sand ha; which is 0.1% of the forested land of the Forest Fund (Table 12). Almost half of the area of these forests has the degree of dieback 10% and less.

About 53.0 thousand ha of forest has died every year (average for 1998–2008) because of the negative impact of biotic factors; it is about 0.009% of the forests. The major reason for the mortality is the damage from pests, which cause the death of 75% of the forest died due to biotic factors. Diseases and animals are responsible annually on average for 13.0 and 0.5 thousand ha of dead forest respectively (Table 13).

Indicator 3.b. Area and percent of forest affected by abiotic agents (e.g. fire, storm, land clearance) beyond reference conditions

Abiotic agents with negative impact on forest are forest fires, severe weather conditions, and anthropogenic impact. About 300 thousand ha of forests dies annually because of these factors,

Table 12.

Damage of the Russian forests caused by Biotic Agents

Biotic Agents	Damaged area						
	Total	Including with different degree of dieback, % from stock					
		10% and less		11–40%		More then 40%	
	Thousand ha	Thousand ha	%	Thousand ha	%	Thousand ha	%
Pests	291.43	152.98	52	80.43	28	58.02	20
Diseases	445.34	189.33	42	191.00	43	65.01	15
Wild and domestic animals	0.23	0.05	22	0.03	13	0.15	65
Total	737.00	342.36	46	271.46	37	123.18	17

Table 13.

Dynamics of dead forest areas affected by biotic agents

Year	Pests		Diseases		Wild and domestic animals		Total	
	Thousand ha	%	Thousand ha	%	Thousand ha	%	Thousand ha	%
1998	3.1	33.3	5.1	54.9	1.1	11.8	9.3	100.0
1999	3.6	36.7	6.0	61.3	0.2	2.0	9.8	100.0
2000	20.4	73.6	5.8	20.9	1.5	5.4	27.7	100.0
2001	15.5	66.5	7.2	30.9	0.6	2.6	23.3	100.0
2002	21.1	72.0	8.0	27.3	0.2	0.7	29.3	100.0
2003	52.0	87.0	7.5	12.5	0.3	0.5	59.8	100.0
2004	204.8	92.5	16.4	7.4	0.3	0.1	221.5	100.0
2005	30.1	61.7	18.5	37.9	0.2	0.4	48.8	100.0
2006	26.6	45.7	31.3	53.8	0.3	0.5	58.2	100.0
2007	22.4	48.3	23.8	51.3	0.2	0.4	46.4	100.0
Average	40.0	74.8	13.0	24.3	0.5	0.9	53.5	

The pathological monitoring of forests is conducted annually for timely detection of any pathological changes in forests.

The pathological monitoring of forests is a system of data collection, analysis and use of information about forest pathology condition, including areas affected by pests classified as quarantine. It is organized and conducted on the basis of zonal forest protection regionalization. A preliminary forest protection regionalization showed that the zones of forest pathology threat of diseases and perts in the Russian Federation as a whole are:

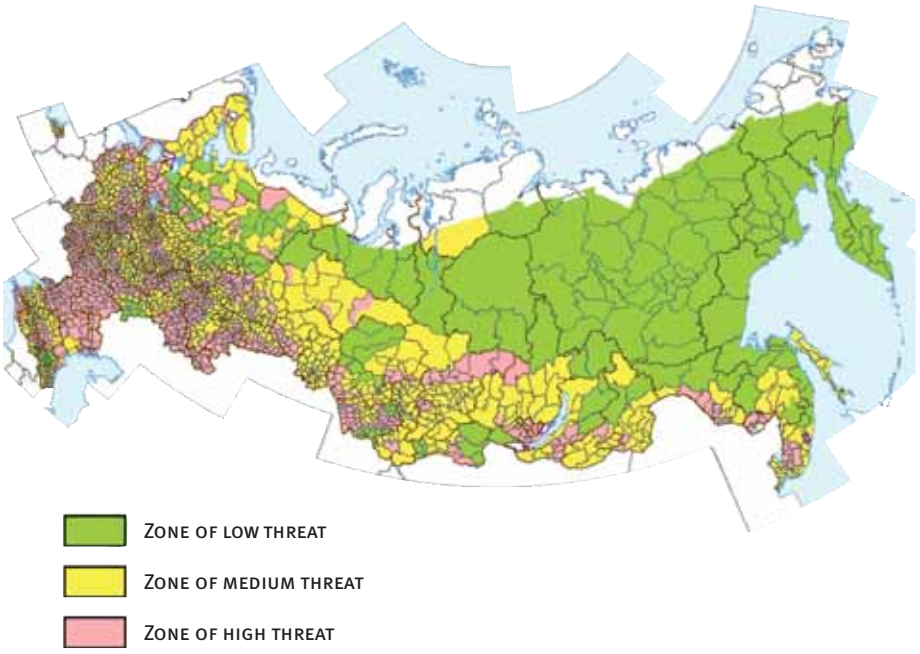
- *zone of low threat – 408,352.0 thousand ha (52.8%)*
- *zone of medium threat – 288,781.9 thousand ha (37.4%)*
- *zone of high threat – 75,804.3 thousand ha (9.8%).*

For every constituent entity of the country forest protection regionalization is represented in the form of tables on the distribution of forest land in the zones of threat and as the maps.

In 2008, forest pathology monitoring was conducted by selected on-ground methods on 76.3 million ha, and at the same time the data from 12.7 thousand permanent monitoring stations were collected and processed.

The remoteness and inaccessibility of pest and diseases affected areas, especially in the forests of Siberia and the Far East, make it difficult to organize and maintenance a network of forest pathology monitoring.

Zones of forest pathology threat scheme



and this is about 0.05% of forested area in the Forest Fund (Table 14).

Forest Fires. Forest fires are the main cause of death of forest. During 1998–2008, fires had been responsible for 67% of all dead forests and 76% of forests dead due to abiotic agents (see Table 14).

The surface fires occur more frequently than others types of fire. They are spreading over the forest litter, leaf debris, and the lower level of forest. The area affected by this type of fires is about 90% of all burned forests.

The major ignition cause is the anthropogenic factor: people directly responsible for 72% of forest fires (Fig. 22). These fires occur often in high developed populated areas.

From 1998 to 2008 annually, from 16 to 37 thousand forest fires started in forests under Rosleskhoz management; burned areas were from 0.4 (2004) to 2.0 (2008) million ha (Fig. 23). In

Table 14.
Dynamics of Forest Mortality due to abiotic agents

Year	Forest fire		Unfavorable weather conditions		Anthropogenic impact		Total died forest
	Thousand ha	%	Thousand ha	%	Thousand ha	%	Thousand ha
1998	245.9	91.5	15.3	5.7	7.6	2.8	268.8
1999	268.4	92.7	20.1	6.9	1.1	0.4	289.6
2000	637.4	94.1	38.2	5.6	1.9	0.3	677.4
2001	131.1	43.2	11.3	3.7	161.1	53.1	303.5
2002	286.0	93.8	16.4	5.4	2.6	0.9	305.0
2003	471.9	96.1	16.4	3.3	2.8	0.6	491.1
2004	138.6	76.3	40.6	22.3	2.5	1.4	181.7
2005	451.1	49.5	456.0	50.0	5.0	0.5	912.1
2006	154.0	71.1	55.3	25.5	7.4	3.4	216.7
2007	197.5	76.9	56.4	22.0	2.8	1.1	256.7
2008	158.1	63.0	33.8	13.0	16.4	7.8	199.7
Average	285.4	76.3	69.3	18.5	19.2	5.2	373.9

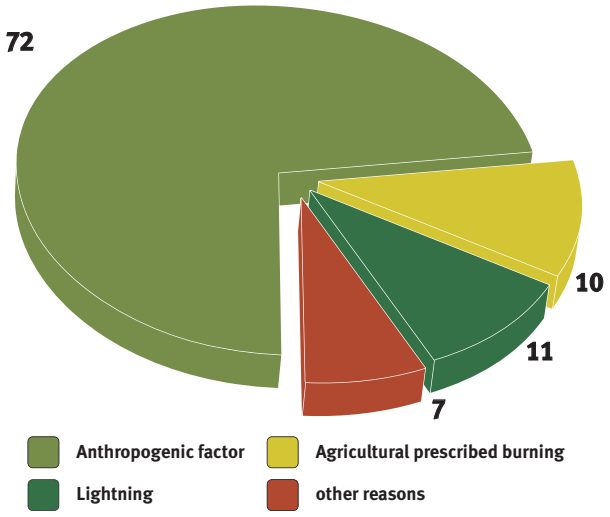


Figure 22. Forest fires and ignition causes, %

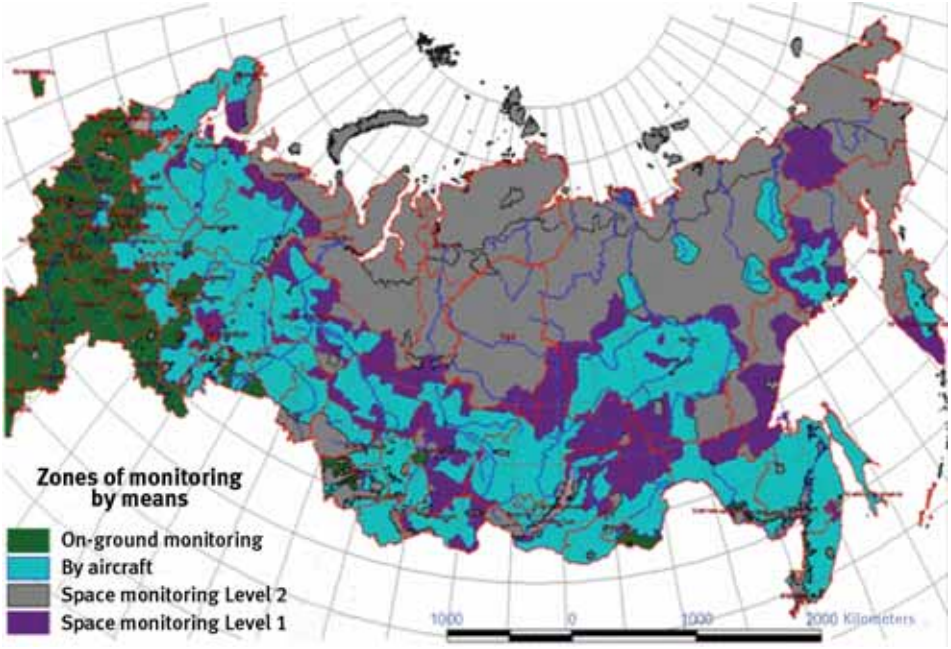
2008, several constituent entities of the Russian Federation had abnormal weather conditions that complicate the fire situation. But not only this was the cause of the lack of effectiveness of the fire fighting services. The executive authorities of the most constituent entities of the Russian Federation were not fully prepared for the fire season. According to the Forest Code of the RF, the authority for the management of forests, including the full cycle of works for the conservation and protection of forests, was transferred from federal to regional level. In 2008, fires killed 206.9 thousand ha of forest stands and damaged to varying degrees the stands on 604.8 thousand ha.

In 2008, in the Forest Fund of the Russian Federation 25 thousand forest fires started. According to the official statistics, in the zone of active using of forest and developed infrastructure fire had spread over the 2.0 million ha.

The average area of the fire was about 90 ha.

Radioactive forest contamination. Chernobyl Nuclear Power Plant accident and several technogenic catastrophes in Ural resulted in radioactive contamination of the Forest Fund land on the area about 1,200 thousand ha.

The Forest Fire Monitoring controls all territory of Forest Fund in the RF by means of ground observations, aviation, and space satellites. The aerial monitoring of fires and protection of forests and reindeer pastures are the responsibilities of The Central Base of Aerial Forest Fire Protection (FSD Avialesookhrana) (www.aviales.ru). They are working together with MNR, Rosleskhoz, Russian Ministry of Transportation, Ministry of Emergency Situations, other federal executive bodies, and also with public authorities of the constituent entities of Russian Federation. 32 aviation bases for serving 466 million ha of forests were organized in constituent entities of RF. «Rosleskhoz Information System of distant fire monitoring» for receiving and processing data from satellites is working on the base of the regional subdivisions of FSD Avialesookhrana and centers for receiving and processing data from satellites.



Zones of forest fire monitoring

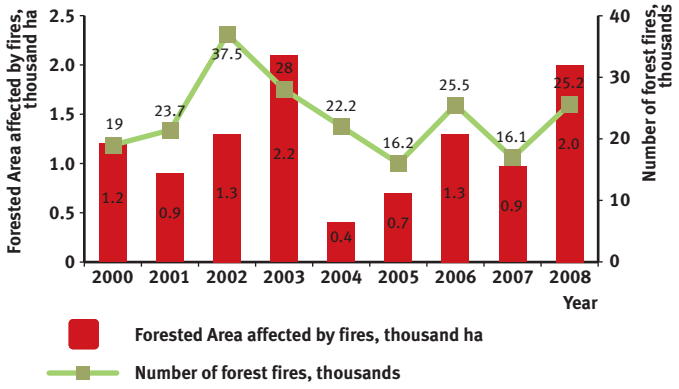


Figure 23. Dynamics of forest fires in Russia

The radioactive contamination changed the natural properties of the forest and forced to change the forest management and forest use considerably. Nineteen constituent entities of the Russian Federation are in the contaminated zone (Fig. 24). The ecological implications of the forest radiation contamination have extremely long-term nature, because long-lived isotopes cesium-137 and strontium-90 as a result of the decay of radionuclides get involved in the biological cycling of matter, and the radiation environment in contaminated forest changes very slowly. Rosleskhoz annually monitors radiation environment in forests once exposed to the radiation. Results of forest radiation monitoring are used by the Interdepartmental Commission on Radiation Monitoring of the Environment and serve as a basis for the establishing a regime of management, planning and implementation of activities on radiation safety in the constituent entities of the RF.

The greatest danger in polluted areas is forest fires. The problem of radioactive contamination of forest will remain important during next decades (at least during two half-lives of ^{137}Cs and ^{90}Sr).

Radiation control inspections of the internal and export markets did not detect any cases of contamination by radionuclides ^{137}Cs and ^{90}Sr in forest products.

Illegal cutting. A major cause of anthropogenic impact on forest ecosystems of Russia remains illegal cutting. Illegal cutting and illegal trafficking of harvested timber cause great damage to the economy and worsen the image of the Wood Industry of Russia.

The illegal cuttings are conducting without compliance with environmental and silvicultural requirements, which leads to a changing in the species composition, age structure of forests, and developing of soil erosion.

Ten-year dynamic of this negative impact on forests shows that after a certain stabilization of illegal cutting (2002–2005), its volume has increased over the past two years, especially in 2007 (by 37% compared to 2006) (Fig. 25). The number of cases of illegal cutting in the Rosleskhoz's Forest Fund in 2007 was 20.58 thousand occurrences.

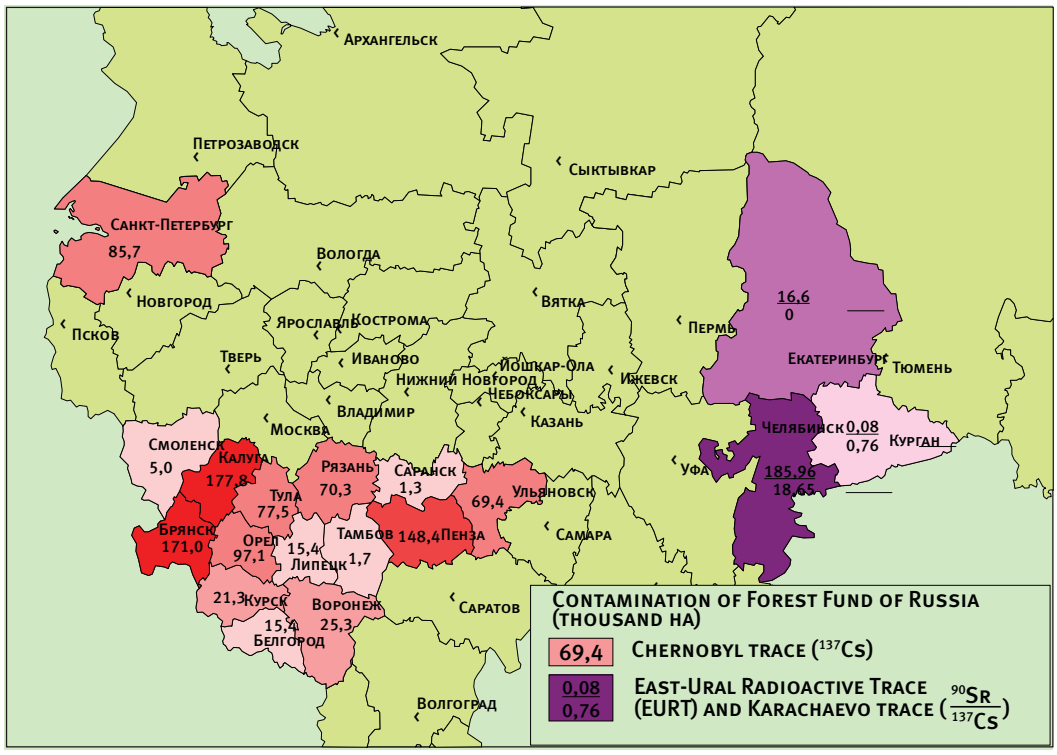


Figure 24. Scheme of radionuclides contamination of Russian Forest Fund

To provide the sustainable radioactivity safe forest management, the Laboratories of Radiation Control are working in 14 constituent entities of the RF. They monitor the radiation envirоument through 167 observation stations, where samples are taken and radiometric measurements are done annually. Samples include timber and food forest resources, forest litter, soil, and other components of forest ecosystems. In 2002-2005, the network of observation stations in neighboring districts of the adversely affected area of Russia and Belarus was developed in the course of realization the Program for Overcoming Consequences of Chernobyl Accident. The radiation monitoring is conducted on 144 observation stations in radionuclide polluted forest. The three additional observation stations were established in Cheljabinsk and Kurgan oblasts. Methods of compiling the electronic cartographic information about the radiation envirоument in the contaminated Forest Fund were developed and tested. These methods provide informational support to the executive authorities in forest management. The scientific organizations of Rosleskhoz conducted extensive researches on forest radio-ecology. The distribution patterns of radionuclides were revealed within the components of the every studied forest ecosystem. According to these patterns, the level of contamination of timber and non-timber forest resources depends on biological property of certain species of forest vegetation and ecological-silvicultural conditions, along with the physical/chemical properties and amount of deposited radionuclides.

In 2008, during the monitoring the production of timber, 153.8 million ha of forest had been inspected in 22 constituent entities of the RF. The work was carried out in 178 forest districts, where 33,976 Allowable cuts were tested, and in 3,351 of them various violations were revealed. The area surveyed cutting spots was 409,177 ha, and the total amount of forfeit penalties calculated on the results of the monitoring was 4,477 million roubles.

The illegal cutting mainly conducted in the forests with high-value species, located close to the transport routes and market outlets. They have fragmented, dispersed nature. The most of illegal cuttings (57%) occurs in the border Federal Okrugs: Siberian and the North Western (Fig. 26).

Summary Criterion 3

Russian forests are constantly under the influence of abiotic and biotic agents. These influences weaken the forests, depress their growing ability, and lead to the death of trees. The dynamics of affected forest show the repeating pattern in death forest occurrences. It is explained by periodic changes in climate conditions and connected with them inflammability of forest and outnumbering of pest's populations.

The main cause for dead forest is the forest fires; their share of dead forest is 67% on average. The second cause of dead forest is unfavorable weather conditions. They are responsible for 73 thousand ha per year on average (16% of total area of dead forest). The forest dead through dangerous insects, diseases, and anthropogenic impact shares are respectively 9%, 3%, and 4% on average of dead stands in the Forest Fund. In 2008, the distribution of forest areas affected by different

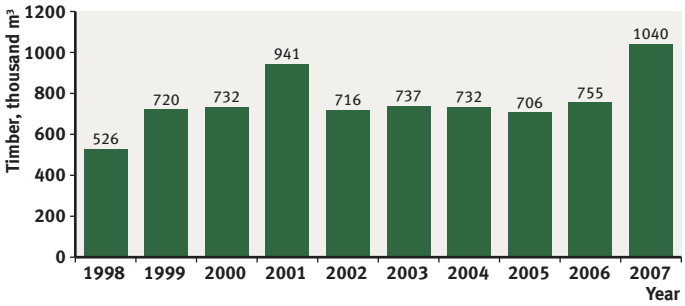


Figure 25. Dynamic of illegaly cut timber

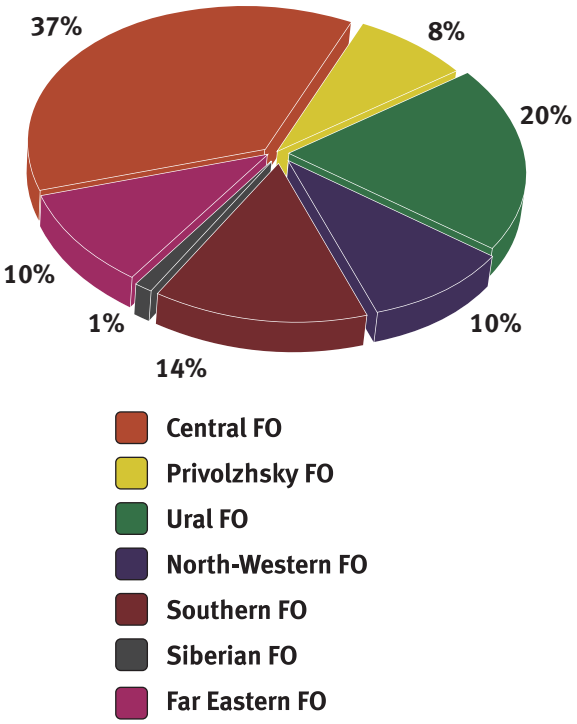


Figure 26. Illegally cut timber in different Federal Okrugs RF

negative agents is the same as the average for the last decade.

The radiation situation in the forest contaminated with radionuclides has not changed significantly in recent years.

Criterion 4

Conservation and maintenance of soil and water resources

Indicator 4.1. Protective function

All forests of the Russian Federation, to varying degrees, carry out anti-erosion, water-protection, and water regulation functions. Between them there are forest stands disignated to focus on the protection of soil and water resourses. Forest Code RF (2006) classified them as Protective forests. Their share is 22.6% of the total forested areas (Table 15).

Variation of this indicator in the constituent entities of the Russian Federation (Fig. 27) is mainly due to varying natural conditions and determined the decision of regional authorities. Over thirty-year period (1978–2008) the values of this indicator have not changed significantly within the boundaries of the constituent entities of the Russian Federation.

Table 15.

Distribution of Protective Forest area by categories, thousand ha

Protective categories	Total area of the Forest Fund land	Forested land
Protective Forest – total	258,304.0	150,187.4
including:		
Forest of State Natural Reserve	19,318.2	11,437.1
Forest of National Parks	6,167	4,287.4
Forest of Natural Parks	32.1	30
State forest shelter belts	126.8	99.4
Forest with scientific and historical importance	189.8	157.6
Natural Monuments	103	88
Forest within the first and second belts of sanitary protection zones of potable and technical water supply sources	1,434.4	1,271.1
Forest within the first, second, and third zones of sanitary (mountain-sanitary) protection districts of cure/recreation locations and health resorts	695.1	632.5
Of which forest within the third zones of sanitary (mountain and sanitary) protection districts of cure/recreation locations and health resorts	415.2	379.5
High value forest arrays	5,528	4,366.8
Anti-erosion forest	14,228.6	9,457.6
Forest fruit-tree stands	5.5	4.7
Commercial nut-harvesting zones	10,573.2	9,612.7
Forest-tundra	100,789.1	29,825.7

Table 15.

Protective categories	Total area of Forest Fund land	Forested land
Restricted belts along spawning grounds of valuable commercial fishes	57,482.8	35,699.8
Reserved Forest Areas	82.7	73.4
Forest shelter-belts along public railways, federal, republic, and regional automobile roads	3,862.7	3,109
Green zones of settlements and economic facilities	13,235	11,390.1
Of which forest parks	3,868.9	3,357.4
Ribbon-like relict pine forests	119.3	109.5
Other forests in desert, semi-desert, forest-steppe, steppes and mountains	9,577.7	8,039.5
Restricted forests belts around rivers, lakes, water reservoirs, and other water bodies	25,774.4	20,495.5

Figure 27. Share of Protective Forest area in constituent entities of the Russian Federation, %

4.1.a. Area and percent of forest whose designation or land management focus is the protection of soil or water resources

The soil of forests and agricultural lands located in the steppe, forest-steppe zone, as well as in the mountains experiences a significant greater rate of erosion than that of land in other ecological regions. Soil erosion leads to moving sand and ravines and in the mountains to the mudslides. Practically, all of the agricultural land and developed woodlands in the North Caucasus are eroded and the erosion-threatening. Significant erosion processes are going on in the mountain forest of the Urals and Siberia.

Protection of the agricultural lands from soil erosion and protection the crop production from droughts and hot winds with the forest stands is the most acceptable melioration approach. The forest planting (afforestation) is provided in the Russian Federation on agricultural lands to protect them from water and wind erosion. However, currently the work in this area virtually stopped: if twenty-thirty years ago 100-150 hectares were planted annually as the shelter belts, forest stands at the ravines, gulches, sands, and other uncomfortable lands of collective and state farms then in the years 2008 in the Russian Federation were planted only 5.6 thousand hectares of protective forest plantations on lands for agricultural purposes (Fig. 28, table 16).

As of 01.01.2008, the total area of forests designated for soil protection was 17.5 million ha or 2.4% of the total area of forested land.

84.7 million ha of forests were assigned for protection of water bodies, which is 7.8% of total forested area of the RF.

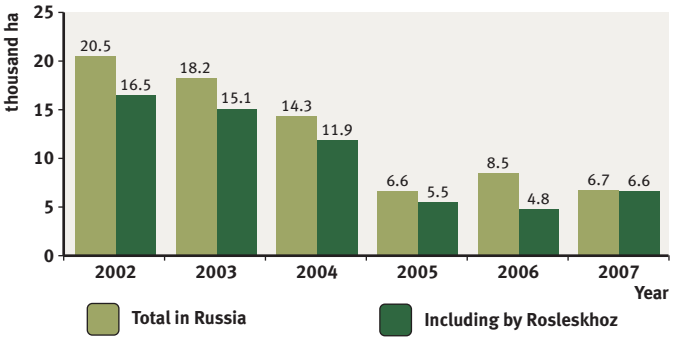


Figure 28. Dynamics of planting forest shelter belts on agricultural lands, thousand ha

Table16.
Volumes of Establishing Protective Forest Plantations, ha

STAND CATEGORY	2007	2008
Field shelterbelts	995	1,365
Anti-erosion forest stands	5,400	4,261
Forest stands to improve degraded grazing areas	250	–
Total: on agricultural lands	6,645	5,626
on Forest Fond lands and lands of other categories	–	9,437
Forest cultures on recultivated lands of Forest Fundn	763	304

Indicator 4.2. Soil

Protection of soil, as an essential component of terrestrial ecosystems and the main habitat and livelihood of plants, animals and microorganisms, should hold a special place in sustainable forest management. The soil cover is a specific type of ecosystem, the unique complex of living and non-living components; the existence of terrestrial ecosystems is not possible without normal development of soil. The formation of soil is a very long process, and soil's destruction may have the most disastrous consequences.

4.2.a. Proportion of forest management activities that meet best management practices or other relevant legislation to protect soil resources

The rules of cutting oblige the forest users to practice the types and technology of cutting that should maintain environmental, water and other protection functions of natural forests, and also preserve conditions necessary for the reforestation of valuable species after clear cutting, prevent soil erosion of mountain slopes.

These tasks are accomplished by differentiated use of the three major types of general use cutting: clear cutting, gradual cutting, and selective cutting. Because mountain forests have their special protective, anti-erosion and water regulation importance, the choice of system and technology of cutting takes into account slope gradient, as well as the sustainability of the soil against erosion. Ether in the mountainous, or in the plain forest, according to the rules, there are limits to the area of particular Allowable Cut. For the forest growing on the permafrost, the special types and technology of cutting are used that are intended to ensure the sustainability of stands, conservation of soil and environment.

Agro-forestry melioration works are not provided in all regions of the Russian Federation, although agro-forestry melioration fund is available in 66 constituent entities of the Federation. According to the Russian MNR, the afforestation fund of degraded agricultural lands of the RF has 8.1 million ha.

According to the All-Russian Scientific Research Institute of Agroforestry Melioration (VNIALMI), secure protection of farmland from adverse factors required to have 14 million hectares of protective forest plantations, the minimum demand set at 6 million hectares. There are currently about 3 million hectares of such forest plantations, of which about 1.4 million hectares require urgent silvicultural care.

According to the expert's estimates, the amount of protective forest plantations founded in recent years do not exceed their natural loss.

The Russian Government adopted three federal target programs for improving the soil fertility for the periods 1992–1995, 1996–2000, 2002–2005, but the goals for protective afforestation have not been met by all of them. The main reason is a lack of funding.

The Federal Target Program «Preservation and restoration of soil fertility of agricultural land and agro-landscapes as Russian national patrimony for the years 2006–2010» (Government of the Russian Federation decree of 20.02.2006, № 99) paid special attention to the hydro-technical, agrochemical, and cultural-technical activities. During this period, it is planned to create 118 hectares of protective forest plantations. This is clearly not enough.

During the years 2006–2007, the recultivation was provided in the Russian Federation on the total area of 30.0 and 29.4 thousand ha respectively. Of this total area 15.3 thousand ha (50.3%) and 16.1 thousand ha (54.6%) were prepared for forest plantations in the years 2006 and 2007 respectively.

4.2.b. Area and percent of forest land with significant soil degradation

The forest territories in the mountains of the Caucasus, the Ural, the Siberia, and the Far East are an erosion-dangerous territory in accordance with the soil-erosion map of Russia. The forest cutting in such areas leads to deflation and soil erosion, enhancement in developing of thermokarst and solifluction, developing of ravines, landslides, mudflows, and stony placers.

The analysis of the data from the State Land Monitoring and other environment observation systems shows the tendency towards reduction in the area of disturbed land in the recent years: at the end of 2006 there was registered 67,043 ha, at the end of 2007 – 64,384 ha, which is the result of the recultivation of damaged land (961 ha and 1,862 ha were recultivated respectively).

Indicator 4.3. Water

Russia has the world's largest water resources and wetlands. At its territory about 120 thousand rivers flow with total length 2.3 million km, there are about 2 million lakes with total area of 370 thousand km^2 (without the Caspian Sea). The area of the water reservoirs is 62 thousand km^2. Wetlands take 1.8 million km^2. The share of lakes and wetlands is about 15% of the area of the Russian Federation, in some regions – up to 85% of the region's area.

4.3.a. Proportion of forest management activities that meet best management practices, or other relevant legislation, to protect water related resources

The forest area allocated for the protection of water resources is 7.8% of the forested land, which takes 84,691.6 thousand ha of the Forest Fund land.

The clear cutting and using chemicals as a protective measure are prohibited in the forest allocated in the protective categories: «Restricted forests belts around rivers, lakes, water reservoirs, and other water bodies», «Forests within the first and second belts of sanitary protection zones of potable and technical water supply sources», «Restricted belts of spawning grounds of valuable commercial fish».

4.3.b. Area and percent of water bodies, or stream length, in forest areas with significant change in physical, chemical or biological properties from reference conditions

The average for the many years for the river discharge in the territory of Russia is 4,271 km^3 per year (10% of the Global River Discharge, the second largest in the world after Brazil), including over 4030 km^3/year of the river discharge formed in the territory of Russia. This corresponds to 230–235 thousand m^3/year on 1 km^2 of the territory and 28 thousand m^3/year per inhabitant. Over 26.5 thousand km^3 of fresh water is concentrated in the lakes of Russia; moreover, the average annual (renewable) discharge from them is more than 500 km^3/year. About 3,000 km^3/year of the water concentrated in the bogs, swamps, marshes give annual discharge (outflow) 1,000 km^3. The majority of the freshwater resources concentrates in large lakes: Baikal (23,000 km^3, or 20% of the world and more than 90% of the national fresh water reserves), Ladoga (908 km^3), Onega (285 km^3), Chudskoe-Pskovskoe (35.2 km^3). The glaciers accumulated about 40 thousand km^3 of fresh water and annually there is forming approximately 110 km^3.

The lands of Water Fund of the RF include lands occupied by water bodies, lands of the water protection zones of water bodies, and also lands allocated for the establishment of the right-of-way and sanitary

Because the Federal Agency of Cadastre of Immovable Property has changed its functions in the field of the implementation of state land control (decree of the Russian Federation Government of 15.12.2006, № 689), the powers to monitor compliance with obligations under the recultivation and preservation of fertile layer of soil have the Federal Service for Supervision of Environmental and Federal Service for Veterinary and Phytosanitary Supervision. The objects of the soil pollution monitoring net are the agricultural land, several forest recreation areas (parks, health resorts, recreation locations, etc.), and coastal zones.

Samplings of the soil are taken from the farm land in 190 districts (612 locations). The names of 21 possible pesticides are determined in the taken samples. In Russia, nine (9) administration offices of the Federal Service for Hydrometeorology and Environmental Monitoring are monitoring contamination of soil with industrial ingredients. The samples are taken annually in 66 cities and every five years in 101 cities (about 2000 samples). Up to 24 industrial ingredients are determined in the samples.

protection zones of potable and technical water supply sources, hydro-technical equipment and other water management structure and facilities. The lands under the water (without the wetlands) in the whole country take 72.1 million ha and among them 27.3 million ha (37.9%) included in the lands of the Water Fund. All the remaining lands under the water are distributed between other categories (Fig. 29). The significant part of them falls on the Forest Fund (18.5 million ha), the land for agricultural purposes (13.2 million ha), and the Reserve land (10.2 million ha).

The quality of the surface water of the most water bodies of Russia still does not meet regulatory requirements, despite the 1990 recession and decrease in the dumping of pollutants. The total volume of wastewater dumped annually into the surface water bodies of Russia is about 50 km^3 (year 2007 – 51.42 km^3, year 2006 – 51.39 km^3).

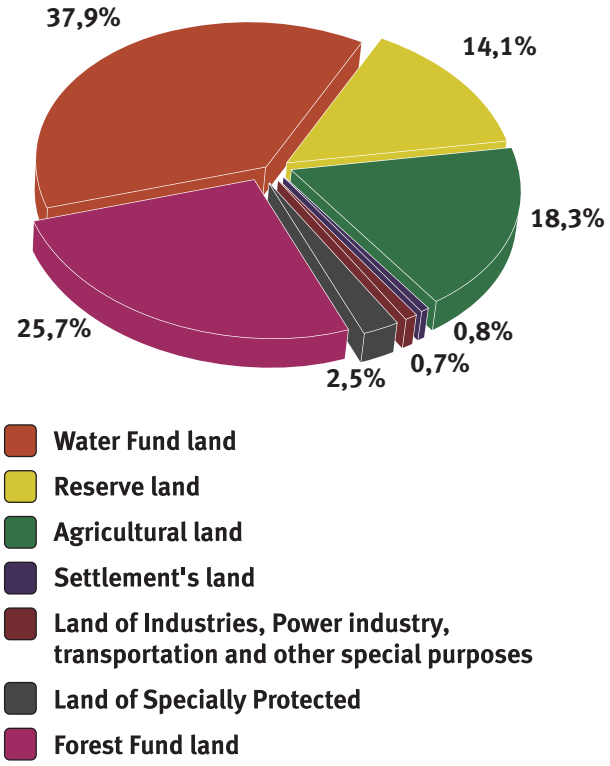


Figure 29. Share of under-water land in different land categories

Summary criterion 4

As of 01.01.2008, the total area of forest designated for soil protection was 17.5 million ha or 2.4% of the total area of forested land.

Currently, 84.7 million ha of forests assigned for the protection of water bodies, which is 7.8% of total forested area of the RF.

In 2008 more then 15 thousand ha of protection forest stands were established. Agro-forestry melioration works are not provided in all regions of the Russian Federation, although agro-forestry melioration fund is available in 66 constituent entities of the Federation. According to MNR Russia, the afforestation fund of degraded agricultural lands of the RF has 8.1 million ha.

During the years 2006–2007, the recultivation was provided in the RF on the total area of 30.0 and 29.4 thousand ha respectively. Analysis of the data from the State Land Monitoring and other environment observation systems shows the tendency towards reduction in the area of disturbed land in the recent years: at the end of 2006 there was registered 67,043 ha, at the end of 2007 – 64,384 ha, which is the result of the recultivation of damaged land.

Criterion 5

Maintenance of forest contribution to global carbon cycles

Indicator 5.a. Total forest ecosystem carbon pools and fluxes

Forest ecosystems play an important role in the global carbon cycle. FAO UN (FRA-2005) estimates the carbon (pools) in the living phytomass of the world's forests accounts for 283 billion tonnes C and in the dead biomass – 38 billion tonnes C. Of these, respectively, 32 and 7 billion tonnes C (without the forest litter), are concentrated in the forests of the Russian Federation (Table 17). Therefore, the share of the live phytomass of Russian forests of the stock of carbon in the world does not exceed 13% and it is understandable, because Russian forests grow in the boreal zone and do not have high productivity.

If we consider the flow of carbon and its annual deposit in the forest, the contribution of Russian forests is estimated significantly higher. According to the Intergovernmental Panel on Climate Change – IPCC, the net flow of carbon (consisting of CO_2) from the atmosphere to the land is 1.7 ±0.5 milliard tonnes C per year. The net annual increment C in world's forests estimated at 1.5 billion tonnes C/year (ECE/TIM/SP/17 – 2000).

Table 17.

Dynamics of total carbon in live and dead biomass of forests, million tonnes

Type of forest vegetation	Year	Total carbon in live and dead biomass	Including		
			Above ground	Underground (without humus soil)	Dead phytomass
Tree stands	2007	39,500	26,000	6,500	7,000
	2005	39,208	25,787	6,423	6,998
	2000	39,185	25,736	6,421	7,028
	1990	39,721	26,052	6,452	7,217
Shrubs	2007	800	250	200	400
	2005	750	200	175	375
	2000	700	200	150	350
	1990	750	200	175	375
Total	2007	41,300	26,250	6,700	7,400
	2005	39,958	25,987	6,598	7,373
	2000	39,885	25,936	6,571	7,378
	1990	40,471	26,252	6,627	7,592

According to the calculations of the International Center for Forests FGU VNIILM, annual carbon sequestration (NEP) in the forests of Russia, calculated using the method of the IPCC (LULUCF, 2003), reaches 600 million tonnes C/year on average (Table 18). The highest value of specific carbon sequestration (up to 6.5 tonnes C/ha/year) recorded in the steppe-forest zone of the European part of Russia and the lowest (0.1 tonnes C/ha/year) – in sparse forests of the Siberia and the Far East (Fig. 30)

Losses of carbon (CO_2 emission) as a result of logging, forest fires, in outbreaks of pests and diseases, waste and wood incineration are estimated at approximately 100 million tonnes C/year (calculated according to the official information from Rosleskhoz). The net annual sequestration (net biome production – NBP) of carbon in living and dead biomass of the country forest is 500 million tonnes C/year. Therefore, the net annual carbon accumulation in forests of Russia is about 1/3 carbon balance of calculated for all the world's forests.

Table 18.

Dynamics of Net Average Increment (NAI) of timber and Net Ecosystem Production (NEP) of carbon in forests of Russia (forested areas only)

Characteristics	Measure unit	1988	1998	2003	2007
Net Annual Increment (NAI)	mill. m^3/yr	938.0	970.4	993.8	1,044
Net Annual Natural Loss (Fall)	mill. m^3/yr	640.0	662.1	678.0	700
Gross Average Increment (GAI)	mill. m^3/yr	1,578.0	1,632.5	1,671.9	1,744
Biomass GAI	mill. tonnes/yr	725.9	750.9	769.1	800
Net Ecosystem Production (NEP)	mill. tonnes /yr	1,088.8	1,126.4	1,153.6	1,200
Carbon NEP	mill. tonnes C/yr	544.4	563.2	576.8	600

Figure 30. Specific Net Ecosystem Production (NEP) of carbon, tonnes C/ha/year

The boreal forests accumulate (in the living and dead phytomass) as net annual increment much more carbon as net annual increment than tropical forests.

Tropical forest ecosystems spend on autotrophic and heterotrophic respiration in hot and humid climate almost 100% of Net Primary Production (NPP). In addition, in boreal forests a significant accumulation of carbon occurs in the dead biomass (dead wood, downed wood, humus soil), while in tropical forests dead phytomass and humus soil are quickly processed by microorganisms and carbon comes to the atmosphere in the form of CO_2. It is known that in the boreal forests the dead phytomass stock can reach large volumes, because the rate of its decomposition (by decomposer microorganisms) is significantly lower than the speed of income phytomass (leaf litter, natural loss). Annual carbon sequestration in dead phytomass can reach up to 100 million tonnes C per year in Russian forests.

Indicator 5.c.
Avoided fossil fuel carbon emissions by using forest biomass for energy

The use of wood fuel for heating instead of coal and fuel oil is becoming increasingly important in world production. The so-called biofuel is a part of forest biomass and, unlike fossil resources, refilled annually. The potential of Russia to obtain bio-fuel from wood is significant. For example, 1 m³ harvested timber can provide 0.8 m³ of biofuel. This figure consists of resources from standing dry trees, downed wood, firewood, logging debris (tops, butting, doty pieces of trunk and so forth), stumps, branches, and roots (Fig. 31).

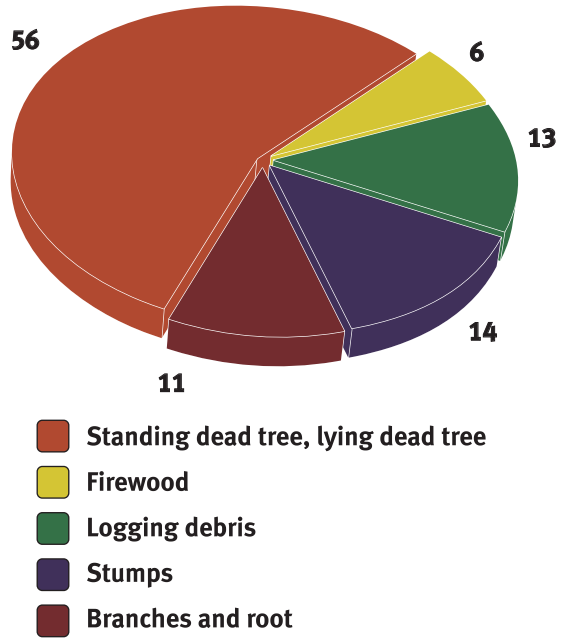


Figure 31. The structure of potential resources of biofuel in forests of the RF, %

Annual biomass increment, which potentially can be used as biofuel, is about 800 million м³, among them in exploitable forest – 430 million м³ or 200 million tonnes of biomass.

But at the current level of forest usage, only 30 million м³ of wooden debris or 14 million tonnes of biomass are economically accessible, that can be expressed as 9 million tonnes of coal equivalent (expert's estimation). This represents approximately 1% of annual energy consumption in our country. Currently, about 600 tonnes of fuel pellets a year have produced in Russia and half of the total - in the North-West of the Russian Federation.

The process of harvesting and removal of wood fuel, especially the drying and pressing, entails considerable energy costs, which calls into question the possibility of reducing greenhouse gas emissions through the use of woody biomass. The implications of switching to biofuel should be more carefully examine having in view a complete energy balance income and expenditure of heat and carbon, as well as emissions of greenhouse gases other than CO_2.

Summary Criterion 5

Forest ecosystems play an important role in the global carbon cycle.

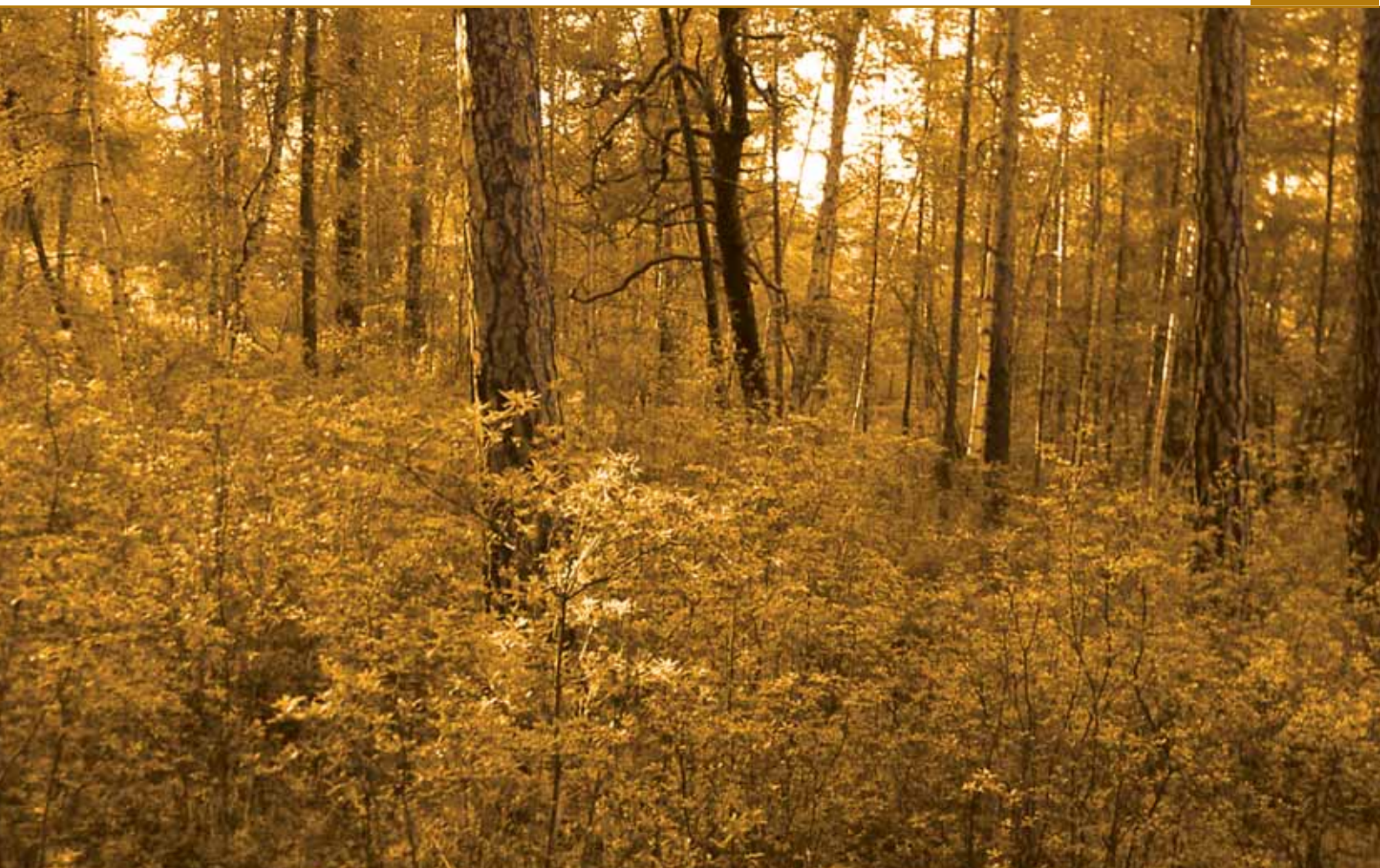
The share of the live phytomass of Russian forests of the stock of carbon in the world does not exceed 13% and it is understandable, because Russian forests grow in the boreal zone and do not have high productivity.

Losses of carbon (CO_2 emission) as a result of logging, forest fires, in outbreaks of pests and diseases, waste and wood incineration are estimated at approximately 100 million tonnes C/year. The net annual sequestration of carbon in living and dead biomass of the country forest is 500 million tonnes C/year. Therefore, the net annual carbon accumulation in forests of Russia is about 1/3 carbon balance of calculated for all the world's forests.

The potential of Russia to obtain bio-fuel from wood is significant. For example, 1 m³ harvested timber can provide 0.8 m³ of biofuel. Currently, about 600 tonnes of fuel pellets a year have produced in Russia and half of the total volume – in the North-West of the RF.

Criterion 6

Maintenance and enhancement of long-term multiple socio-economic benefits to meet the needs of societies



Criterion 6.1. Production and consumption

The following forest uses are permitted in the Forest Fund of the Russian Federation (article 25 FC RF):

- ✔ wood harvesting (logging);
- ✔ resin harvesting;
- ✔ harvesting and collecting of non-timber forest resources;
- ✔ harvesting of food forest resources and collecting of medicinal plants;
- ✔ game management and hunting;
- ✔ agriculture;
- ✔ scientific research activities, educational activities;
- ✔ recreational activities;
- ✔ establishing and using of forest plantations;
- ✔ cultivation of forest fruits, berries, ornamental plants, and medicinal plants;

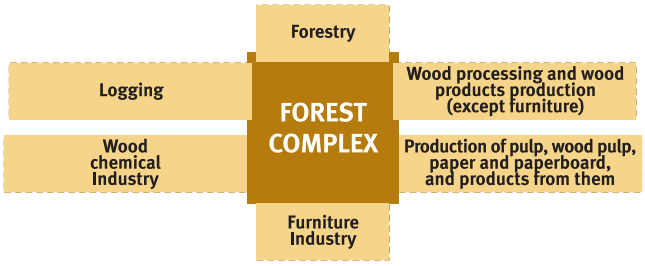


Figure 32. Structure of the Forest complex of the RF

- ✔ works related to geological exploration of mineral resources and development of mineral resource deposits;
- ✔ construction and operation of water reservoirs and other man-made water bodies as well as water engineering facilities and special-purpose ports;
- ✔ construction, reconstruction, and operation of power transmission lines, communication lines, roads, pipelines, and other linear utilities;
- ✔ processing of wood and other forest resources;
- ✔ religious activities;
- ✔ other uses.

The Forest (Wood) Complex of the Russian Federation includes Forestry, timber harvesting enterprises, wood processing, pulp and paper, and wood chemical enterprises (Fig. 32). Currently, the Forest Complex does not belong to the main branches of Russian economy, but still plays an important role. In 45 constituent entities of the Russian Federation the share of the forest sector makes from 10 to 50% of whole industrial production of the regions. The products of the Forest Complex are widely used in many branches of industry, building, agriculture, printing industry, trade, and medicine.

In 2008, the share of the Forest Complex in gross domestic product of the Russian Federation was 1.1%, in the volume of shipped product – 3.75%, in export – 2.3%, in investments in fixed assets – 1.0%.

Harvesting and processing of wood is performed by approximately 60,000 big, middle, and small enterprises in all regions of Russia. There are more than a million employees in the Wood Industry. 99% of the Wood Industry enterprises are private. 12 enterprises are the leading wood industry holdings. These holdings cover 27% of all wood industry production, more than 75% of pulp production, and about 70% of paper and paperboard.

6.1.a. Value and volume of wood and wood products production, including primary and secondary processing

The volume of wood harvesting in Russia has been increasing since 2002. In 2007, it reached 206.1 mill. m³, where 134.6 mill. м³ was harvested from the final cutting (Table 19). The volume of timber removal also increased: by 4.3% in 2007 comparing to the 2006. But in 2008 the volume of timber removal in Russia decreased by 21.7% comparing to 2007 (Table 20), and this decreasing occurred in all Federal Okrugs. The biggest decrease ratios were in Southern (71.4%), Central (37.8%), and Ural (34.6%) Okrugs, the lowest – in North-Western Okrug (13.3%). The biggest decrease in absolute volume of timber removal was in Siberian Okrug (8.8 mill. m³).

In 2007, the growth index of wood industry production in Russia was 4.2%. This is less than in the entire Russian industry (6.3%) – oil, gas, coal, metallurgic, and chemical industries. Until 2008 the most of wood industry indices had positive dynamics (Table 21). Increase of production volumes based on both export (see indicator 6.1.h) and domestic market expansion.

The financial condition of wood industry was improving, new production capacities were developed. During 2006–2007, the leading pulp and paper enterprises carried out a reconstruction in order to increase their production of boxboard. The production of plywood, particleboard, and fibreboard is evolving most rapidly (Table 22). During 2006–2008, the production of sawn wood, pulp, paper and paperboard has been rather stable, showing some positive trends. But the volumes of logging, production of sawn wood, particleboard, pulp, paper, and paperboard still have not reached the level of 1990.

The sawn wood production in 2007 increased, making 24.3 mill. m³. The rate of increase was higher in Siberian (9%) and North-Western (6.5%) Federal Okrugs. The top positions in sawn wood production

Table 19.

Dynamics of logging by types of cutting in the Russian Federation

Cuttings	Volume of harvested wood, mill. m³						
	2001	2002	2003	2004	2005	2006	2007
Final cuttings	127.0	122.8	126.1	127.0	130.9	127.6	134.6
Other cuttings	15.7	17.0	20.8	23.5	23.5	27.2	35.6
including sanitation cuttings	9.2	10.5	14.4	16.3	15.8	17.8	23.0
Intermediate cuttings, including	23.1	25.1	27.2	27.9	30.6	30.5	35.9
thinning and advanced thinning	7.5	8.8	11.5	11.7	13.5	14.2	17.8
regeneration and restocking cuttings	5.8	6.8	8.0	8.7	9.1	8.6	9.8
selective sanitation cuttings	7.0	6.8	7.2	7.0	7.4	7.1	7.5
reconstruction cuttings	0.2	0.3	0.3	0.3	0.5	0.5	0.7
TOTAL	165.8	164.9	174.1	178.4	185.0	185.3	206.1

Table 20.

Volume of wood removal by Federal Okrugs of the Russian Federation (2007 - according to operative data of the Rosstat)

Federal Okrugs	Volume of wood removal, mill. m³		
	2006	2007	2008
Russian Federation, in total	117.6	134.2	105.0
Central	10.7	12.7	7.9
North-Western	34.7	39.2	34.0
Southern	0.5	0.7	0.2
Privolzhsky	15.5	16.2	12.5
Ural	7.4	7.8	5.1
Siberian	33.3	41.4	32.6
Far East	15.5	16.2	12.7

Table 21.

Dynamics of main products production of RF Forest Complex *

Type	1990	1998	2000	2005	2006	2007	2008
Sawn wood, mill. m^3	75.0	18.6	20.0	22.0	22.1	24.3	21,6
Plywood, mill. m^3	1.6	1.1	1.5	2.6	2.6	2.8	2,6
Particleboard, mill. m^3	5.6	1.6	2.3	3.8	4.7	5.5	5,8
Fibreboard, mill. m^3	1.5	0.6	0.9	1.3	1.5	1.9	2,0
Pulp on cooking, mill. t	7.5	3.2	5.0	6.0	6.0	6.0	5,9
Paper and paperboard, mill. t	8.3	3.6	5.3	7.1	7.4	7.6	7,7

** -According to Minprominergo*

Table 22.

Volume of main products production of Forest Complex by Federal Okrugs of the RF*

Federal Okrug	Sawn wood, mill. m^3		Plywood, mill. m^3		Particleboard, mill. m^3		Fibreboard, mill. m^2		Paper and paperboard, mill. tonnes	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Russian Federation, in total	24.3	21.6	2,776.8	2,592.0	5,500.8	5,750.6	496.6	494.8	7,581.4	7,675.8
Central	2.3	2.0	588.4	553.8	2,363.8	2,562.1	174.8	179.7	562,0	631,9
North-Western	6.9	6.0	989.8	937.6	1,556.0	1,559.1	100.1	102.9	4,357,8	4,345
Southern	0.3	0.2	7.4	7.6	285.3	263.4	18.1	16.2	80,2	95,1
Privolzhsky	3.8	3.4	683.4	670.1	559.2	620.8	87.8	82.4	1,982,6	1,994,0
Ural	1.8	1.6	301.8	232.6	181.3	172.7	15.0	16.0	59,0	52,4
Siberia	7.8	7.2	206.0	190.9	531.1	545.0	100.8	97.6	518,4	533,6
Far East	1.4	1.2	-	-	24.0	27.0	-	-	21,4	23,5

** 2007 - According to operative data of Rosstat*

still belong to the Krasnoyarsk Kray, Irkutsk, and Arkhangelsk oblast (Fig. 33). In many cases the production growth was reached due to development of small entrepreneurship.

In 2007, the plywood production increased by 5.7% compared to 2006. The growth was reached mostly due to the fuller use of the existing capacities.

In 2008, sawn wood production decreased by 9.4%, plywood – by 7.0%, fibreboard – by 0.1%, pulp on cooking – by 1.6%, paper – by 2.5%. The financial results of the Russian Wood Industry have also worsened.

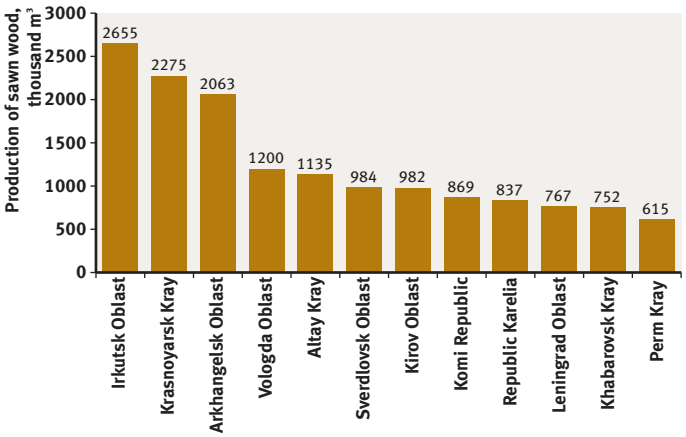


Figure 33. Constituent entities of the Russian Federation - the main producers of sawn wood, 2007, thousand m^3

The growth was mostly reached due to bringing new facilities into operation. In the North-Western Okrug the increment reached 31.6% due to new production capacities (134 thousand m^3) at the particleboard factory of Pfleiderer company in Novgorod Oblast (entered into service in 2006) and due to the capacities expansion on the enterprises of Komi Republic. The fibreboard production increased by 8.6% compared to 2006 due to the growth reached in Central (13.2%) and Siberian (10.6%) Federal Okrugs. But in 2008, this parameter remained almost the same as in 2007. Industrial production of wood houses in 2008 was 181.8 thousand m^2 for the whole of Russia, which is unsatisfactory low. For comparison, in 1990 this production reached 4,514 thousand m^2.

In 2007, paper and paperboard production was 7.6 million tonnes, like in the early 1980s.

By the beginning of 2008, the Forest Complex almost reached the maximum possible level of existing capacity utilization in high-level wood processing, %:

- ✔ 91.4% for plywood production,
- ✔ 84.5% for fibreboard production,
- ✔ 82.4% for pulp on cooking,
- ✔ 83% for commodity pulp production,
- ✔ 86.4% for paper production,
- ✔ 93.5% for paperboard production.

Figure 34 shows the structure of the Wood Industry in Russia in 2007.

There is a disproportion in geographical distribution of logging and wood processing units of the Wood Industry of the Russian Federation (Table 22). Wood processing is mostly concentrated in the European part of Russia: 60.4% of sawn wood, 90.5% of plywood, 84.0% of wood-based panels, 92.9% of paper and paperboard were produced there in 2007. Herewith, for North-Western Okrug the shares in sawn wood were – 26.5%, in wood-board production – 30.4%, in pulp – 62.6%, in paper and paperboard – 57.2%. At the same time, in the Far East Okrug, where the stock of forest stands is more than 20 billion m^3, there is almost no production of paper and paperboard, plywood, and wood-based panels.

The use of forest in the Russian Federation is provided on a paying basis. Either payments for lease or payments under the Sale and Purchase Agreement should be made for forest use. The average payment per unit of timber (2008) is given in Table 23.

In 2008, the total income from the forest land use reached 18,512.1 million roubles, among them (Fig. 35):

✔ forest use – 17,477.7 million roubles (94.4%);

✔ conversion of forest lands into non-forest lands – 73.7 million roubles (0.5%);

✔ charged services and compensation of state expenditures – 4.35 million roubles (0.02%);

✔ penalties (fines) paid to federal budget – 634.1 million roubles (3.4%);

✔ penalties for violation of forest legislation – 167.4 million roubles (0.9%);

✔ realization of sequestered wood – 19.6 million roubles (0.1%);

✔ realization of wood received from measures on forest protection, conservation, reproduction, etc. – 133.5 million roubles (0.7%).

In general, the plan of collecting payments for forest land use in 2008 was fulfilled by 104.6%.

In 2008, the Federal budget received 1,1796.2 million roubles, regional budgets – 6,715.9 million roubles.

In 2008, lease charges for all kinds of forest use earned 10,703.7 mill.roubles or 61.2% of all payments for forest use.

The total amount of charges under the Sale and Purchase Agreements for forest stands in 2008

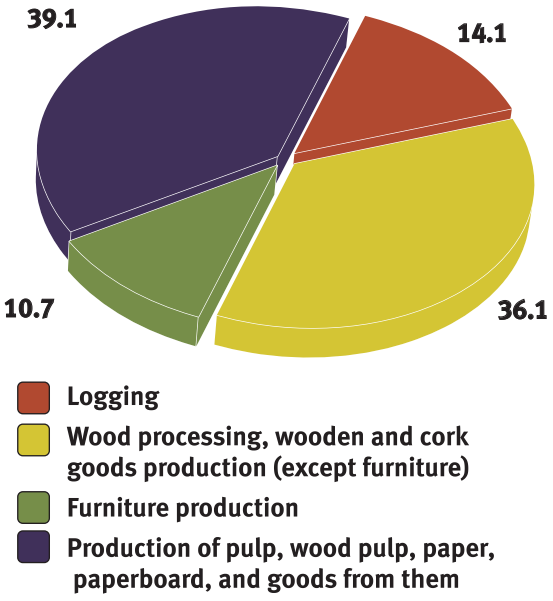


Figure 34. Structure of the Wood Industry in the RF, 2007

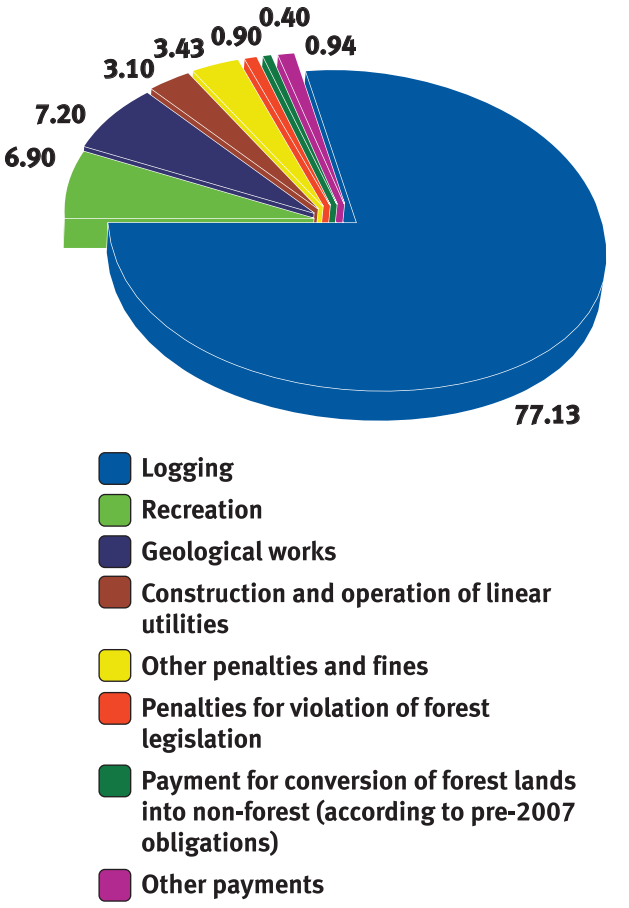


Figure 35. Structure of forest use income, 2008, %

Table 23.

Average payments per unit of volume of forest stand (2008), roubles/m^3

Parameter	Actual payment	Including minimum payment
Average payment	61.18	35.86
Average payment, lease agreement	51.55	33.53
Average payment, sale-purchase agreement	87.42	40.13
Average payment, sale-purchase agreement for subsistence needs	42.54	–

reached 6,156.7 million roubles or 35.2% of all payments for forest use, including 6,156.6 million roubles for logging (99.9% of all charges under the Sale and Purchase Agreements).

Charges under the Sale and Purchase Agreements for forest stand for subsistence needs are defined according to the rates set by government bodies of constituent entities of RF. In 2008, these payments made 578.7 million roubles or 3.3% of all payments for forest use.

Market relations take place in the Russian Wood Industry. More than 98% of the enterprises are private; domestic market prices are free-of-control for all types of timber products; foreign economic activity is liberalized. Dynamics of wood products cost in 2005–2007 are shown in Table 24.

6.1.b. Value of non-wood forest products produced or collected

Harvesting and collection of non-timber forest resources are performed by citizens and legal persons as an entrepreneurial activity, and also by citizens (including indigenous people) for subsistence needs.

The market for mushrooms, berries, nuts, and medicinal plants is rapidly growing. They are harvested and processed by individuals, small firms, and also by large companies and agro holdings working with exporters and Russian real estate brokers. Market specialists can not tell the volume and rate of the growth of this market. Rosstat, Ministry of Agriculture, and Federal Tax Service also do not keep statistics of collecting, processing, and exporting of wild forest products. But the cost of these products can reach hundreds of millions USD.

Rosleskhoz's data shows almost decrease by half in cost of harvested and produced non-timber forest products in 2007 comparing to 2006 (Fig. 36), but it does not take into account the real volumes collected and produced by Russian citizens.

More detailed information about the harvested volumes of some product types is available for some regions of Russia from scientific sources. For example, Annex 4, Table 1 contains data on cowberry resources and their development in some regions of Russia.

Medicinal plants are the very important part of non-timber forest resources. As economists estimate, Russian pharmaceutical industry requires up to 50,000 tonnes per year. Currently, there is no federal state body for management and funding for growing medicinal plants. According to the MNR data, 488.5 tonnes of wild medicinal plants were harvested in 2003 in the Russian Federation forest (Annex 4, Table 2). In 2004, the total volume of harvested wild medicinal plant raw materials in Russia reached 228.4 tonnes, while during 1990-s it was 20–23 thousand tonnes annually.

There are no systemized data about purchasing price for non-timber products. These prices are negotiated and depend on a region and on specie productivity each year. In fruitful years, cranberry, cowberry, and blueberry are bought for 35–50 roubles/kg, chanterelles – for 40–50 roubles/kg.

Annually many game animals are hunted in the Russian Federation. Fur and meat of many of them are popular on domestic and external markets. Data on hunting volumes of main game species is shown in Annex 5, Tables 1, 2, 3.

Comparing procured amounts (Annex 5, Table 1) with hunting quotas (see Indicator 2, Annex 3, Table 2) shows that quotas for the most species are not reached. For example, in 2006–2007 season brown

Table 24.
Dynamics of wood products cost and volume (2005 - 2007)*

Parameter	2005	2006	2007
Wood production cost, billion roubles	52.5	60.4	50.8
Wood products production cost, billion roubles	274.9	322.1	274.6 (first 9 months)
Sawn wood, mill. m^3	22.0	21.3	23.2
Plywood, mill. m^3	2.55	2.6	2.8
Fibreboard, mill. m^2	375.2	373.0	477.0
Particleboard, mill. m^3	3.9	4.6	5.3
Pulp on cooking, mill. t	5.934	6.045	5.954
Commodity pulp, mill. t	2.42	2.38	2.42
Paper, mill. t	3.97	4.0	4.06
Newsprint, mill. t	2.01	1.99	1.98
Paperboard, mill. t	3.06	3.44	3.50
Boxboard, mill. t	2.248	2.493	2.568
Paper bags, mill.	526.0	564.0	595.0

** Statistical data of the Analytical department of the Federal Forestry Agency*