumes of timber harvesting and forest regeneration; (2) increase in labour efficiency at logging sites and mechanical wood-processing enterprises; (3) reduction in administrative staff due to computerization; and (4) institutional reforms in the forest management system and the liquidation of the state forest preservation service.

Out of total employment in the forestry sector, 40 percent are employed in forestry and logging operations and related services, 45 percent are employed in wood processing and manufacturing of forest products, and the remaining 15 percent are employed in pulp and paper production. Figure 12.1 shows the employment forecast in the forest sector until 2030, in accordance with the adopted scenarios of forest sector development.

From 1992 to 2010, some negative changes took place in the area of scientific support of the forest sector. A series of scientific institutions were dismantled. The total number of staff, mostly researchers, was reduced. The number of scientific employees in federal forest institutions was reduced by five times and currently comprises about 600 researchers, of which 132 have a PhD, and 37 have an ScD. The average age of the latter is 65. Institutions that ensure scientific follow-up of the forest industry employ about 300 researchers of which only 10 have an ScD and 70 have a PhD. Ten organizations and institutions of the Russian Academy of Sciences participate in fundamental forest sector research, employing about 1 000 people including 600 PhD and ScD researchers.

FIGURE 12.1
Employment in the forest sector (thousand persons)



The university potential of forest research is not fully utilized. Out of ten leading universities specialized in forestry, over 2 000 scientific employees, including 600 PhD and ScD researchers, participate in forest sector research. The total number of researchers conducting fundamental and applied research for the forest sector amounts to about 3 500 scientific employees, including about 1 400 with academic titles.

An expert estimate of the needed increase in number of researchers ensuring forest sector development is shown in Figure 12.2. The information refers only to state sector scientific and educational institutions. Assessment of private sector participation in scientific research is uncertain. Currently, this participation is practically absent.

Figure 12.3 reports an assessment of the financial requirements for forest science in the public sector for different scenarios of forest sector development.

In 2010, the volume of funding of all scientific research amounted to 450 million roubles, that is, equivalent to 0.08 percent of the gross domestic product (GDP) of the forest sector. Education has a leading role to play in the innovative development of the forest sector. Currently, basic vocational education is provided by 108 vocational schools and training colleges, which in 2010 trained 17 200 skilled workers for professional occupations in the logging, wood processing, and pulp and paper branches of the forest sector. Intermediate vocational education is provided by 110 secondary technical schools and colleges that produce annually about 5 000 specialists. In 2010 the number of graduates amounted to 4 700 persons. Fifty-two higher educational institutions under the jurisdiction of the Ministry of Education and Science and the Ministry of Agriculture provide higher vocational education. In 2010 they produced 6 200 professional graduates and 400 bachelors and masters. The total number of trainee students amounted to 30 400 persons.

Improvement of forest education will take place in line with the following approach. Vocational training resource centres will be formed on the basis of vocational schools, training schools, secondary technical schools and technical colleges. General educational functions will be transferred to the general education system. Existing non-governmental training facilities will become a fully legitimate part of the national vocational training system. New educational institutions will be set up on the basis of state and business cooperation. All vocational training institutions, irrespective of the form of ownership, will be granted access to budgetary funding following tender results. A professional community representative must be incorporated into the governing bodies of educational institutions.

FIGURE 12.2
Number of researchers (persons)

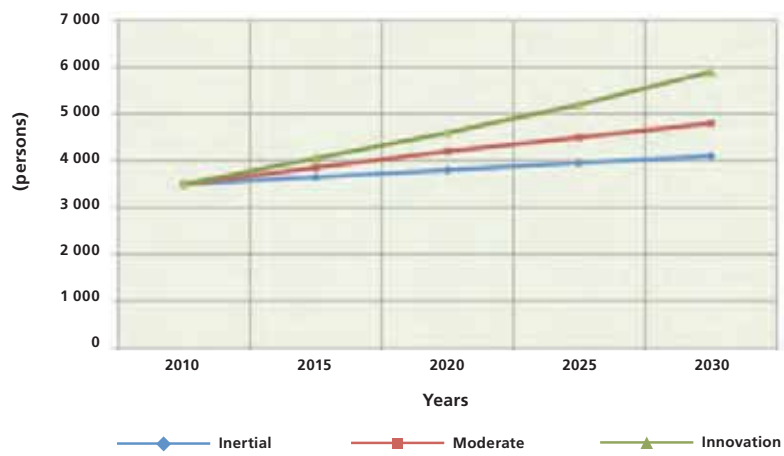
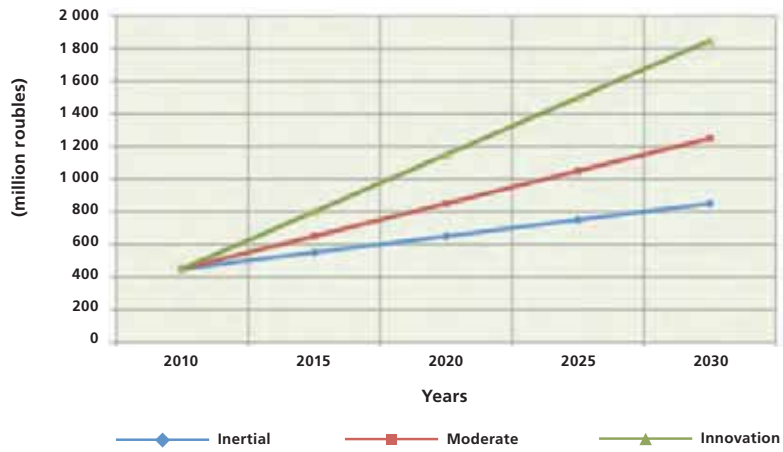


FIGURE 12.3
Financial requirements of forest science (million roubles)



Optimization of the higher education institutional network is planned through the concentration of resources. Until 2030, state support will be granted to 8-10 leading research and education centres, integrating advanced scientific research and educational programmes. The role of socio-professional accreditation of higher educational institutions will increase. The introduction of educational loans will contribute to the accessibility of higher professional education and the promotion of competitiveness between higher educational institutions. Scholarship funds in educational institutions will increase considerably.

Additional conditions will be created for business participation in the formation of educational programmes, the governing of higher educational institutions, and the formation of independent higher education institution ratings by specialties. National and international academic mobility programmes for academic staff and students will be developed and implemented. Figure 12.4 and Figure 12.5 report the results of expert assessment of demand for staff with basic, intermediate and higher professional training for the three forest sector development scenarios.

Figure 12.6 indicates federal budget expenditure for forest sector staff training for all educational levels. In 2010 expenditure amounted to about 5 billion roubles. Expenditure was distributed by educational levels in the following way: (1) higher professional education, 3 billion roubles; (2) intermediate professional education, 1.5 billion roubles; and (3) basic professional education, 0.5 billion roubles.

For the innovation scenario, the expenditure share for forest education in proportion to GDP will increase during the 2010-2030 period from 0.86 to 0.99 percent. The projected financial demand for forest science and education in the innovation scenario will ensure the sustainable development of the forest sector in the context of growing economic and environmental requirements.

12.2 BREAKTHROUGH TECHNOLOGIES AND INNOVATIONS

Breakthrough technologies are the only route to the innovative path of development. The European Forest Sector Outlook (UN, 2012) notes that innovation might improve the outlook in any of the policy scenarios. A twenty-year delay in the development of the forest sector in the Russian Federation has opened up a unique possibility for implementation of the innovation scenario through the overall reconstruction of existing enterprises on the basis of scientific achievements of the preceding decades, and

FIGURE 12.4
Demand for staff with basic and intermediate professional training

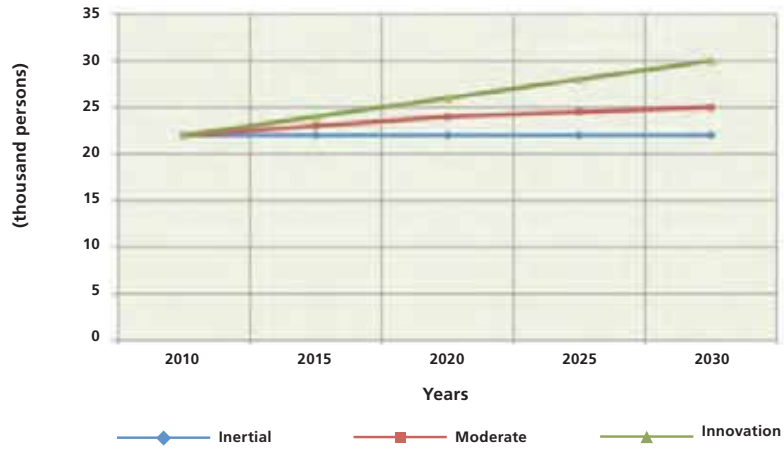
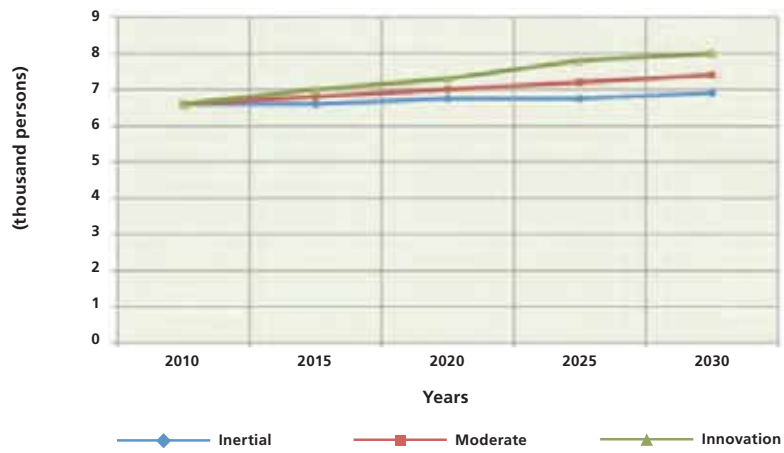


FIGURE 12.5
Demand for staff with higher professional education



next-generation techniques and technologies. The most viable way of reconstructing existing enterprises is the transition to the manufacturing of science-intensive products. For many branches of forest industries, this approach is the only way to survive under conditions of global competition and free trade.

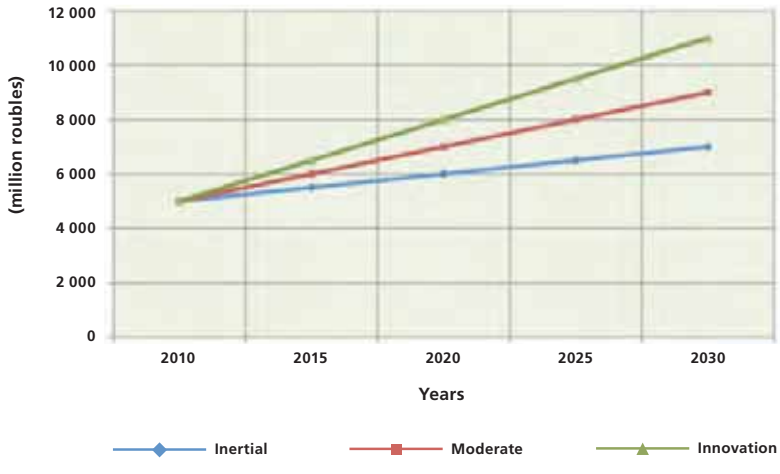
Forest sector enterprises that were projected and built in the mid-twentieth century are now subject to complete reconstruction. This will enable the creation of fundamentally new enterprises of the twenty-first century, bypassing stages undertaken by leaders of the world forest sector during the past decades. In other words, Russia's forest sector must skip over the past decades and adopt next-generation technologies. Implementation of such a model of technological and intellectual breakthrough requires very serious scientific support, trained staff, and forecasts for markets and development trends for decades ahead.

Breakthrough technologies in the forest sector include information technology, nanotechnology and biotechnology. *Information and computer technologies* are used

in the process of creating geoinformation systems (GIS). These systems can assess and update data on actual growing stock and elaborate an optimal strategy for timber harvesting. Geoinformation systems can monitor logging and wood transportation, forest fires, supply chains and water reservoirs during the construction of hydro-power plants. Development of these technologies has led to structural changes in the variety of paper products. In particular, a new class of paper has appeared – office paper. Its share in the global market of paper and paperboard is growing fast. At the same time, the share of newsprint paper is decreasing. The development of computer technologies in the construction industry has led to the new "smart house" concept. Joint use of computer technologies and second-generation biofuel (pellets) in individual automated heating systems has enabled the "green construction" of houses. Heating of such houses is programmed by days of the week and time of day and is characterized by high wood-combustion efficiency. The combination of wooden house building, computer technologies and wood pellets will ensure a synergistic effect, improving the ecology and economy of the forest sector.

Nanotechnologies are used for obtaining new types of composite materials based on wood and its components. *Biotechnologies* are realized through the creation of new industrial wood-processing technologies. Big, diversified biotechnology industries use renewable resources and produce different types of materials and biofuels, organic solvents, chemical compounds, fodder and energy. Such enterprises are commonly called bioprocessing plants or biorefineries. Wood biorefining is considered the main area for the development of the pulp and paper industry in European Union member states and North America. In these countries, biorefining is associated with the transition to a business diversification model. Currently, first-generation bio-processing plants are widespread worldwide. They use food raw materials and are predominantly oriented towards biofuel production. In the next 10 years, the emergence of second-generation bioprocessing plants is expected. These will be capable of the economically viable utilization of inedible biomass – wood and wooden residues, lignocellulose, microalgae, and urban and agricultural waste. At present, there is extensive worldwide use of so-called "dietary fibres" obtained from wood raw materials and microcrystalline cellulose (MCC). These products are almost totally imported to Russia. The so-called "fodder fibres" obtained from wood raw materials are now widely used.

FIGURE 12.6
Demand for funding for forest education (million roubles)



Progress towards a green economy or bioeconomy is the main evolutionary path for the entire forest sector. The green economy is based on sustainable production and the use of renewable resources and energy. It is useful to begin an analysis of the prospective range of innovations for the development of the Russian forest sector with a review of global forest sector development over the last two decades. This will enable a selection of potential approaches relevant to the Russian forest sector for the period until 2030 and beyond.

In April 2012, the Chairman of the Government of the Russian Federation validated a complex biotechnology development programme in the Russian Federation until 2020 (BIO-2020, 2012). It is based upon best global and national technologies for developing high-quality forest products.

The development of sustainable forestry is based upon a series of breakthrough innovations, including technologies of combined management of natural forests and plantations. This combination is crucially important for sustainable wood supplies to the pulp and paper industry, especially during reconstruction of operational factories. The reconstructed enterprises have mostly used up their resource bases during the last 40-50 years. The further efficient operation of these enterprises will depend on increases in the distance and cost of wood transportation. The BIO-2020 programme suggests increasing the size of fast-growing forest plantation areas to 20 000 hectares by 2015 and to 100 000 hectares by 2020.

The development of principles and approaches to the substantiation of forms, types and ages of forest felling foresees: (1) scientific substantiation of the felling age of forest stands in specific forest groups; (2) the development of advanced logging technologies; (3) the development of a scientific basis and principles of forestry management for energy use; and (4) the development of multipurpose management and regeneration of forests, the growing of specific plantations to meet multiple demands of the forest industry, and the increase of forest conservation and protection levels.

The use of breakthrough innovations is particularly efficient in cross-sectoral research and development within the forest sector, together with the other sectors of economy. The BIO-2020 programme predicts increased use of biopreparations in oil and gas extraction by five times by 2020, in comparison with 2010. The biomass share of the total output of the chemical and petrochemical industry must increase by 15 percent.

A special place is reserved in the BIO-2020 programme for the creation of biodegradable packages and packaging materials. The programme envisages bringing the share of biodegradable materials in the total volume of consumable polymer products in 2020 up to 10 percent, and up to 30 percent if the packaging sector is included.

The BIO-2020 programme predicts an increase in solid biofuel production from 3 million tonnes in 2010 to 18 million tonnes by 2020. In the field of bioenergy, the following priority spheres of scientific and technical research and development have been proposed: (1) the manufacture of solid and other biofuels; (2) technologies for combined generation of heat and power with considerable increase of electricity output; (3) wood biorefineries with combined production of cellulose, and (4) a range of new chemical products, in particular, biodegradable polymers, energy and biofuel.

Technology platforms are among the most effective vehicles for launching breakthrough technologies and innovation scenarios on the basis of state-private cooperation. At present, the European Union (FTP, 2012) and North America (Agenda 2020, 2012) are following this approach.

The Russian forest-based sector technology platform (2012) is an integral part of the Russian technology platform "Bioindustry and bioresources" (BioTech2030, 2012). The platform contains 19 fields, eight of which directly concern the pulp and paper industry. The national research programme of the Russian platform was developed in cooperation with the European forest-based technology platform. It examines a series of breakthrough innovations, covering technologies and materials, as well as

the principles of their combined use. At the same time, the programme pays attention to the best available technologies, the concept of which was inserted into ecological legislation of the European Union, the United States and the Russian Federation. The problems of mitigating global climate change, carbon and water footprints, energy savings, and increasing energy efficiency are fundamental at all stages of the life cycle of products, materials and technologies. All these issues must be considered as steps towards a green economy.

The goal of the "pulp and paper products" section of the Russian forest-based technology platform is the creation and realization of an innovative development model for the Russian Federation pulp and paper industry, principally on the basis of the gradual ecological and technical reconstruction of existing enterprises. The realization of this approach, however, leads to a series of new issues and problems related to stable timber supply, increase of energy efficiency, and the need to resolve a series of ecological problems. In the Russian Federation, which is the birthplace of oxygen bleaching, the transition to chlorine-free bleaching has been unreasonably delayed. At present, the Russian Federation is practically the only country that continues to use molecular chlorine for bleaching. The transition to chlorine-free bleaching during the reconstruction of existing enterprises only partially resolves the problem. The problem of the utilization of accumulated sludge and the reconstruction of sludge reservoirs remains. These reservoirs contain millions of tonnes of hazardous sludge, including organoclorines. In this case, application of biotechnologies is the principal solution.

Along with the increase in consumption of paper and paperboard products, diversification of their raw material base will proceed. The scientific basis for the optimization of wood pulp structure and the wider use of secondary fibre and mineral fillers, is to be developed. Innovative development of the pulp and paper industry will include: (1) the development of resource and energy-saving technologies for manufacturing cellulose, chemical-thermomechanical pulp, paper, paperboard and processing of waste paper; and (2) the creation of a new range of competitive types of paper, paperboard and composite materials in accordance with the best available technologies, to provide import substitution and ensure integration of the Russian Federation into the global pulp and paper product market, including (i) the development of technologies for manufacturing printing paper, including coated paper, paper for digital printing, and coated paper for different uses on the basis of chemical-thermomechanical pulping and cellulose produced without chlorine; (ii) the creation of new biodegradable packaging materials for common technical and specific uses; (iii) the production of new types of paper and paperboard with ecologically safe barrier coating; (iv) the development of perspective technologies for the production of technical, tissue paper and composite materials; and (v) the introduction of new types of paper and paperboard using nanotechnology and innovative chemicals.

At the same time, a series of changes are necessary to reduce the environmental pressure of pulp and paper enterprises: (1) the transition to chlorine-free bleach; (2) the optimization of water management systems and the reconstruction of water rotation systems; (3) the transition to energy-saving technologies and use of waste for manufacturing and as energy; (4) a reduction in the quantity and toxicity of liquid, gaseous and solid waste as a result of the transition to best available technologies; (5) the introduction of advanced technological processes, new equipment and materials; (6) the development of assessment criteria for damages caused by pollution by chemical substances; (7) the alignment of Russian industrial safety rules and regulations with international standards; and (8) the use of wood-processing waste for reclamation of industrial landscapes. The combined use of breakthrough technologies can produce a synergistic effect and will facilitate the innovation scenario.

The following ecological indexes can be achieved in the pulp and paper industry by 2030: (1) the utilization rate of secondary fibre, 52 percent; (2) the percentage of

cellulose bleached by chlorine-free technology, 100 percent; (3) reduction of specific water consumption, 55 percent; (4) energy savings, 30 percent; and (5) the use of biofuel, 70 percent of total energy consumption.

The implementation of priority investment projects with innovation elements is a key approach in the transition towards the innovation development scenario. One such example is the "Larch" project on vegetative polymers, a joint project of the JSC ILIM GROUP and SPbGTURP. The "Larch" project is directly related to the innovative development of the forest sector on the basis of private-state partnership. The state allotted a 150 million-rouble subsidy and the JSC ILIM GROUP will spend an equal sum. Realization of the project will enable the Russian forest sector to take a new conceptual step forward in the resource management of Siberia and the Far East. This means a fundamental change of the existing wood raw material base in an economically accessible zone.

The provision of staff and staff training for the operation of innovative technologies is of particular importance for the successful realization of investment programmes related to pulp and paper enterprises. The manufacturing of science-intensive products would require qualified staff and innovative training and re-training. Specialists will be required that have a vast knowledge in technologies, science-intensive types of pulp, paper and paperboard, packaging materials, resource savings, optimization of water management, and the creation of new materials and technologies.

Innovative methods of organizing research and development (R&D) activity include (1) utilization of the private-state partnership mechanism; (2) the synchronization of fundamental, applied, experimental and technological work; (3) the specifically oriented development of an experimental base, scaling in the process of transition from research activities under laboratory conditions to experimental and industrial testing; and (4) system-oriented analysis of the state and development trends of global forest product markets. The innovative approach envisages: (1) integration of the scientific potential of Russian universities and academic institutions; (2) systematic involvement in the work of leading foreign scientists and experts; (3) the use of modern research equipment of national and world scientific centres; and (4) the vast involvement of students, postgraduates and young scientists in participatory projects. The mechanism of the Russian and foreign technological platforms includes cooperation with international UN structures and non-governmental organizations.

One of the key elements of bioeconomy construction in the Russian Federation is international cooperation. Scientific research, engineering, the organization of new production facilities, market development – all these tasks require the active participation of international companies and experts; the integration of efforts of Russian scientists and entrepreneurs in the global production system of new knowledge, technologies and products; and cooperation with the structures of the United Nations organization (e.g. FAO, UNECE), and European and international organizations.

Conclusions and recommendations

AIM AND GOALS OF THE OUTLOOK STUDY

The aim of this Outlook Study is to provide an objective and independent assessment of the current state and perspectives of the Russian Federation forest sector until 2030. The federal government authorities initiated the project by agreement with FAO, stimulated independent research, participated in the supervisory board, allocated all resources and data required for the work, and examined and assessed the obtained results.

The research goals are: (1) independent and objective analysis of the current state of Russia's forest sector over the last 20 years; (2) proposals for the most efficient path of development for the next two decades; (3) assistance to politicians in informed decision-making; and (4) increase of openness, transparency and investment appeal of the Russian forest sector for national and foreign investors.

METHODS

The research methodology is based upon comparison between demand and supply of forest resources. This methodology differs in principle from the elaborated methodology of the draft programme "Development of forestry for the period of 2012-2020" (Rosleshoz, 2012a) and the "Strategy of the development of forest sector of the Russian Federation until 2020" (Prikaz Minpromtorga, 2008) where the conclusions are based upon supply of resources. In the authors' opinion, the proposed model better reflects the market realities of the forest sector. Forecasting difficulties stemmed from the absence in Russia of an office on continuous monitoring and forecasting of demand for forest products in domestic and external markets. The problem was resolved through expert assessments; however, these cannot replace the comprehensive scientific monitoring of demand. *The authors of the report recommend that federal authorities institute an official structure devoted to monitoring, forecasting and elaborating proposals on stimulating demand for forest products in the Russian Federation.*

CURRENT STATE OF THE FOREST SECTOR

For most of the last 20 years following the collapse of the former Soviet Union, the Russian forest sector has experienced transitional difficulties. The short period of recovery at the beginning of the twenty-first century was interrupted by the 2008–2010 global financial crisis. In the meantime, technologies in the world were progressively developing and improving, and new-generation technologies and new ideas emerged. As a result, a technological competitiveness gap expanded between Russia and the leaders of global forest markets. At present, Russia accounts for 20 percent of global forests, but its share in the global trade of forest products does not exceed 4 percent. The potential of Russian forests is considerably underused and underestimated by the country's political leadership.

FOREST RESOURCES

By 2030, the total forest area of Russia must increase by 0.9-1.5 percent, growing stock must increase by 2.4-5.0 percent, and the annual increment by 7.7-10.4 percent. Carbon stock will increase by 2.0-4.7 percent and net ecosystem production (NEP) by 7.2-10.1 percent. The study recommends including the NEP indicator in the FAO *Global Forest Resources Assessment* report. Damage caused by fires and pests will increase, but will not have any significant impact upon the general positive trend in growing stock. This study recommends launching continuous assessment of economically accessible forest resources and annual allowable cuts in Russia, excluding all physically and economically

inaccessible forests. It also recommends expanding protective afforestation, which must form part of the innovation scenario in order to increase the forestry and agricultural potential of the country.

FOREST INDUSTRY SECTOR

The manufacturing of primary products will increase until 2030: roundwood by 1.6-2.1 times, sawnwood by 1.5-2.7 times, plywood by 1.5-2.1 times, particle board by 1.6-2.1 times, fibreboard by 1.7-2.5 times, pulp by 1.6-1.9 times, paper and paperboard by 1.9-3.3 times, and wood-based biofuel by 2 times.

The innovation scenario requires the spatial and structural reorganization of the forest sector. Underused annual growth in sparsely and moderately wooded European forests, amounting to 255 million cubic metres, ought to be used. To this purpose, it is recommended to double the volume of timber harvesting in these regions by 2020, and to triple it by 2030. In such a case, only half of the growth will be used. Expansion of intermediate cutting will be required with a view to substituting low-quality stock with high-quality forests. Politicians are recommended to revise normative legal acts prohibiting timely renewal and conversion of forests in sparsely and moderately wooded regions. In case of intensification of forestry in the aforesaid regions, the conditions will be created for the ecological restoration of the forests along with reinforcement of their environmental protection and social functions. A radical rise in the investment rating of Russia will be required to support the innovation scenario.

CLIMATE

The total carbon sink in the Russian forests accounts for 500-700 million tonnes of carbon per year. Russia provides up to 90 percent of the carbon sink in global boreal forests, including Canada and Scandinavia. If the warming forecast for the end of the century becomes a reality, the carbon emissions from Russia's permafrost territories might exceed current emissions due to tropical deforestation by several times, and Russia will transform from a carbon recipient to a net carbon emitter. The Outlook Study recommends adding the permafrost problem to the international agenda with a view to undertaking an in-depth study and inserting the issue into the international negotiation process on climate change. The Study also recommends changing to a complete accounting of the impact of forests on the global budget of greenhouse gases.

FOREST CERTIFICATION

Depending upon the scenario, the area of certified forests in Russia will increase by 2.4-4.2 times and will exceed 100 million hectares in 2030 in accordance with the innovation scenario. Expenditure on certification will decrease owing to the competitiveness of certifying agents. The development of market demand for certified forest products is a necessary condition.

ILLEGAL WOOD

According to official data, reported by Rosleshoz, illegal logging in 2010 amounted to 1.3 million cubic metres, that is, less than 1 percent of total logging countrywide and in line with the best global forestry standards. According to independent assessments (WWF Russia and World Bank), up to 20 percent of logging (approximately 35 million cubic metres) is of illegal or doubtful origin. The total volume of the illegal wood trade can amount to 13-30 billion roubles per year. Depending upon the scenario, a decrease in the illegal wood trade of 5-80 percent has been predicted. This study recommends the establishment of a clear legislative definition of the concept of the illegal wood trade. To ensure an efficient and sustainable resolution of the problem of illegal logging, macroeconomic problems must be resolved that far transcend the forest sector boundaries – primarily, unemployment and the low income of the rural population.

POLICY AND INSTITUTIONS

The draft forest policy of Russia is under discussion. Its adoption is expected pending majority agreement. Upon adoption of the document, existing institutions and legislation in the forest sector must be put in compliance with the goals of Russia's forest policy. Forest policy must create conditions for the transition from the inertial to the moderate scenario (until 2020), and then from the moderate to the innovation scenario (until 2030). The policy must contain measures for the support of forestry, the forest industry, demand for forest products, investments, science, education, forest trade, international cooperation and collaboration with international organizations.

SCIENCE AND EDUCATION

Innovative development of the forest sector in the Russian Federation will require substantial provisioning with staff and scientific assistance. The scientific community is expected to rise by 1.1-1.7 times by 2030. State funding of science will increase by 1.9-4.1 times. The provisioning of the forest sector with qualified staff with basic and intermediate professional education will increase by 1.1-1.4 times. The number of managerial staff with higher education will increase by 1.1-1.2 times, amounting to 8 000 persons. In 2030, the educational budget will increase by 1.4-2 times and will reach 2.2 billion roubles or about 1 percent of forest sector GDP. The wide use of technological platforms is recommended to provide staff support and scientific assistance under the innovation scenario, and also for the development and introduction of breakthrough technologies and innovations in Russia's forest sector on the basis of private-state partnerships.

HISTORICAL CHANCE

The twenty-year delay in the development of the Russian forest sector has opened up a unique historical possibility to radically renovate and reconstruct its key branches on a fundamentally new technological basis for the twenty-first century. This must be achieved through the introduction of breakthrough technologies and innovations in the leading branches of the forest sector. This conclusion relates to techniques, technologies, policy, institutions, science and education. With the help of breakthrough technologies and innovations, the Russian forest sector should bypass the twenty-year gap and integrate into the global economy as a renovated, competitive and innovative segment. For many branches of the Russian forest sector this is likely the only route to survival in the face of global competition and free trade. Implementation of the innovation development scenario of the forest sector, however, will require considerable scientific backup, increased staff provision, insight, forecasting of global market demand, and active stimulation of domestic consumption of forest products.

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The main purpose of this Outlook Study is to present an independent expert evaluation of the current state of the forest sector in the Russian Federation and possible alternatives for its development to the year 2030. The study analyses the main systemic problems of the forest sector in the country and offers potential solutions. The concept of the study rests on the comparison of supply and demand for forest resources. It examines key areas, such as forest regeneration, conservation and protection, climate change impacts, legality of wood, the role of certification, forest ownership, policy, education, and breakthrough technologies and innovations.

The forest sector forecast is based on three development scenarios: inertial, moderate and innovation. The study recommends a gradual transition from inertial to moderate and then to innovative development. This approach relates not only to engineering and technology, but also to politics, governance, science and education.

The Outlook Study has been designed to aid policy-makers in developing and implementing informative decisions. It aims to increase the openness, transparency and investment attractiveness of the Russian forest sector for national and international investors.

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