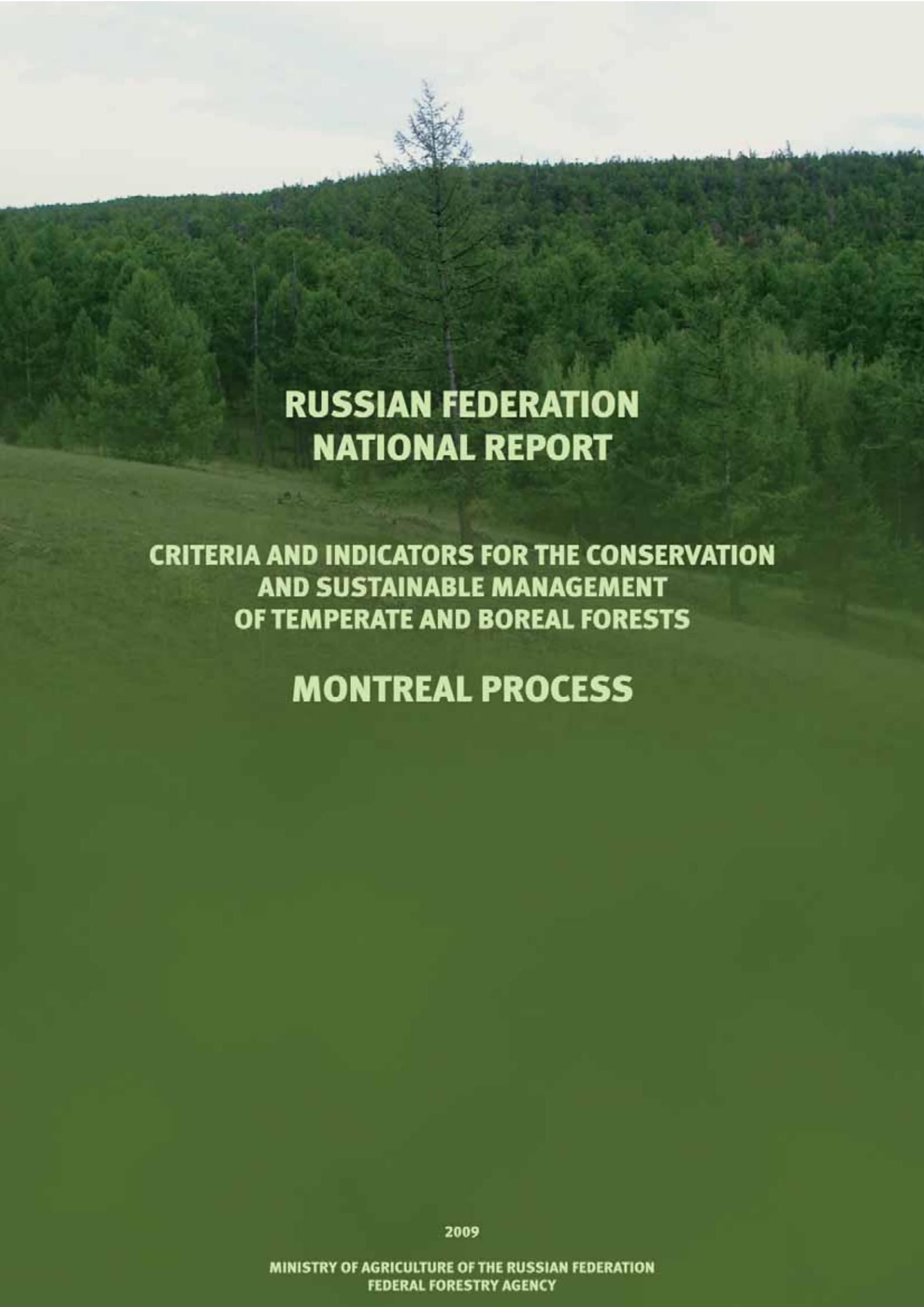

RUSSIAN FEDERATION NATIONAL REPORT

CRITERIA AND INDICATORS FOR THE CONSERVATION AND SUSTAINABLE MANAGEMENT OF TEMPERATE AND BOREAL FORESTS

MONTREAL PROCESS

2009

MINISTRY OF AGRICULTURE OF THE RUSSIAN FEDERATION
FEDERAL FORESTRY AGENCY

Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process): Russian Federation's National report. – Moscow, ARISFM, 2009. – 110 p.

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The Second National report on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process) is prepared according to the Russian Federation's obligations on the Principles of Sustainable Forest Management, adopted by the United Nations Conference on Environment and Development (Rio-de-Janeiro, 1992) and confirmed by the Montreal Process Declarations (Santiago, 1995, Quebec, 2003). The report details 54 indicators of sustainable forest management and contains the most complete set of available up to date information on Russian forests.

The purpose of this report is to provide current information on condition and management of the forest resources of the Russian Federation to policy makers, all interested parties, and the international community. An Overview Report and National Reports on Forests from the Montreal Process member countries will be presented at the XIII World Forestry Congress (Buenos Aires, Argentina, October 2009). Also the political obligations of the 12 countries, the members of the Montreal Process, will be endorsed on progress in the use of criteria and indicators for the conservation and sustainable management of temperate and boreal forests. This report can be viewed on the Internet at www.rosleshoz.gov.ru.

Froofreading in Russian: Z. S. Brunova, M. F. Nezhlukto, M. M. Sergeeva
Computer layout: A. A. Fedorov

Conservation of forests is the guarantee of supplying community with forest products and jobs, the guarantee of biodiversity conservation, the mitigation of climate change, the protection of soil and water resources, and the improvement of air quality. The sustainable management of 1/5th of all the Earth's forests under jurisdiction of the Federal Forestry Agency is a globally scaled task.

The Federal Forestry Agency in its work follows the principles of organic unity of ecological, historical, cultural, social, and economic priorities in forest land management. This means that Russian forests are considered not only as a base for the Wood Industry, but also as the centuries-long living environment for the people of Russia. Russian forests provide environmental security for the population of Russia and neighboring countries.

Russia has an active stand in the development of new approaches to the sustainable management of forest resources, based on national and international experience. That is the reason that the Montreal Process criteria and indicators for the conservation and sustainable management of boreal and temperate forests have great importance. Russia was one of the first Montreal Process members (joined in 1993). Here we are presenting the second National Report prepared according to the renewed criteria and indicators (2007–2009). We hope this publication in Russian and English will help better the understanding of the current situation and the priority trends in Russian forest policy.

A.I.Savinov, Head of the Russian Federal Forestry Agency

The Second National report on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process) is prepared according to the Russian obligations on the Principles of Sustainable Forest Management, adopted by the United Nations Conference on Environment and Development (Rio-de-Janeiro, 1992) and confirmed by the Montreal Process Declarations (Santiago, 1995, Quebec, 2003). This report is based on criteria and indicators of sustainable management of temperate and boreal forests adopted in 2007-2009 by the Montreal Process Working Group at 18th, 19th, and 20th meetings.

The statistical information about condition, quantity, and quality characteristics of the Russian Federation forest is collected, analyzed, and accumulated in the Forest State Inventory, the State Forest Cadastre, the Silvicultural Regulations, the Forest Development projects, the information from fire and pathology monitoring, and also from the results of the monitoring of the Forest Management. This information was used for the preparation of the current report. Additional sources of information include: annual reports "On Condition and Use of the Forest Resources of the Russian Federation" and "On Condition and Protection of Environment of the Russian Federation" as well as statistical digests and periodical publications concerning forestry, silviculture, and the Wood Industry. Data collection, analysis, text, and illustrations for this Report were prepared by the VNIILM staff (All-Russian Scientific Research Institute of Silviculture and Forestry Mechanization) with participation of leading experts in Forestry from Rosleskhoz. We deeply appreciate the help of authors and organizations who provided materials for this National Report. Authors of this publication compile the isolated data in an attempt to write an integral report. We hope that the Second National Report will not be only the source of relevant information on forests of Russia, but will also serve as a basis for discussion of forest policy development. We are ready to gratefully accept any constructive comments on this publication. Special thanks to Yuri Nesterenko, Mark Fearon, and Jeanne Bertini for helping with English version.

This report can be viewed on the Internet at www.rosleshoz.gov.ru.

The «Montreal process» is a short name for the inter-governmental non-official Working Group of experts developing scientifically grounded criteria and indicators for the conservation and sustainable management of temperate and boreal forests. The name of the Process comes from the international seminar of experts in Montreal, Canada (1993) on implementing decisions of the United Nations Conference on Environment and Development in connection with boreal and temperate forest countries at the initiative of Canada.

The most important political documents of Montreal process are Santiago Declaration endorsed in Santiago, Chile, in February 1995 and Quebec City Declaration endorsed in Quebec, Canada, in September 2003. Both Declarations reaffirm the participating countries' commitment to implement the Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests for national forest policy, monitoring, and assessing forest condition.

The Montreal process involves Argentina, Australia, Canada, Chile, China, Japan, Mexico, New Zealand, Republic of Korea, Russian Federation, United States of America, and Uruguay. The 12 member countries together represent about 83 per cent of the world's temperate and boreal forests, and together with the tropical forests - 49 per cent of the world's forests. Their share in the world timber and wood products is 45 %.

The current work of the Montreal process is the annual Working Group meetings of experts on the flexible basis. Ongoing work of the Montreal process is provided by the Liaison Office, which until the end of 2006 was located in Canada and now is in Japan as well as the Technical Advisory Committee. By 2009, 20 Working Group meetings and 11 meetings of Technical Advisory Committee were held.

In 2003, member countries had prepared the First National Reports and the First Overview Report on the state of forests and the forest sectors of participating countries.

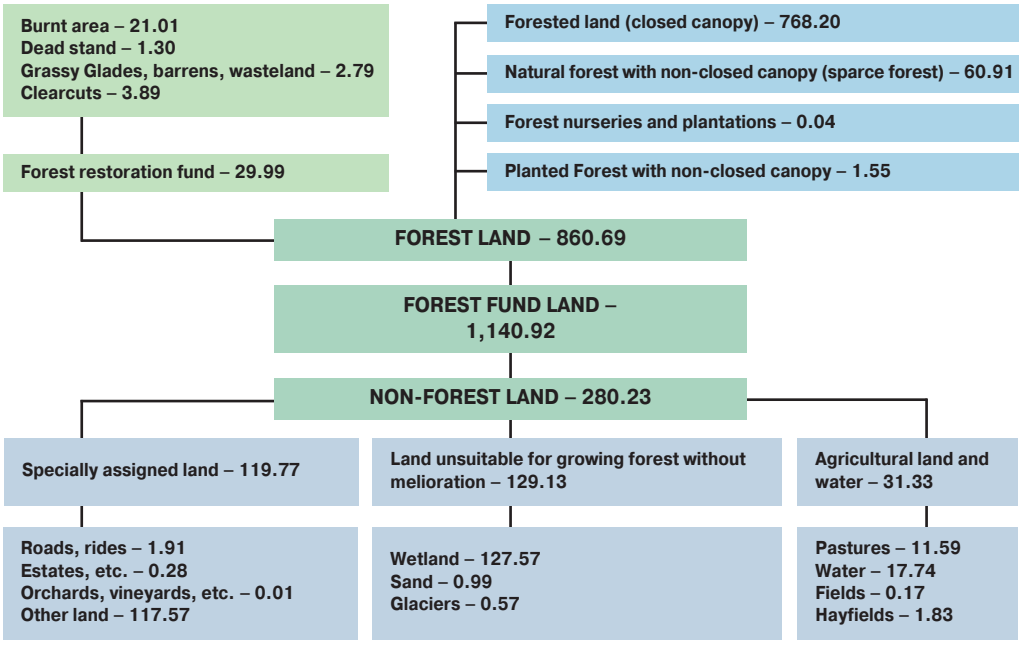
The purpose of this report is to provide current information to policy makers, all interested parties, and the international community on condition and management of the forest resources of the Russian Federation. An Overview Report and National Reports on Forests from the Montreal Process countries will be presented at the XIII World Forestry Congress in October 2009 in Buenos Aires (Argentina). One more time the political obligations of the 12 countries, the members of the Montreal Process, will be endorsed on progress in the use of criteria and indicators for the conservation and sustainable management of temperate and boreal forests.

For documents and more details on history and evolution of the Montreal process, please visit official web site at: www.mpci.org.

Russia is the biggest forest country in the world. The area of the Forest Fund* of the Russian Federation (RF) is almost 12 million km², containing about 8 million km² covered with forest vegetation (forested area), making 0.8 ha of forest per capita. 19% of the world's total growing stock is located in Russia. The Russian forests play a key role in the environment and mitigation of the changes in climate. The boreal forests of Russia contain about 60% of the world's boreal forests and 95% of Russian forests. Russia has significant experience in forest resources management and has become a recognized world leader in the cultivation and preservation of forests as well as in silvicultural research and development of Forestry.

Information about Forest Fund and other forests in the Russian Federation (as of 01.01.2009)

Name	Total area, million ha	Forest land, million ha	Forested land (land covered with closed forest vegetation), million ha
Forests of the Russian Federation	1,182.92	891.86	797.01
among them:			
Forest Fund land	1,140.92	860.69	768.20
Forests on Settlements land (city forests)	1.30	1.07	0.97
Specially Protected Natural Territories land	26.75	17.62	16.66
Other land	13.95	12.49	11.19



Classification of Forest Fund land (as of January 1, 2009), million ha

* Forest Fund Land – according to the Legislation of the RF, this category of Land includes forest and non-forest land. Forest land is the parcels that covered with forest vegetation (forested land) and parcels that not-covered with forest vegetation, but are meant for the forest restoration (clear cuts, burns, etc.). Non-forest land includes land serving for the forest management (roads, rides, etc.)

Criterion 1

Conservation of biological diversity

Russia plays a key role in the maintaining global biodiversity and functioning the biosphere because its territory contains every variety of non-tropical natural ecosystems in Eurasia: polar desert, tundra, forest-tundra, taigas, mixed and broad-leaved forest, forest-steppe, steppe, semi-desert, and subtropics. The variety of soils is extremely large: from arctic in the North to semi-brown and subtropical yellowish soil in the South. The territory of Russia is unique because it has clear shifts of natural ecosystems from zone to zone, resulting in a natural pattern of consistent zones forming a wide spectrum of biodiversity.

About 25% of all intact forests of the world is concentrated in Russia. These intact forests are in large arrays that can serve as a model of natural ecosystems, biological diversity, and the natural dynamics of forest ecosystems. Forest is an essential natural feature of Russia. The forest land share of the forest-tundra sparse forest and taiga zone is 18%, northern taiga sub-zone -18%, middle taiga sub-zone – 31%, southern taiga sub-zone – 22%, coniferous-broadleaf forest zone – 9%, the steppe-forest zone – 2%, zones of steppe and semi-desert – 0.2%.

The underlying principles of the forest management in the Russian Federation are sustainable management, conservation of biological diversity, enhancing forest capacity (Article 1 Forest Code RF, 2006). Conservation of biodiversity requires the preservation and maintenance of historic landscapes in the country's Forest Fund habitats and ecological niches, which in turn will generally preserve the existence of living organisms at the genetic, specie, and ecosystem levels.

While assessing biodiversity, the landscape of the territory is taken into account as a leading factor differentiating ecotopes with their species and ecosystems diversity. For inventory of forest biodiversity, organizing forestry, and forest management, Russia has traditionally used forest regionalization. Forest regionalization divides the territory of the Forest Fund into the qualitatively similar parts that differ from others in natural conditions. These natural conditions are determined by the distribution of the main, or prevalent, forest tree species, species composition, types and productivity of the forest, and forest regeneration processes. The goal of regionalization is to provide the natural history basis for the regional system of forestry management. The Order of the Ministry of Agriculture of 04.02.2009 N 37 approved 8 forest zones (Fig. 1): 1 – forest-tundra and sparse tundra zone, 2 – taiga zone (2.1 – Northern taiga sub-zone, 2.2 – taiga sub-zone, 2.3– Southern taiga sub-zone), 3 – coniferous-broadleaf forest zone, 4 – forest-steppe zone, 5 – steppe zone, 6 – semi-desert zones, 7 – mountain North Caucasus zone, and 8 – Southern-Siberian mountain zone.

Based on forest regionalization, the forest zones are divided into forest areas that have relatively similar states of use, conservation, protec-

Figure 1. The scheme of forest regionalization. 1 – forest-tundra and sparse tundra zone. 2 – taiga zone: 2.1– Northern taiga sub-zone; 2.2 – taiga sub-zone; 2.3 – Southern taiga sub-zone. 3 – coniferous-broadleaf forest zone. 4 – forest-steppe zone. 5 and 6 – steppes and semi-desert zones (not shown in the scheme zones: 7 – mountain North Caucasus zone and 8 – Southern-Siberian mountain zone)

tion, and reproduction. The forest zones include 34 forest areas (Fig. 2). Specifically for every forest area there are established cutting age limits, rules of harvesting wood and other resources, rules of fire and sanitary safety, reforestation, and forest management.

Figure 2. The scheme of forest areas of the Russian Federation

The main purposes of the conservation of biodiversity in the Forest Fund are the preservation of the existing diversity of the forest ecosystems and of the forest associated species and the maintenance of genetic diversity of each biological specie. According to the goals, the indicators for biodiversity conservation are in three general groups: characterization of the ecosystem, specie, and genetic forest diversity.

Currently, the forest typology of particular territories has been developed for the most of the Russian Federation. This typology is based on identifying the dominant species. Reviews of the main types of forest communities are presented in a number of generalizing works as belonging to particular territories (Sambuc, 1932; Tsinzerling, 1932; Korchagin, 1940; Nitsenko, 1960; Saburo, 1972; Smagin, 1991; Vasilevich, 1996, 1997, 1998; Forest of the Vologda oblast, 1998; Udmur Forest, 1999, the Republic of Komi Forests, 1999, etc.) and to the larger regions (Vegetation cover of the USSR, 1956; Rysin, 1975; Kurnaev, 1980; Vegetation of the European part of the USSR, 1980; Rysin, Savelyeva, 2002, Short Guide for Types of Forest, 2002; Gromtsev, 2003; The Green Book of Siberia, 1996, etc.). Despite the seeming abundance of available materials, the classification units on the basis of dominant specie are very small, and it is making the comparisons very difficult. This is because (1) the structure of hierarchical classification is not developed on the scale of forest communities throughout Russia, (2) the principles for allocation the units of the lower ranks are not unified, (3) the unified terminology is not developed. The word recognized Ecological Floristic Classification (Braun-Blanquet, 1964; Mirkin, 1985, 1989; Mirkin, Naumova, 1998) has now been developed for the forests of the European Russia (Korotkov, Morozova, 1986; Korotkov et al., 1991; Korotkov, 1991; Morozova, 1999; Morozova, Korotkov, 1999; Bulohov, Solomeshch, 2003; Zaugolnowa, Braslavsky, 2003), the Southern Siberia and Far East (Ermakov, 2003), Primorye (Regional Environmental scale ..., 2003). However, it is difficult to combine its units with available information from forest inventory. It appears promising now to cross-use of both the units of dominant classification and the syntaxa of European Floristic classification. The correspondence of forest types, allocated by dominant typology, and syntaxa, grouped by Floristic classification, would allow to make correct comparison between Russian and European classifications and also could serve as a basis for a unified classification for forest communities.

Types of forest in North Taiga, the European part of Russia (Zaugolnova, Morozova, 2006)

Names of syntaxa in Ecologo-floristic Classification (Braun-Blanquet system)	Section (Subsection)	Dominants of the upper canopy					
		Pine	Spruce	Larch (+pine, spruce)	Downy Birch (Betula pubescens)	Siberian pine (+spruce, fir)	Fir (+spruce, siberian pine)
Flavocetrario-Pinetum, Cladonio-Pinetum typicum, Cladonio-Pinetum pulsatilletosum	Lichen (Lichen)	*Pineta sylv. cladinosa*	*Piceeta cladinosa*	*Lariceta cladinosa*	*Betuleta cladinosa*	*Pineta sib. cladinosa*	–
Cladonio-Pinetum vaccinietosum, Vaccinio-Pinetum	Lichen (Green-mosses)	*Pineta sylv. hylocomioso-cladinosa*	*Piceeta hylo-comioso-cladi-nosa*	*Lariceta hylo-comioso-cladi-nosa*	*Betuleta hylo-comioso-cladi-nosa*	*Pineta sib. hylocomioso-cladinosa*	*Abieta hylo-comioso-cladinosa*
Empetro-Piceetum, Eu-Piceetum myrtilletosum	Green-mosses (Dwarf shrub)	*Pineta sylv. fruticuloso-hylocomiosa*	*Piceeta frutic-uloso-hylo-comiosa*	*Lariceta frutic-uloso- hylo-comiosa*	*Betuleta frutic-uloso- hylo-comiosa*	*Pineta sib.fruticu-loso- hylo-comiosa*	*Abieta frutic-uloso-hylo-comiosa*
Eu-Piceetum dry-opteridetosum	Green-mosses (Low-herb)	–	*Piceeta parvi-herboso-hylo-comiosa*	N/A	*Betuleta parvi-herboso-hylo-comiosa*	N/A	*Abieta parvi-herboso-hylocomiosa*
Eu-Piceetum athyri-etosum, Aconito-Piceetum	Green-mosses (Tall-herb)	–	*Piceeta mag-noherboso-hylocomiosa*	*Lariceta mag-noherboso-hylocomiosa*	N/A	N/A	*Abieta mag-noherboso-hylocomiosa*
Aconito-Piceetum	Herbaceous (Tall-herb)	–	–	*Lariceta mag-noherbosa*	*Betuleta mag-noherbosa*	–	–
Rubo chamaemoro-Piceetum	Sphagnous (Tall moss - Sphagnous)	*Pineta sylv. polytrichoso-sphagnosa*	*Piceeta poly-trichoso-sphagnosa*	N/A	N/A	*Pineta sib. polytrichoso-sphagnosa*	–
Carici loliaceae-Piceetum	Sphagnous (Higrophilous herb)	–	*Piceeta hygro-herboso-sphag-nosa*	N/A	N/A	N/A	–
Oxycocco-Pinetum	Sphagnous (Dwarf shrub)	*Pineta sylv. fruticuloso-sphagnosa*	*Piceeta frutic-uloso-sphag-nosa*	N/A	N/A	N/A	–

The Centre for Problems of Ecology and Productivity of Forests (CEPF) at the Russian Academy of Science (RAS) has compiled a cadastre of basic units of forest vegetation (mfd.cepl.rssi.ru/flora) and has completed a hierarchical classification of ecologo-cenotic groups for the forest belt of European Russia. Structured descriptions of the main classification units of the forest vegetation of European Russia (excluding the Caucasus) are derived from the original geobotanical descriptions, on the base FORUS and other data containing descriptions of the floristic compound of forest communities. The Joint Research Center of the European Commission, the Space Research Institute RAS, and the CEPF RAS have prepared a «Map of terrestrial ecosystems of North Eurasia» (http://terranorte.iki.rssi.ru/) created using the data of «SPOT-Vegetation» with a space-resolution of about 1 km, which reflects the spatial distribution of basic vegetation types and lands not covered with vegetation. This covers areas of the RF as of the year 2000.

Spatial distribution of the main types of vegetation and lands not covered with vegetation

Indicator 1.1 Ecosystem diversity

1.1.a. Area and percent of forest by forest ecosystem type, successional stage, age class, and forest ownership or tenure

The lack of a unified classification, the numbers of different approaches for regional systems, and the significant granularity of dominant units do not allow the determination of the typological diversity of forest ecosystems on a consistent basis; however the typological diversity of forest ecosystems is the basis for the evaluation of the ecosystem diversity of forested areas.

The current Russian system of Forest Evaluation and Forest Inventory and Planning only generally reflects the ecosystem diversity for the entire country at the local and regional levels. The data on the area of forest with a predominance of certain tree species can be used conditionally to evaluate this indicator using available standard forest inventory information (Table 1).

Russian forests are mostly boreal. The main forest species are: larch, pine, spruce, oak, beech, birch, and aspen. They occupy more than 90% of forested land (Fig. 3). Other trees (pear, chestnut, common walnut, Manchurian walnut, others) occupy less than 1%, and the rest of the area is covered with the shrubs (dwarf pine, birch shrub, others).

Forests dominated by larch have the greatest area. They are represented by different species of larches: Siberian (*Larix sibirica*), Dahurian (*L. gmelinii*), Cajanderi (*L. cajanderi*), and Czekanowski (*L. czekanowskii*). These forests are disturbed only slightly because they are growing in the low developed territories of the Siberia and the Far East.

The second greatest by area is forest dominated by Scotch pine (*Pinus sylvestris*), which is being heavily exploited. Careful and balanced forest management is required to preserve and maintain

Table 1.

Dynamics of forested area with different forest forming tree and shrub species, thousand ha (share of total forested area, %)

Forest forming specie	Area, thousand ha		
	Year of account		
	1998	2003	2009
Pine (*Pinus* sp.)	124,161.1	117,472.9	119,995.1
Spruce (*Picea* sp.)	82,161.1	77,198.4	77,469.9
Fir (*Abies* sp.)	15,467.1	14,930.2	14,307.5
Larch (*Larix* sp.)	283,515.8	264,287.4	275,715.3
Siberian pines (*Pinus sibirica* + *Pinus koraiensis*)	42,725.3	40,852.0	38,845.1
Greek Juniper (*Juniperus excelsa*)	–	2.2	2.2
Total coniferous	548,030.5 (70.78)	514,743.1(70.2)	526,335.1 (69.5)
Oak (*Quercus*), tall interior	3,898.8	3,633.7	3,752.0
Oak (*Quercus*), low pole	3,270.9	3,200.0	3,115.6
Beech (*Fagus* sp.)	788.2	789.6	684.4
Hornbeam (*Carpinus* sp.)	257.4	254.6	273.2
Ash (*Fraxinus* sp.)	660.1	629.9	659.9
Maple (*Acer* sp.)	349.2	336.9	335.4
Elm (*Ulmus* sp.)	347.3	334.1	381.2
Stone birch (*Betula* sp.)	9,227.7	8,950.5	8,842.2
Black Saksaul (*Haloxylon aphyllum*)	1.4	0.7	0.7
White Acacia (*Robinia pseudoacacia*)	50.7	54.7	56.2
Total hardwood	18,851.8 (2.43)	18,184.7(2.48)	18,100.8 (2.5)
Birch (*Betula* sp.)	100,199.9	97,950.0	114,628.7
Aspen (*Populus* tremula)	21,318.6	20,573.4	23,568.4
Gray Alder (*Alnus incana*)	1,060.7	1,276.1	2,366.7
Black Alder (*Alnus glutinosa*)	802.0	739.8	940.9
Lime (*Tilia* sp.)	3,410.8	3,284.5	3,346.1
Poplar (*Populus* sp.)	1,115.1	962.7	971.4
Willow (*Salix* sp.)	1,064.5	1,134.2	1,385.2
Total softwood	128,971.5 (16.66)	125,920.7(17.2)	147,207.4 (17.6)
Other trees	1,250.9 (0.16)	1,025.8(0.14)	777.0 (0.1)
Dwarf pine (*Pinus pumila*)	40,954.6 (5.29)	38,472.0(5.25)	40,060 (5.4)
Other shrubs	36,190.7 (4.67)	34,697.1(4.7)	35,715.1 (0.6)

the existing biodiversity of pineries with associated flora and fauna.

Dark (shade tolerant) coniferous spruce and fir forests cover about 13% of the Forest Fund area. Slightly over the half of them are growing in the European-Ural part of the country. The most common dominating species are: the Norway spruce (*Picea abies*), Siberian (*P. obovata*), and Ajanensis (*P. ajanensis*) as well as hybrid forms of spruces which are emerging on the ranges' boundaries. The forests with fir dominance are found in limited areas; mostly in the Ural, South and West of the Siberia, and the Far East. In the small areas can be found single specie stands of the Siberian fir (*Abies sibirica*), Nordmann Fir (*A. nordmanniana*), Manchurian Fir (*A. nephrolepis*), Sachalin Fir (*A. sachalinensis*). Dark coniferous forests are heavily exploited and need sustainable management: the particular type of management that balances the needs of commercial forest usage and the conservation, environmental protection, and the maintenance of natural biodiversity.

Growing mostly in Siberia (dominated by Siberian pine, *Pinus sibirica*) and in the Far East (dominated by Korean pine, *Pinus koraiensis*), the pine forests have an area of about 40 million ha. Siberian pine has a great commercial value and is an important object of exploitation. At the same time, pine forests provide habitats for many species of flora and fauna. Therefore, conservation and maintenance of pine forest biodiversity, at all levels, are the main goals through the implementing sustainable forest management.

The main part of the Forest Fund area, which is covered with the soft broadleaved species, is represented by birch forests dominated by European Common Birch (*Betula pendula*) and Downy (White) birch (*B. pubescens*). The smaller, although a still large area, is covered with the forest dominated by Aspen (*Populus tremula*). Birch and aspen forests are forming on clear cuts, burns, abandoned agricultural lands. Stands dominated with Grey, Black, and Manchurian alder (*Alnus incana,*

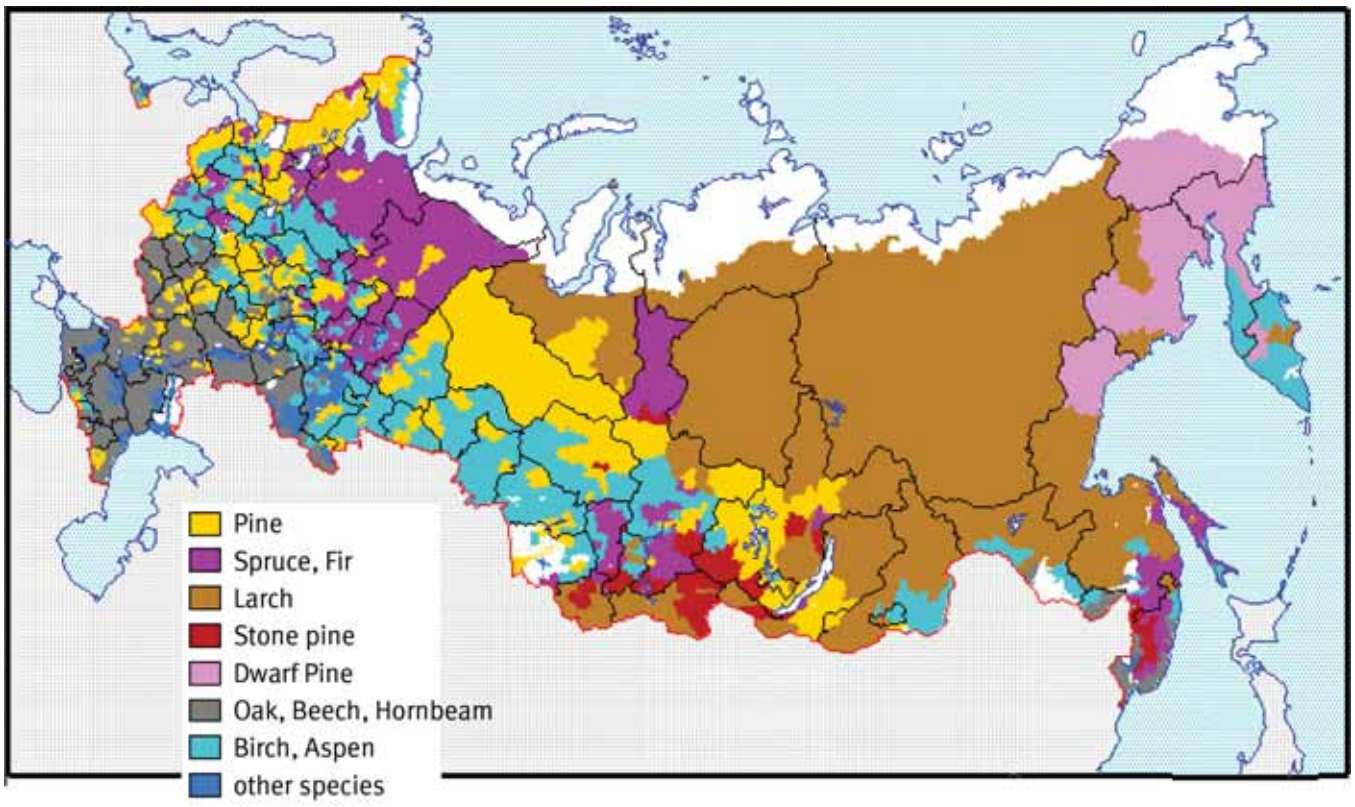


Figure 3. Spatial distribution of forest with dominance of main forest forming tree species

A. glutinosa, A. hirsuta), poplars (*Populus nigra, P. suaveolens, P. maximovichii,* etc.), and Willow trees (*Salix alba, S. fragilis,* etc.) are usually associated with rivers and valleys, where they have an important soil and water protection value.

The soft broadleaved species also include lime (*Tilia* spp.). It is a good nectariferous tree and in the recent past had been actively exploited by the people. This led to a sharp reduction in areas with this specie domination. The largest areas with lime forest are in the European part of Russia and in the Ural. They are represented by Small-leaved Lime (*Tilia cordata*). The smaller area occupied by lime forests is on the south of the Far East. It is formed with Amur Lime (*T. amurensis*), Manchurian Lime (*T. mandshurica*), and Take Lime (*T. taquetii*). In the Far East, the forests with prevalent of stone birch occupy big areas. Several birch species are present in these forests: *Betula costata, B. davurica, B. ermanii, B. lanata, B. schmidtii*.

The oak forests cover the significant area of the Forest Fund. They have a high level of biodiversity. Approximately 55% of oak tree stands are concentrated in the European part of Russia. The English Oak (*Quercus robur*) dominates in this area. In the Far East, the oak forests are formed with Mongolian Oak (*Q. mongolica*). Across Russia, the forests with dominating of other hard broadleaved species (beech, hornbeam, ash, maple, and elm-genres species) are not significant and require the special care.

The forests with dominance of saksaul (*Haloxylon aphyllum*) represent a very rare type of plant communities that are special for the semi-deserts of Caspian area. The saksaul forests bear a vital importance to soil and water protection. The forests with prevalent of other tree species: Chestnut tree (*Castanea* sp.), Pear (*Pyrus* sp.), Honey locust's species (*Gleditsia* sp.), Walnut (*Juglans regia*), Manchurian Walnut (*Juglans mandshurica*) occupy a small areas, but are of great importance for conservation of ecosystem diversity.

In the forests of Siberia and the Far East an important ecological role is played by forests dominated by Dwarf Pine (*Pinus pumila*). It has also great commercial nut-harvesting value. In addition to the dwarf pine, other plant communities are growing in this adverse conditions. They are mostly represented by shrub species of birches (*Betula ovalifolia, B. fruticosa*, and others).

The Forest Fund areas that are occupied by forests with dominance of the main groups of species have changed little over the past decades. That proves the stability of ecosystem diversity (see Table 1).

The presence of forests in different succession stages is linked directly to the forest ecosystem diversity and determines its level. The species diversity on different succession stages varies significantly. Only the succession mosaic at different scales is capable of supporting all the species biodiversity of plants, fungi, microorganisms, and

animals that potentially can exist on a particular forest territory. The data from the State Forest Cadastre contains no information about forest succession stages. But it has data on the distribution of the main forest species by their age groups* that in some way reflects the distribution of forest by succession stages (Fig. 4, Table 2).

The mature and over-mature stands prevail in the Forest Fund (43.7%). Middle age stands takes the second place for area (28.5%). The smallest area is taken by maturing stands. There is a tendency of reducing the proportion of mature and over-mature stands and increasing the proportion of young which indicates the alignment of the age structure of forests. The stands of different age groups have been not distributed evenly over the country. Most of the mature and over-mature stands fall at larch forest. They are located in the Siberia and are almost unexploited.

All forest parcels inside the Forest Fund land are the federal property (Article 8 Forest Code RF).

Figure 4. Average age of stands, years

Table 2.

Forest age structure (as of 01.01.2009), area - thousand ha, stock – million м³.

Dominant tree species	Parameter	Total	Age group				
			Youth		Middle-aged	Maturing	Mature and over-mature
			Class 1	Class 2			
Coniferous	area	526,335.1	40,962.6	50,543.5	123,723.9	53,505.6	257,599.5
	stock	59,078.96	578.13	2,514.09	14,388.73	8,408.53	33,189.48
Hard broadleaved	area	18,100.8	595.4	1,110.8	4,718.2	2,063.6	9,612.8
	stock	2,037.76	10.26	59.94	579.54	253.32	1,134.70
Soft broadleaved	area	147,207.4	11,893.9	13,325.9	50,452.1	17,467.3	54,068.2
	stock	17,088.30	121.28	421.06	4,918.96	2,553.35	9,073.65
Shrubs and others	area	76,552.1	1,022.8	12,143.0	40,140.7	8,906.7	14,338.9
	stock	1,555.38	7.39	97.77	804.6	226.16	419.46
total	area	768,195.4	54,474.7	77,123.2	219,034.9	81,943.2	335,619.4
	stock	79,760.40	717.06	3,092.86	20,691.83	11,441.36	43,817.29

* According to the Forest Inventory and Planning Instruction (1995), the forest stands are aggregated into the age groups based on age of clear cutting and class of maturity. The class of maturity is an age interval specifying age of trees and shrubs within the following gradations: for coniferous and hard broadleaved deciduous species of seed origin - 20 years, for soft broadleaved and hard broadleaved deciduous species of vegetative origin - 10 years, for shrubs - 5 years or 1 year. The exclusion is dwarf pine stands - 40 years. The forest stands have five age groups: Youth class 1, Youth class 2, Middle aged, Maturing, and Mature together with Over-matured.

1.1.b. Area and percent of forest in protected areas by forest ecosystem type, and by age class or successional stage

Forests located in Russia have been designated (Article 10 Forest Code RF) as Protective, Production, and Reserve forests (Fig. 5).

Protective forests are subject to maintain environmental, water protection, conservation, sanitary-hygienic, recreational, and other beneficial functions of forests. Using and management of the Protective forests are possible only if they are compatible with the designation and beneficial functions of the forest.

The following legal categories of the Protective forests have been established:

1. Forests located in Specially Protected Natural Territories;
2. Forests located in water protection zones;
3. Forests acting as protection for natural and other objects:

✔ forests within the first and second belts of sanitary protection zones of potable and technical water supply sources;

✔ protective forest shelter-belts along public railways, federal public automobile roads, and public automobile roads under ownership of the constituent entities of the Russian Federation;

✔ green belts and forest parks;

✔ urban forests;

✔ forests within the first, second, and third zones of the sanitary (mountain-sanitary) protection districts of therapeutic and recreational territories, health resorts;

4. Valuable forests:

✔ state protective forest shelter belts;

✔ anti-erosion forests;

✔ forests located in desert, semi-desert, forest-steppe, tundra-forest, steppes, mountains;

✔ forests of scientific or historical value;

✔ commercial nut-harvesting zones;

✔ forest fruit-tree stands;

✔ ribbon-like relict pine forests.

The system of Specially Protected Natural Territories (SPNT) in Russia plays important role in the conservation of typical and unique natural landscapes, the diversity of flora and fauna, objects of natural and cultural heritage. SPNT can be considered parcels of land and water bodies with air space above them, where natural complexes and objects with special environmental, scientific, cultural, aesthetic, recreational, and health therapy values are located. These territories are withdrawn completely or partially from economic use by the decisions of the public authorities. The SPNT are

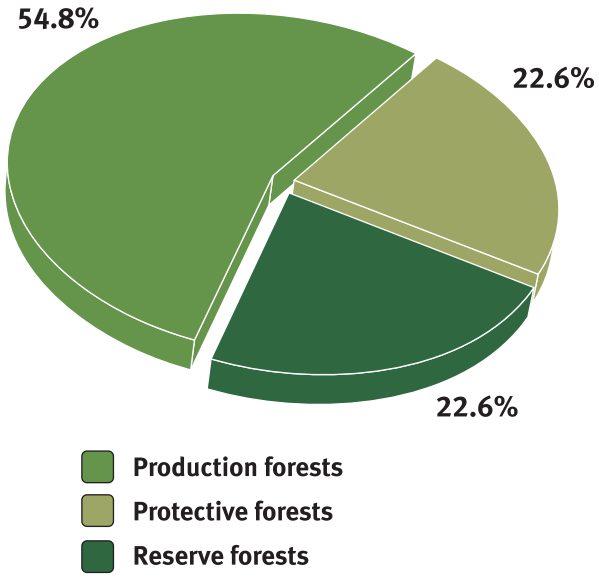


Figure 5. Distribution of forests by designation

under a regime of special protection (protective regime). In the Russian Federation in accordance with the Law «On Specially Protected Natural Territories» (1995), the following categories of SPNT are specified: State Natural Reserves, including biosphere; National Parks; Natural Parks; State Natural Refuges; Natural Monuments; Dendrological Parks (Dendrariums, Arboretums) and Botanical Gardens; recreational areas and health resorts.

At the present time in Russia, 204 federal SPNT operate with a total area of about 580 thousand km^2. They are located in 84 constituent entities of the Russian Federation (Fig. 6).

The current system SPNT began to emerge in Russia about 100 years ago. Today it includes (www.zapoved.ru; www.oopt.info):

✔ 101 State Natural Reserves, total area 33.8 million ha (1.6% of territory of Russia);

✔ 40 National Natural Parks, total area 8.23 million ha (0.48%);

✔ 69 State Natural Refuges of federal importance , total area 12.6 million ha (0.73%);

✔ 2,439 State Natural Refuges of regional importance, total area 44.8 million ha (4.26%);

✔ 8,942 Natural Monuments of regional importance, total area 4.15 million ha (0.2%);

✔ 21 Natural Monument of federal importance, total area 24.5 ha;

✔ 59 Natural Parks of regional importance, total area 17.88 million ha (1.05%).

The establishing of the SPNT and supporting its effective functioning are essential to execute the decisions of the Convention on Biological Diversity ratified by Russia on February 17, 1995. Among the Russian SPNT, 37 have the international status of Biosphere Reserve; 9 facilities are under the juris-

diction of the World Heritage Convention on the protection of Cultural and Natural Heritage; 4 Reserves have diplomas of the Council of Europe; 45 SPNT of federal and regional importance are under the jurisdiction of the Convention on Wetlands of International Importance – especially as the habitats of waterfowl. According to a decree of the RF Government, there is a plan to create 8 new State Nature Reserves and 7 National Parks in the Russian Federation before 2010. A draft for the Strategy Development of SPNT System of the RF has been prepared. The first draft version has been prepared for the Development and Deployment Prospective Scheme of SPNT of federal importance.

The most traditional form of SPNT is a **State Natural Reserve**. The Reserves have an essential importance for biological diversity conservation. According to the accounting on 01.01.2008, the area of the Forest Fund of Russian State Natural Reserves was 19,318.2 thousand ha. In accordance with the law, State Natural Reserves have the status of environmental, scientific-research, and environmental-education institutions. Any business activity and recreational use are prohibited in their territory. Reserves are located in 19 republics, 5 krays, 34 oblasts, one autonomous oblast, 5 autonomous okrugs (Annex 1, Table 1).

National Parks are the territories that include natural complexes and objects with special environmental, historical, and aesthetic value and are designed to be used for environmental, educational, scientific, cultural purposes, and controlled tourism. The state system of National Parks of the Russian Federation began more than 20 years ago. The area of Forest Fund land in National Parks of the Russian Federation is 6,167.0 thousand ha as of 2007.

The base for the forest management in the National Parks is development of a Target Landscape Structure of the forest with consideration of the regulations on maintenance, protection, and exploitation of forest established in the functional zones. The regulations for the forest management and silvicultural activities in the reserved zone in National Parks fully coincide with the regulations of the State Nature Reserves. Activities conducting in the recreational zone should create favorable conditions for recreational use of forest altogether with the greatest possible preservation of natural complexes during the recreation activities.

The measures for forest fire protection, sanitary and recreational activities are designed for all the functional zones in National Parks. In National Parks and on their adjacent territories, a special regime is established for satisfaction of the needs of the local population for wood and non-wood forest products. Also, the possibilities of preserving the traditional usages of the forest are being identified. National Parks are located on the territories of 11 republics, 4 krays, 19 oblasts, 1 autonomous okrug, and 1 city of federal importance (Annex 1, Table 2).

The **State Natural Refuges** are the territories (and/or water bodies) that are especially important for the preservation or restoration of natural complexes or their components and maintaining eco-

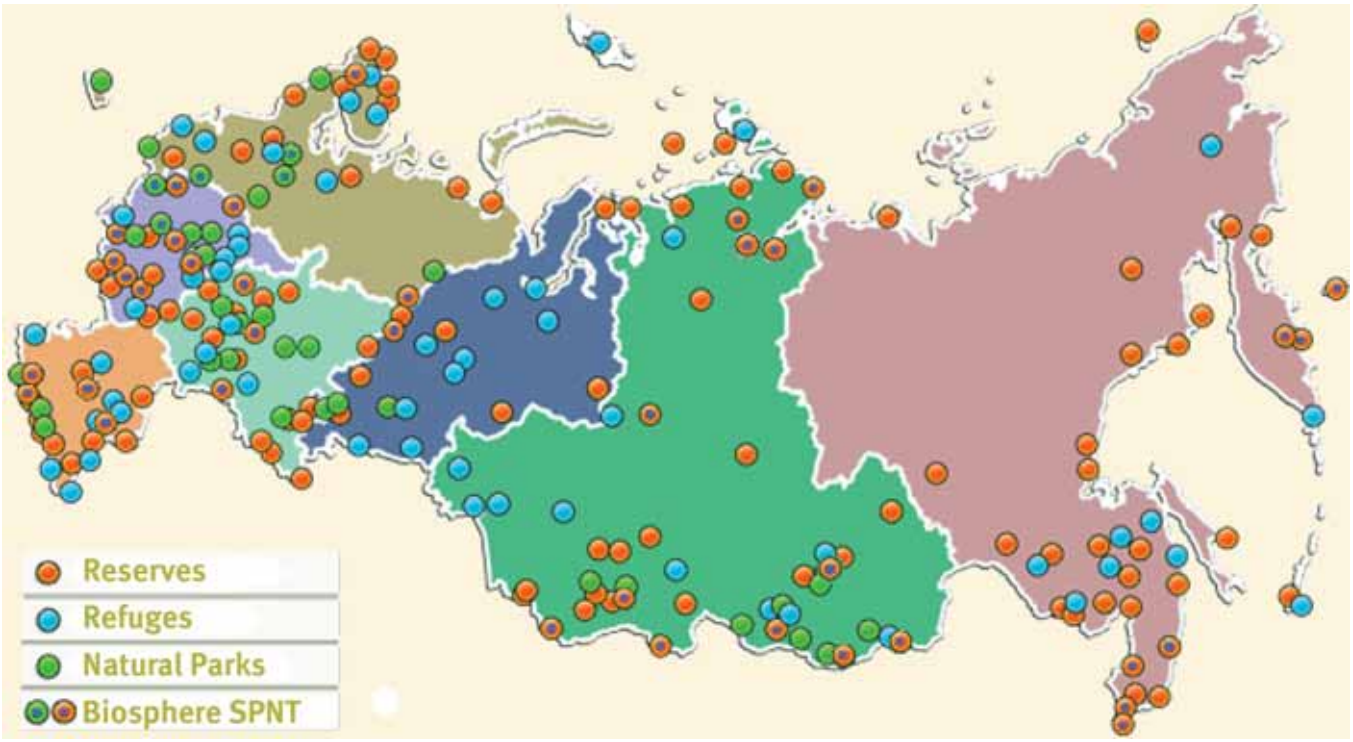


Figure 6. Specially Protected Natural Territories of Russia

logical balance. The State Refuges serve as protection for natural territories by limiting certain types of economic activities and uses of natural resources. State Natural Refuges locate in 10 republics, 4 krays, 25 oblasts, 4 autonomous okrugs (Annex 1, Table 3).

Natural Parks of regional importance are environmental recreational facilities administered by the constituent entities of the Russian Federation. In these territories (and/or water bodies) are located the natural complexes and objects that have great ecological and aesthetic value and are intended for environmental, educational, and recreational use. Natural Park is a relatively new category of Protected Territories. The network of Natural Parks of the Russian Federation is under development now. There are currently 59 Parks, their total Forest Fund area is 32.1 thousand ha. Natural Parks are located on the territories of the 9 republics, 3 krays, 11 oblasts, 2 autonomous okrugs, and 1 city of federal importance (Annex 1, Table 5).

The largest category of SPNT is **Natural Monuments** (geological, water, botanical, zoological, and combined natural complexes). These natural complexes are unique, irreplaceable, valuable in environmental, scientific, cultural, and aesthetic ways, and also are the objects of natural and artificial origin. Natural Monuments have federal or regional importance, depending on environmental, aesthetic, and other values of the protected complexes and facilities (Annex 1, Table 4). The total area of Forest Fund land in this category SPNT is 103.0 thousand ha.

Different types of SPNT in the forest area and mountain's forest belt cover more than 120 million ha (about 7% of the country's area). The formation of Regional Ecological Networks of Protected Natural Territories is taking place in several forest regions of Russia. It is aimed at a gradual integration into the Pan-European Ecological Network. The SPNT protects the major diversity of the forest ecosystems: up to 75% of fauna and more than 50% of flora of the country. They preserve up to 80–90% of rare and endangered species of plants and animals.

In addition to the above mentioned SPNT categories, the Specially Protected Areas of forests (SPA) have been allocated inside the Protective, Production, and Reserve forests, according to the Article 107 of the Forest Code. SPA are the small forest plots that are greatly important for biodiversity conservation. SPA include:

- ✔ bank protecting and soil protecting forest areas along water bodies, slopes of ravines;
- ✔ forest margins bordering woodless spaces;
- ✔ Permanent Seed Collection areas;
- ✔ protected forest zones;
- ✔ forest plots with the relic and endemic plants;
- ✔ habitats of rare and endangered wild animals;
- ✔ other Specially Protected Areas of forests:

small plots of forest located in woodless territories;

specially protected zones of the State Natural Refuges;

plots of forest around capercaillie mating display territories;

strips of forest along the banks of rivers and other water bodies inhabited by European Beavers;

nectariferous areas of forest;

Permanent Sample Plots;

strip of forest along the federal or regional permanent tourist routes approved in the accordance with the established procedure;

forest on the stony placers;

forest on the easily-erodible soils;

forest on the reclaimed quarries and dumps, etc.

Parameters have been developed for selecting the SPA in areas of potential habitats and distribution of rare and endangered animal and plant species in the forests of different regions (North of the European part of Russia, South of the Far East) have been developed. Currently, proposals have been prepared for amendments to the Forest Code to transfer the power of allocation of SPA to the constituent entities of the RF while leaving to the Russian Federation the authority of establishing the list and protective regimes of SPA.

Because the list of Protective forests and SPA, provided by the Forest Code (2006), does not include many types of biologically and socially valuable forests, the national concept of «Forests of High Conservation Value» (The High Conservation Value Forests, HCVF) was developed in the Russian Federation. Currently, HCVF are identified in the Russian National Framework Standard Certification of forests. They can be valuable on different scales – international, regional, or national. Significant experience is being accumulated in identifying, allocating, and mapping HCVF (www.wwf.ru). An Atlas and Methods of Allocation HCVF in the Komi Republic and the Arkhangelsk Oblast have been prepared. An Atlas of HCVF for Primorsky Kray is compiled and a similar Atlas for the southern areas of Khabarovsk Kray and the Jewish Autonomous Region is preparing. HCVFs were allocated for the southern areas of Krasnoyarsk Kray (Priangarie). In 2008, the practical manual (guideline) on allocating HCVF in Russia was developed (www.wwf.ru).

Protective Forests, SPA, and HCVF have important environmental and ecological value. These categories are the reserve pool for later inclusion in the SPNT network; these areas have been already identi-

fied in the forest and have regulations on protective regimes and forest management similar to the SPNT.

Distribution of areas of Russian Federation Protective Forests on predominant tree and shrub species and age groups is given in Table 3.

In the Russian Federation the significant information has accumulated on the status of the lightly disturbed forest ecosystems and their biodiversity. Maps of ecologically valuable forests, which combine topographic and thematic maps with Remote Sensing data, were composed.

WWF and Greenpeace Russia using Remote Sensing data have prepared an «Atlas of Intact Forest Lands of Russia» that allow, for the first time, estimate degree of conservation of forest ecosystems in Russia.

1.1.c. Fragmentation of forests

Most of the Russian forests the form large dense forest areas. The exceptions are the territories in transition: between forest zone and steppe zone – along the southern boundary of the forest zone; between forest zone and tundra zone – along northern border of forest zone; and also forests in agriculturally highly developed areas of the forest zone (southern part of the European – Ural geographical region).

The most complete information about the fragmentation of forests is obtained during the Forest Inventory. It contains cartographic forest management materials (forest management maps and plans

Table 3.

Distribution of areas of Protective Forests on predominant tree and shrub species and age groups, thousand ha (as of 01.01.2007)

Main forest species	Total	Youth		Middle-aged	Maturing	Mature and over-mature
		Class 1	Class 2			
Coniferous						
Pine	23,682.8	1,774.9	2,715.8	9,325.1	2,585.9	7,281.1
Spruce	21,131.7	770.2	633.1	2,674.7	2,558.8	14,494.9
Fir	3,408.2	82.9	92.0	970.6	742.7	1,520.0
Larch	33,307.1	1,566.5	2,225.3	8,437.7	3,321.5	17,756.1
Stone pines	13,739.0	481.0	756.7	6,064.3	3,734.8	2,702.2
Greek Juniper	2.2	0.0	0.0	0.4	0.4	1.4
Total coniferous	95,271.0	4,675.5	6,422.9	27,472.8	12,944.1	43,755.7
Hard broadleaved						
Oak, tall interior	2,052.2	118.7	225.0	1,145.1	243.4	320.0
Oak, low pole	2,240.7	48.0	89.8	1,104.4	403.7	594.8
Beech	789.1	14.2	30.8	323.7	111.0	309.4
Hornbeam	259.6	2.9	7.9	142.1	35.4	71.3
Ash	363.2	27.0	37.7	155.1	49.2	94.2
Maple	151.4	13.1	23.9	64.1	12.9	37.4
Elms	250.1	9.6	26.4	85.3	35.3	93.5
Stone Birch	1,983.1	25.7	78.6	351.6	209.4	1,317.8
Black Saksaul	0.7	0.0	0.0	0.0	0.0	0.7
White Acacia	53.4	12.9	8.6	17.7	7.5	6.7
Total hard broadleaved	8,143.5	272.1	528.7	3,389.1	1,107.8	2,845.8
Soft broadleaved						
Birch	21,692.6	989.1	1,181.3	9,536.3	2,840.2	7,145.7
Aspen	4,474.5	356.0	318.3	936.8	576.3	2,287.1
Gray Alder	570.2	8.5	31.9	239.6	152.9	137.3
Black Alder	476.0	16.7	31.6	229.2	77.0	121.5
Lime	1,076.6	39.8	63.9	516.7	160.9	295.3
Poplar	726.4	17.0	19.6	125.6	76.3	487.9
Willow trees	940.3	38.9	96.5	431.9	120.3	252.7
Total soft broadleaved	29,956.6	1,466.0	1,743.1	12,016.1	4,003.9	10,727.5
Other tree species						
Apricot	1.6	0.5	0.4	0.7	0.0	0.0
Amur Cork Tree	1.1	0.3	0.2	0.6	0.0	0.0
Hornbeam	4.3	0.0	0.0	0.3	0.6	3.4
Honeylocust	5.4	0.4	0.3	2.3	1.8	0.6
Pears	16.5	0.1	0.1	5.4	2.6	8.3
Zelkova	0.4	0.0	0.0	0.0	0.2	0.2

Table 3

Main forest species	Total	Youth		Middle-aged	Maturing	Mature and over-mature
		Class 1	Class 2			
Cork Oak	0.2	0.0	0.1	0.1	0.0	0.0
The Sweet Chestnut	47.2	3.5	8.4	0.8	0.9	33.6
Common Walnut	10.1	2.0	5.7	2.3	0.0	0.1
Manchurian Walnut	3.0	0.1	0.4	2.0	0.5	0.0
Mountain Ash	0.1	0.0	0.0	0.0	0.0	0.1
Box(wood)	3.0	0.0	0.4	2.3	0.1	0.2
Cherry plum	0.6	0.0	0.0	0.6	0.0	0.0
Pistachio	0.1	0.0	0.0	0.0	0.1	0.0
Bird cherry tree	5.2	0.1	1.5	1.7	0.9	1.0
Mulberry	0.4	0.0	0.0	0.1	0.0	0.3
Apple tree	3.0	0.0	0.0	2.7	0.1	0.2
Other trees	163.6	2.7	6.2	141.7	11.0	2.0
Total for section 2	265.8	9.7	23.7	163.6	18.8	50.0
Shrubs						
Birch shrubs	4,407.3	51.0	1,434.6	2,010.0	233.1	678.6
Spindle	0.1	0.0	0.0	0.1	0.0	0.0
Hawthorn	1.8	0.0	0.0	0.4	0.1	1.3
Tamarisk	7.6	0.5	0.0	0.8	1.5	4.8
Dogwoods	0.1	0.0	0.0	0.0	0.0	0.1
Calligonum aphyllum	5.1	0.2	0.2	1.6	0.5	2.6
Willow shrubs	3,072.3	24.3	1,171.7	1,353.9	223.8	298.6
Dwarf pine	7,229.1	65.0	432.0	3,464.9	1,416.6	1,850.6
Hazel	12.5	0.5	0.7	2.1	0.2	9.0
Silverberry	7.1	1.6	0.5	2.2	0.6	2.2
Juniper	0.9	0.0	0.0	0.0	0.0	0.9
Sea-buckthorn	5.6	0.6	0.9	2.0	0.7	1.4
Rhododendron	8.9	0.0	2.5	1.6	2.3	2.5
Current	3.5	0.0	0.5	1.6	0.8	0.6
Other shrubs	1,788.6	5.6	27.5	1,206.3	222.2	327.0
Total for section 3	16,550.5	149.3	3,071.1	8,047.5	2,102.4	3,180.2
Total in Protective Forest	150,187.4	6,572.6	11,789.5	51,089.1	20,177.0	60,559.2

The share of large forest's areas of mature and over-mature trees in the Russian Federation reaches over 40% of the forested area. This parameter is specific to the Russian forests, as it determines the significant area of intact forest in the north of the European Russia, in the Siberia, and in the Far East (www.forest.ru). The large (more than 50 thousand ha) forested areas where economic activity is either not registered or barely provided (no trace of logging, poor or no network roads, extremely low population) are particularly valuable unique forest objects and must be preserved as benchmarks boreal forests for the future generations.

for tree planting) for each forest district. The State Cadastre of the Russian forests does not have an index for the forest fragmentation.

The relative indicator of the degree of forest's fragmentation is an average forest cover, or the extent of forested territory, defined as a percentage of area covered with forest vegetation out of all the total land of the particular territory. The forest cover of the territory of the Russian Federation has changed slightly over the recent years; as of 2009, it is 46.6%.

On the territory of the country, the forests are distributed unevenly, depending on climatic and anthropogenic factors. The greatest forest cover index (more than 80%) is observed in the middle taiga sub-zone of Perm region, Komi Republic and

Central Siberia. The lowest forest cover index (less than 1%) is recorded in the arid zone of the European part of Russia (Republic of Kalmykia, part of Stavropol Kray, Astrakhan, Rostov, and Volgograd Oblasts).

The ranks of the forest fragmentation of the Russian Federation were calculated by experts on the basis of forest cover index available for the administrative districts (Fig. 7). Relatively high degree of fragmentation of forests in the Western Siberia is due to the presence of a large areas of wetlands in this geographical region and therefore has a natural character.

From biodiversity point of view, the fragmentation of forests in forest zone has some positive aspects, as the border strip between forest and non-forest communities form the ecotone complexes, which are typically characterized by stability and high species diversity. There is currently no scientific justification for the best measure of forest fragmentation in botanically different geographic areas; many issues in this area of research remain open.

Indicator 1.2. Species diversity

In general, the condition of the animal and plant species diversity in Russia is quite satisfactory. The major complexes of fauna and flora have been conserved in all landscape zones of the country. The conservation and maintenance of species diversity in forest ecosystems is determined by the balance in distribution of main forest species, by the age structure, and by the degree of their territorial disintegration.

1.2.a. Number of native forest associated species

The taxonomy (species) diversity is the best scientifically and methodologically elaborated of all the various parameters of biological diversity. The numerous indexes are proposed to determine the species diversity at different levels of spatial hierarchy.

The floristic composition of the Russian forest has 824 species of wild trees, shrubs, subshrubs, and lianas; of these more than 180 are native species of tree and shrub species forming the forest (Table 4). The forest taxation is done on the level of genus (in taxonomy it is one level higher then species), therefore the complete list of native and introduced species is not available. The database SAFF (2007) has information on the land covered by and the stock available for 62 taxa of trees and shrubs, mostly at the genus level. It is enough to evaluate the timber

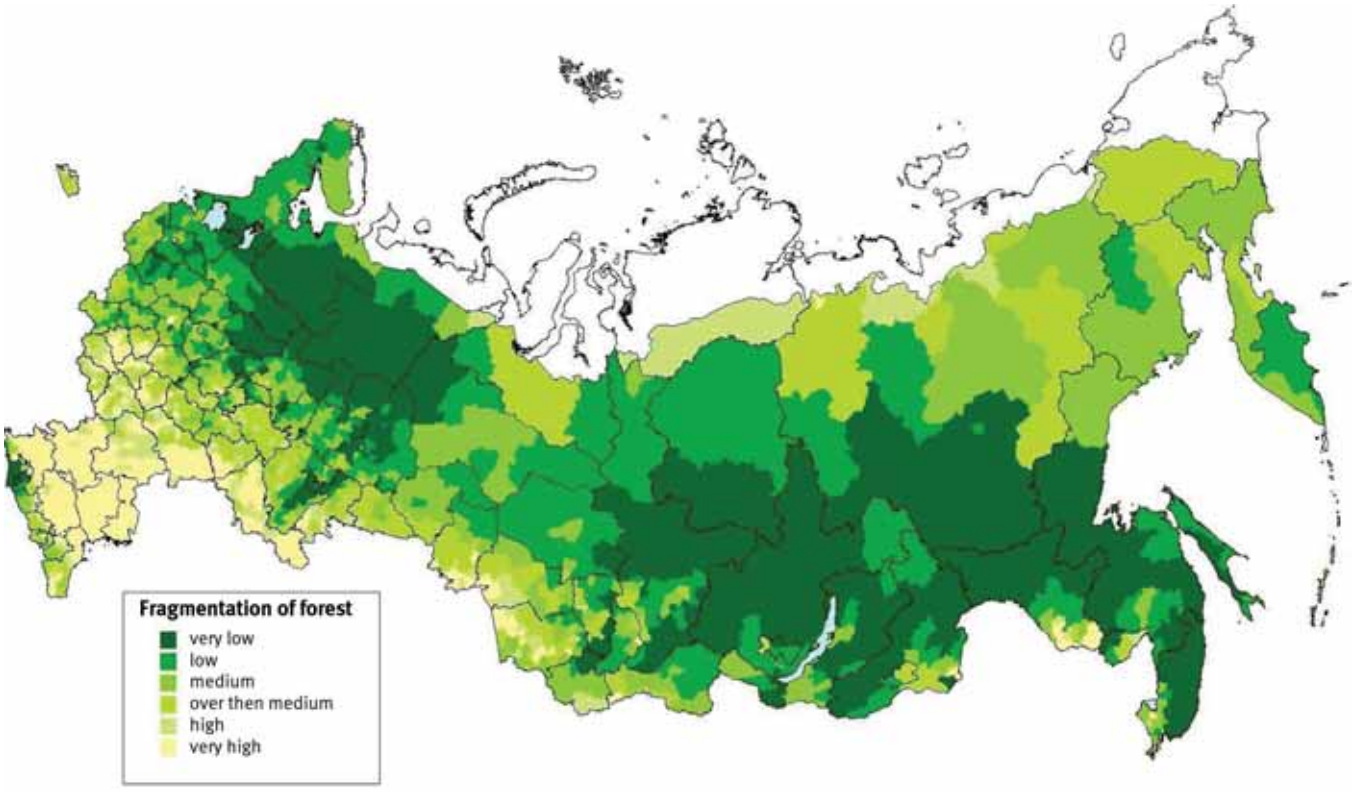


Figure 7. Ranks of fragmentation of forest of the RF (scientific assessment) on basis of forest cover index for administrative districts

Table 4.

List and number of native species/genera forming forests of the Russian Federation

Common names	Scientific names	Number of species
Pine	*Pinus*	6
Spruce	*Picea*	6
Fir	*Abies*	4
Larch	*Larix*	4
Stone pines	*Pinus*	2
Greek Juniper	*Juniperus excelsa*	1
Oak	*Quercus*	5
Beech	*Fagus*	2
Hornbeam	*Carpinus*	2
Ash	*Fraxinus*	4
Maple	*Acer*	7
Elms	*Ulmus*	6
Black Saksaul	*Haloxylon*	2
White Acacia	*Robinia pseudoacacia*	1
Birch	*Betula*	40
Aspen	*Populus tremula*	1
Gray Alder	*Alnus incana*	1
Black Alder	*Alnus glutinosa*	1
Lime	*Tilia*	6
Poplar	*Populus*	9
Willow trees	*Salix*	3
Apricot	*Armeniaca*	2
Amur Cork Tree	*Phellodendron amurense*	1
Hornbeam	*Carpinus*	2
Honeylocust	*Gleditscia*	2
Pears	*Pyrus*	4
Zelkova	*Zelkova*	1
Cork Oak	*Quercus suber*	1
The Sweet Chestnut	*Castanea sativa*	1
Common Walnut	*Juglans regia*	1
Manchurian Walnut	*Juglans mandshurica*	1
Box (wood)	*Buxus*	2
Cherry plum	*Prunus divaricata*	1
Yew	*Taxus*	2
Pistachio	*Pistacia vera*	1
Bird cherry tree	*Padus*	3
Mulberry	*Morus*	2
Apple tree	*Malus*	1
Bamboo	*Bambuseae*	1
Birch bushes	*Betula*	2
Hawthorn	*Grataegus*	3
Tamarisk	*Tamarix*	2
Calligonum aphyllum	*Calligonum aphyllum*	1
Willow shrubs	*Salix*	6
Dwarf pine	*Pinus pumila*	1
Hazel	*Corylus*	2
Silverberry	*Elaeagnus*	2
Juniper	*Juniperus*	5
Sea-buckthorn	*Hippophae rhamnoides*	1
Rhododendron	*Rhododendron*	3
Current	*Ribes*	3

resources, but does not give a clear picture on the tree species composition.

The largest number of tree and shrub forest forming species (36) is in the Sochi National Park (Krasnodar Kray), and the lowest (2-5 species) is in the Kalmykia, Karelia, South Taimyr, and some areas of the Yakutia (Fig. 8). Overall, the diversity of species increases from north to south and reaches a peak in the forest-steppe zone. In the mountains, the species diversity naturally increases due to altitudinal vegetation zonality. Among the plains, the Kaliningrad Oblast stands out with 21 forest forming species.

The abundance of forest species results from the mild climate in this territory of the Middle-Europe Botanical Province (European territory of the RF). Moreover, this oblast has had a long practice of establishing forest plantations. The high species diversity is a feature of the forest of the Russian Far East.

The numbers of predominant tree's and shrub's species listed in the SAFF data base (2007) do not fully reflect the nature of spatial representation and occurrence of these species in the territory of Russia. The Shannon Index H(X) is the most informative in this case. It reflects the spatial «balance» of forest species on area or on stock. The quantity evaluation of species diversity with the Shannon index (Fig. 9) has revealed some differences in spatial layout of the forest dominant tree and shrub species (see Fig. 8). In general, the information index of species diversity increases from North to South (from 0.5 to 3.0 bits). The diversity index has the maximum in the mountains of the Caucasus – 4 bits.

The index of species diversity is much higher in the Western Siberia and Krasnoyarsk Kray than in the forest zone of the European part of Russia. The reasons for this increase are not only the diversity of habitats caused by altitude zoning and variability of ecotones in Central Siberia, but also the spatial evenness of tree and shrub species in these territories.

The core species diversity of the Northern Eurasia - the largest region of the planet - is concentrated in the territory of the Russian Federation. According to the rough estimate, about 20% of the Russian Flora and Fauna are endemic species, and many of them inhabit the forest ecosystems. Flora and Fauna associated with forest have been studied very unevenly. The exact number of the native species for all the territory of Russia is hard to determine because this parameter is insufficiently studied in particular regions, and there is no cumulated data.

Figure 8. **Spatial visualization of species diversity, number of species (on numbers of predominant trees and shrubs in the Russian Federation forests)**

Figure 9. **Quantity evaluation of species diversity with the Shannon index - H (X), bits**

Flora

Vascular plants. Currently, the Russian Federation has registered in its territory more than 12,500 wild species of vascular plants belonging to 1,488 genera and 197 families. According to the preliminary estimates, approximately 30% of species of vascular plants (about 3.5 thousand species) is associated with the forest ecosystems.

Bryophytes. All three classes of Bryophytes are presented in the flora of Russia: Hornworts (*Anthocerae*), Liverworts (*Hepaticae*), and Mosses (*Bryales*). The total number of species is 2,200, including 1,000 species belonging to the class Mosses. Most of the Bryophytes species are an important component of the forest ecosystems,

especially in the boreal zone, although the exact number of those species is unknown so far.

Algae. More than 9,000 species of sea, freshwater, and soil algae are recorded on the land and in the waters of Russia. Some of them are the permanent residents of forest soil or epiphytes living on the trunks of trees.

Lichens. The Lichen's flora of Russia has about 3,000 species. Many of the lichens, along with Algae and Bryophytes, are also epiphytes on trees or are the part of the living ground cover in the boreal forest.

Fungi. Fungi - one of the most important components of the wildlife, they have a high level of diversity and are the part of nearly all terrestrial ecosystems. Number of fungal species in Russia is about 20-25 thousands. The main groups, which include forest associated species, are Myxomycetes and Macromycetes.

Myxomycetes (Slime Mold) belong to one of the least-studied groups of fungi. In the territory of Russia 211 species of 5 orders and 10 families have been identified, they represent approximately 30% of the world Mycobiota. It is possible to expect the discovery of new species of Myxomicetes in the territory of the Russian Federation.

Macromycetes (Macro fungi) – a large, biologically and systematically diverse group of fungi. It includes the most of edible and forming the mycorhiza forms (pileate fungi). This group of mushrooms is still insufficiently studied, the exact number of species on the territory of Russia has not yet been determined. Botanical Institute of the Russian Academy of Sciences has composed the list of Macromycetes including 241 rare species and 103 species requiring protection.

Fauna

In Russia, the Fauna Inventory is not finished yet. The certain groups of vertebrates are studied adequately. The species diversity of the most groups of invertebrate animals of Russia, particularly insects, is studied insufficiently. There are no current taxonomic reviews and revisions of the major systematic groups of terrestrial insect's fauna.

Vertebrates. Vertebrates Fauna of Russia has more than 1500 species belonging to 7 classes.

Mammals and Birds are the most studied groups of vertebrates in Russia. In the territory of the Russian Federation, nearly 320 mammals species are registered, of which about 90 species are associated with the forest ecosystems.

The Russian Bird Fauna (about 800 species) is well studied. The vast number of species (515) breeds in the Russian Federation, among them 27 species breed only here. The most numerous are the species in the orders: Passerine (*Passeriformes*), Charadriiformes (*Charadriiformes*), and Anseriformes (*Anseriformes*). About 9% of the Russian bird species is listed in the Red Book of the RF. Currently, there is no accurate estimate on the number of forest associated species of birds. About 70% of bird species of the Russia breeds in the forest zone, although the proportion of forest associated species may be slightly smaller.

The Russian Reptile and Amphibian Fauna are small (80 and 29 species respectively) because of the sufficiently severe climatic conditions in the most of the territory. There are no adapted estimations on the forest associated species of this systematic groups.

Invertebrate animals. Currently, it is possible to talk only about a rough estimate of the number of representatives of the Russian Invertebrate Fauna - about 130-150 thousand species. They represent approximately 10% of the world's diversity. The basis of Russian Invertebrate Fauna is the insects (97% of all species).

The following taxonomic groups of invertebrates are the mostly involved in the forest ecosystems: the Protozoan (about 6,500 species), annelid worms (about 1,000 species), insects (about 100,000 species), Arachnids (about 10,000 species).

1.2.b. Number and status of native forest associated species at risk, as determined by legislation or scientific assessment

Rare and endangered species of animals, plants, and fungi are the most fragile, but a very important part of the biodiversity in forest ecosystems. The priorities for the protection of such species are defined by Convention on Biodiversity and by Russian environmental legislation, in particular by the Strategy of Conservation Rare and Endangered Species of Animals, Plants and Fungi, adopted by the Ministry of Natural Resources RF (2004).

Among living in Russia animals and growing plants, according the WWF's data, 15% Vertebrates and 4% Vascular plants are considered as rare or endangered species. The loss of their habitats is the biggest danger for them. Between other threats are illegal trade, environmental pollution, climate change, unsustainable use of natural resources.

The Red Book of the RF lists the rare and endangered animals, plants, and fungi that permanently or temporarily exist in a state of natural freedom (wildlife) or growing naturally within the Russian territory, its continental shelf, and marine economic

zone and are in need of public legal actions within the competence of the Russian Government, the Ministry of Natural Resources, and other federal executive bodies.

These actions must also provide (1) Russian compliance with the international obligations to preserve such objects, (2) the coordination of activities among constituent entities of the Federation, and (3) the State control over the conservation of the objects that are found in only one entity of the Federation, in case if its extinction from this territory entails the loss of this object from Russian Fauna or Flora. The articles in the Russian Red Book indicate the spreading of the species in the past and at the present time, the reproduction peculiarities, already taken actions and necessary measures to protect the species, subspecies, and local populations.

In accordance with the current law, the Red Book of Russia should be issued not less than ones in 10 years. Animals, plants, and fungi listed in the Red Book of the IUCN and living (growing) permanently or temporarily in the territory of the Russian Federation, its continental shelf and sea economic zone are entered in the Red Book of the Russian Federation in case when it is required by the status of their population or conditions of their existence in the Russian Federation. The same applies to the animals, plants, and fungi protected by the international conventions.

The Red Book was established in the USSR in 1974. Its first edition appeared in the 1978. In 1982, the decree of the Council of Ministers of the RSFSR «On Establishing of the Red Book of the RSFSR» was adopted. The Red book RSFSR (Animals) was printed in 1985; the Red book RSFSR (Plants) – in 1988; the Red book RF (Animals) – in 2000; the Red book of the RF (Plants) – in 2008. Currently, the protection of rare and endangered species of plants and animals in Russia is done in accordance with the list approved in 1997 (Animals) and 2005 (Plants). There are a public information system developed with an integrated database for data on rare and endangered species of the Russian Federation (www.sevin.ru) and a Red Book of the RF complete on-line version (www.biodat.ru).

Red Books are maintained on two levels: federal (Red Book of RF) and regional (the territorial lists of protected species and the Red Books of the constituent entities of the RF). They are complementing each other and have been created by a uniform method. In order to implement a unified state policy in the field of biodiversity conservation, the Ministry of Natural Resources RF had developed and forwarded in 2006 to the administrations of the constituent entities of the Russian Federation the «Methodological Recommendations on the Conducting the Red Book of the Constituent Entity of the Russian Federation». The recommendations define the framework requirements for the maintenance and publication of the Red Books of the constituent entities of the Russian Federation. The legal basis for the formation and maintenance of the Red Book of the RF and Red Books of the constituent entities of the RF is formed by the Federal Law «On Protection of Natural Environment» (2002) and the Federal Law «On Animal World» (1995). The maintaining the Red Books in accordance with current legislation is the part of the direct responsibilities of administrations of constituent entities of the Russian Federation.

Currently, 676 taxa* of the Russian Federation Flora require protection, of which 474 – Angiosperms (flowering), 14 – Gymnosperms, 23 – Ferns, 3 – Lycopsids, 61 – Bryophytes, 44 – Lichens, 22 – Fungi, and 35 – Algae taxa. From the species listed in the Red Book of the Russian Federation, 58% Vascular plants, 30% Bryophytes, 64% of Fungi, and 80% Lichens have been recorded in the territory of the State Reserves.

In forests of Russia one specie of tree is listed in the category «probably extinct», 14 species of trees are endangered, 19 are vulnerable species, and 30 rare species are placed on record, according to the Red Book of Russia. Annex 2 shows the selection of the tree and shrub species from the Red Book of the RF (Order № 289 of the Ministry of Natural Resources RF of 25.10.2005).

The forest associated plants make up a large proportion (40%) of the total number of species included in the Red Book of the RF (Table 5). It regards mostly to the Gymnosperms, Fungi, and Lichens that are closely associated with the forest ecosystems.

In accordance with the requirements of the Forest Code RF (2006), the decree of the Government of the RF of 15.03.2007 № 162 had approved the list of trees and shrubs species for those timber harvesting is not permitted in the RF territory. This list is coordinated with the Red Book of the RF.

The list of animal wildlife objects listed in the Red Book of the RF includes 439 animal species and subspecies: 155 taxa of invertebrates (0.1% of the total specie number of invertebrates described in the territory of Russia, of which 95 taxa are insects) and 284 taxa of vertebrates, including 48 taxa of Fish and Cyclostomes (7% of the total number of Cyclostomes and Fish species in the Russian territory), 8 taxa of Amphibians (30%), 21 Reptile taxa (28%), 128 Bird taxa (17%), 79 Mammal taxa (20%).

* The term «taxon» (plural taxa) is used for convenience and can be applied to the species or the lower systematic units: sub-species, populations etc.

Table 5.

Number of forest associated plant species (subspecies) and their share in protecting cathegories of the Red book of the Russian Federation

Scientific group	Number of forest associated species						Total number of species
	Total	Including within the protecting categories					
		0 (EX)	1 (EN)	2 (VU)	3 (NT)	4 (DD)	
Vascular plants, including:	180 (38.7)*	1	28	43	104	4	465
Angiosperms (flowering)	166 (37.7)	1	27	34	100	4	440
Gymnosperms	10 (90.9)		1	7	2		11
Ferns	4 (40.0)			2	2		10
Lycopsids	(0)						4
Bryophytes	9 (40.9)				9		22
Lichens	19 (65.5)			5	14		29
Fungi	17 (100)				16	1	17
Total	225 (42.2)	1	28	48	143	5	533

** In parenthesis - percent (%) of forest associated species compared to all species included in Red book of the RF*

From the species included in the Red Book of the RF, the State Reserves and National Parks have 46% of invertebrates and 71% of vertebrates: 100% of Fish and Cyclostomes, 63% of Amphibians, 62% of Reptiles, 95% of Birds, 78% of Mammals. About 45% of animal taxa listed in the Red Book of the RF (including 70% of invertebrate taxa) are closely associated with the forest ecosystems.

1.2.c. Status of *in situ* and *ex situ* efforts focused on conservation of species diversity

The National Strategy of Biodiversity Conservation in Russia (2001) determines the following ways to preserve species diversity *in situ* – in their natural habitats:

✔ Protecting species in the Specially Protected Natural Territories.

✔ Conservation of rare and endangered species listed in the Red Book of the Russian Federation.

✔ Regulation on the harvesting (hunting) for the exploited species. While planning the harvesting, it is important to take into account the maintaining not only the population number at sustainable level but also the spatial-genetic population structure of the specie.

✔ Monitoring, control, and regulation of the status for the populations of other not-exploited species: measures to regulate the status of populations, species, and ecosystems, including the

In recent years, the legislative work has been improving in maintaining the regional Red Books of the constituent entities of the Russian Federation.

An important step was the adoption at the regional level the Law «On Red Book of the Constituent Entity of the Russian Federation».

Up to date, such laws have adopted in 8 constituent entities of the Russian Federation: in Krasnoyarsk Kray (1996), in oblasts of Vladimir (2002), Kostroma (2006), Kursk (2004), Ulyanovsk (2002), and Sakhalin (1999), in the Republic of Kalmykia (2002), and in the Jewish Autonomous Region (2004). A law's draft is prepared in Tver (2006) and Chita (2006) oblasts.

Several regional Red Books have been published every year. During 2004–2007, the new lists of the Red Book's species were approved by the law in 31 regions of the RF: Republics of Buryatia (2004, P., 2005, A.), Ingushetia (2006, C.), Kabardino-Balkaria (2004, C.), Tatarstan (2006, C.), Sakha (Yakutia) (2006, C.); Krays of Krasnodar (2006, C.), Krasnoyarsk (2005, P.), Perm (2007, C.) Khabarovsk (2006, C.); oblasts of Belgorod (2005, C.), Vladimir (2006, C.), Volgograd (2004, J., 2006, P.), Vologda (2004, P.), Kamchatka (2006, C.), Kemerovo (2004, C.), Kostroma (2005, C.), Kursk (2005, C.), Lipetsk (2005, A.), Omsk (2005, C.), Orel (2006, C.), Samara (2005, C.), Saratov (2006, C.), Sakhalin (2005, P.), Sverdlovsk (2006, C.), Tver (2006, C.), Tumen (2006, C.), Cheljabinsk (2005, C.), Yaroslavl (2004, C.); the Jewish Autonomous Region (2005, C.); Nenetsk (2005, C.) and Chukotka Autonomous Okrugs (2007, A.).

In 2007, the number of constituent entities of the Russian Federation that are providing legal protection of rare and endangered natural sites reached 76 (88.4% of administrative territories of this rank). The Red Books were published (101 volumes) in the 72 constituent entities of the Russian Federation. The total number of species in the Red Books of constituent entities of the Russian Federation varies greatly: from 109 species in the Red Book of Karachayevo-Cherkess Republic till 1141 in the Red Books (volumes «Animals» and «Plants») of Leningrad

Oblast. The average number of species included in regional Red Books is ranging from 200 to 400.

In 2007, the Laboratory of the Red Book of the Russian Institute of Nature Protection completed the formation of the Red List of Russia - the first consolidated inventory of natural objects taken under the special protection in the country's territory. According to the clarified data, 6668 species are taken in the country under legal protection including 2,216 species of animals (33.2%) and 4,452 species of plants and fungi (66.8%). The comparison of the Red List of Russia and the Red Book of the Russian Federation showed that with a slight difference in the structure of the main macro taxa, the number of species in the Red List exceeds the number of species in the Red Book: in Flora in 6.5 times (from 2 to 14 in different regions), in Fauna - in 5.3 times (vertebrates – in 2.6-3.6 times, invertebrates – in 9 times). The allocation of protected species in macro taxa is more natural in the Red List of Russia. In 2007, the publication of the Red List of protected, rare, and endangered animals and plants of Russia in 5 books was accomplished. This Red List publication was compiled by the Red Books of constituent entities of the RF.

Note: P. – volume «Plants»; A. – volume «Animals»; C. – Cumulated volume

struggle against their illegal exploitation, regulatory actions on their legal use for different purposes (recreational, scientific, cultural, etc.), conducting environmental impact assessments of economic projects, involving objects of biodiversity, etc.

✔ The preservation and restoration of natural habitats, the reconstruction of biotopes.

✔ Reintroduction (re-acclimatization) of the disappeared populations in their natural habitats, restoration of (and/or genetic –«recovery») of small populations.

Federal executive bodies in the field of forest management and non-governmental organizations of Russia pay a great attention to the protection of the endangered species. First of all, Russia bears a worldwide responsibility for the conservation of these species. The monitoring and conservation strategies have been provided for Amur tiger, Asian leopard, Snow leopard, and others (www.mnr.gov.ru, www.wwf.ru).

The protection of populations of animals, plants, and fungi species in Specially Protected Natural Territories is one of the most effective methods for conservation of rare and endangered species. Many Russian SPNT had been created specially for the conservation of such species. The Information Retrieval System and Integrated Database for Fauna and Flora in Protected Natural Areas of the Russian Federation collect the information on the protected species in Reserved and Protected Territories of Russia (www.sevin.ru/natreserves/).

Protection of populations *in situ* is supported by an allocation SPA and HCVF (see indicator 1.1.b) in the areas of potential habitats and occurrence of rare and endangered animal and plant species. Before the beginning of the Forest Inventory and Planning works, the trainings are given to the appraiser to became familiar with the species of plants and animals included into the Red Book of the RF. This practice during the Forest Inventory and Planning work allows to better allocate SPA in the forests, where industrial timber cutting is prohibited, in other words, where it is prohibited to disturb the habitats of rare species. In the south part of the Far East, the WWF is developing a method of allocating SPA for the conservation of large animals (Amur tiger, Asian leopard, Polar bear, and ungulate species).

The greatest result in protecting populations of rare species is achieved when the network of SPNT with different protective regimes connected by «ecological corridors» is organized. The legal basis for building the ecological network in Russia is provided by the Ecological doctrine of the Russian Federation, Federal laws «On Protection of the Environment», «On Specially Protected Natural Territories», «On the Animal World», Codes of laws of the Russian Federation – Land, Forest, Water, Urban Development, on the Mineral Resources, a number of other federal and many regional legislative and other regulations that impose order of establishing and operation of the SPNT, maintenance valuable natural processes in other (non-protected) territories.

One of the examples of efforts to restore populations in the natural environment is the WWF project to restore the population of the Persian leopard in the Russian part of the Caucasus (www.wwf.ru). At the present time, a breeding center is been creating in the territory of the Sochi National Park for the shaping in the captivity a group of founders of the natural population. The release of the leopards into the natural habitats is planned for the years 2009–2013. To create the food supply for the leopard population, a set of biotechnological activities is implemented aiming to increase the number of ungulates (feeding the animals, creating salt-lick spots), and also the protection of the territory from poachers is being enhanced.

The Strategy of Biodiversity Conservation of Russia (2001) provides the following measures for

preserving populations of rare and endangered species *ex-situ* – in the artificially created habitat:

✔ maintenance and breeding of selected individuals in nurseries, zoos, botanical gardens, etc.;

✔ storage of genetic materials (gametes, zygotes, somatic cells, embryos) in low temperature genetic banks, in the banks of cell and tissue cultures, as well as in the seed banks;

✔ domestication the species.

The conservation of certain individuals and groups of individuals in specialized breeding centers – nurseries, zoos, botanical gardens, etc. – includes development and deployment methods of maintenance and reproduction (using both natural and artificial means) for rare and endangered species. This approach is used for (1) creating a «pool» for natural population/specie being in critical condition, (2) early recovery of population/specie in the natural habitat in the case of vanishing from the nature, (3) declining the pressure of the consumer's demand for naturally grown resources substituting them with animals raised in artificially created habitats. The examples of works in this field are the Breeding Center of the Persian Leopard, Nursery of Rare Species of Cranes (www.mybirds.ru/org/oka/), the Center for the Conservation of European Mink, and others.

The Russian zoos (www.zoo.ru) preserve and breed the individual members of the rare species of Russia. An Information Retrieval System «Russian Zoos» is developed, and it represents 48 zoos (www.sevin.ru/zoo/). The collection of vertebrate animals in zoos, zoological gardens, and aquariums of Russia consists of: fishes (*Pisces*) – 456 species and subspecies, amphibians (*Amphibia*) – 60, reptiles (*Reptilia*) – 436, birds (*Aves*) – 519, mammals (*Mammalia*) – 371. All together – 1,842 species/subspecies.

Botanical Gardens and Dendrological Arboretum (Parks) of the Russian Federation are united in the Regional councils of Botanical Gardens of Russia (www.hortulanus.narod.ru), one of the units of the International Council of Botanical Gardens for Plant Conservation (now Botanic Gardens Conservation International). In accordance with the federal law «On Specially Protected Natural Territories» (1995), Botanical Gardens and Dendrological Parks represent an independent category of Specially Protected Natural Territories. Their goals are creation of special collections of plants for conservation of the biodiver-

Asian leopard (Panthera pardus orientalis) is the rarest member of felines. It inhabits only the south-west part of the Far East of Russia. Since 1997, the monitoring for the number of this specie has been provided, in particular, using automatic cameras. The results of accounting of the year 2007 are very alarming for the scientists: in the last spot of its habitat in the south-west part of the Primorsky Kray of Russia there are only 25-34 individuals of Asian leopard. The number remains roughly at the level of the year 2003 accounting. Currently, the visiting center "Earth of the leopard" was organized to raise public awareness (www.phoenix.vl.ru).

sity and enrichment of the Flora, as well as implementation of scientific, educational, and outreach activities.

In 2008, the Regional councils of Botanical Gardens of Russia included about 100 Botanical Gardens and Dendrological Parks (Annex 1, Table 6) under jurisdiction of different departments: Russian Academy of Sciences, Russian Academy of Agricultural Sciences, Ministry of Education and Science of the Russian Federation, and others. The total area of Botanical Gardens and Dendrological Parks are more than 7.5 thousand ha.

The important goal of the Russian Botanical Gardens is the conservation of biodiversity of the Russian Flora *ex situ*. The scientifically grounded methods of conservation, sustainable use, and reproduction of valuable, rare, and endangered plants are developed here. The information on the localization of taxa and their representation in the collections of the Russian Federation of trees and perennial herbs has been gathered (www.sevin.ru/collect:ons/gardens/). The database contains: collections of the open ground – 83,382 specimens (29,032 taxa), collections of the greenhouses – 17,465 specimens (12,485 taxa), collections of rare plants – 217 specimens (108 taxa).

The technologies of cryoconservation and other kinds of storage genetic materials (gametes, zygotes, somatic cells, and embryos), the conceptual framework and basic practical methods of recreating live organisms from the genetic material are developed in Russia. The reconstruction of organisms from the saved genetic material is provided by obtaining a partheno-, andro-, and gyno-genetic individuals, transplantation of the gonads, creating of interspecies chimeras from normal and damaged during cryoconservation embryos, transplantation the embryo on the yolk of another species, cloning by transplantation of somatic nuclei and germ track cell nuclei in an enucleated egg. The genetic material from the storages can be used to restore extinct populations and species, as well as to maintain or restore genetic diversity in highly disturbed populations. The Institute of Cell Biophysics RAS had created and has been continuing to grow the genetic cryo bank of rare and endangered species of animals and plants.

Indicator 1.3. Genetic diversity

The intensification of development of forest resources in recent times requires advanced knowledge of the genetic processes that occur in populations of forest plants and animals. The development of modern technology of reforestation also involves a wide range of genetic and selection researches in order to avoid drastic impoverishment of the gene pool of forest plantations. Studying of genetic structure of natural populations as an original material for breeding becomes, therefore, a very essential problem.

The knowledge about population genetic structure of the trees will allow: to monitor its changes and stand up to oncoming threats of instability in population's reproduction over the time, to find hidden resources necessary for the creation productive plantations adapted to the climate change, disease, industrial pollution etc.

In the territory of Russia and several regions of the East Asia, where native genetic structure of forest populations is still preserved, it is possible to conduct the unique researches necessary to preserve the future genetic diversity of Eurasian trees, to establish genetic reservations and seed banks, to develop a concept of the sustainable use of genetic diversity. The destruction of the last natural trees populations before they will be studied in details would mean that mankind will never be able to obtain the information about their native genetic structure and the range of specie genetic variation, as well as will not be able to develop appropriate measures on reforestation for species affected by genetic impoverishment.

1.3.a. Number and geographic distribution of forest associated species at risk of losing genetic variation and locally adapted genotypes*

Reducing the habitats of rare species of forest ecosystems is often associated with different types of anthropogenic impacts, of which the most crucial are: forests clear cutting, reducing forests to agricultural land, conversion floodplain forests into hayfields and pastures, drainage of wetlands, forest fires, using chemicals against pests and diseases, harvesting medicinal raw materials, collecting ornamental plants, and others . The active anthropogenic impact on forest landscapes has resulted in reduction of population size of many forest associated species. In some cases, the forest management measures, such as sanitary cutting and cleaning downed wood, lead to the loss of an entire group of species associated

* The information in this section should be considered preliminary, requiring specification and additions.

with decomposing dead woods. Populations of large mammals are seriously harmed by poachers.

The greatest number of rare species with limited distribution or reducing their range is concentrated in the broadleaf, coniferous-broadleaf, and coniferous forests of the Caucasus, the south parts of the Siberia and the Far East. A significant number of rare species conjunctions with the broadleaf forests of the European part of Russia and the Ural.

The Far East. The broadleaf, broadleaf-cedar, spruce-fir forests of the Primorsky Kray and Sakhalin Region play an essential role in maintenance of viable populations of many rare species.

The many rare species of mammals have been preserved only in remote forested areas, and also in the territory of State Nature Reserves. These are Siberian tiger (*Pantera tigris altaica*), Amur leopard (*Pantera pardus orientalis*), Amur wildcat (*Felis euptilura*), the Dhole or Red wolf (*Cuon alpinus*), Asiatic black bear (*Ursus thibetanus*), Sika deer (*Cervus nippon hortulorum*), Long-tailed goral (*Nemorhaedus caudatus*), Siberian (*Sakhalin*) musk deer (*Moschus moschiferus sachalinensis*), Ussuri (Giant) shrew (*Sorex mirabilis*). The special WWF projects are devoted to conservation of viable populations of tiger and leopard. Among the forest species with limited range there are at least 11 species of birds and 7 species of insects.

Among the trees and shrubs with limited ranges there are 20 species: Kalopanax or Castor Aralia (*Kalopanax septemlobus*), Schmidt birch (*Betula schmidtii*), European Hop hornbeam (*Ostrya carpinifolia*), Daimyo Oak (*Quercus dentata*), Manchurian apricot (*Armeniaca mandshurica*), Exochorda or Pearl shrub (*Exochorda serratifolia*), Cherry Prinsepia (*Prinsepia sinensis*), Japanese Walnut (*Juglans ailanthifolia*), Japanese Bigleaf (*Whitebark*) Magnolia (*Magnolia obovata*), Olga Bay Larch (*Larix olgensis*), Japanese red pine (*Pinus densiflora*), Japanese Yew (*Taxus cuspidata*), Temple Juniper (*Juniperus rigida*), Siberian cypress (*Microbiota decussata*), Japanese Devil's-Club (*Oplopanax elatus*), Japanese Spikenard (*Aralia cordata*), Turkish Hazel (*Corylus colurna*), Fauriei Rhododendron and Shlippenbach Rhododendron (Royal Azalea) (*Rhododendron fauriei, R. schlippenbachii*), Leafy Lespedeza (*Lespedeza cyrtobotrya*). Among herbaceous vascular plants belonging to the forest ecosystems of the Far East at least 19 species have limited range and are included in the Red Book of the RF.

Caucasus Mountain Forests. There are following rare and protected species of mammals associated with the Mountain Forest ecosystems: European bison (*Bos bonasus*), Bezoar goat (*Capra aegagrus*), Greater Noctule bat (*Nyctalus lasiopterus*). Among the birds there are – Short-toed Eagle (*Circaetus gallicus*), Caucasian Black Grouse (*Lyrurus mlokosiewiczi*), Krueper's Nuthatch (*Sitta krueperi*), Short-toed Treecreeper (*Certhia brachydactyla*). Among the reptiles – Caucasian viper (*Vipera kaznakovi*) and Caucasian Parsley Frog (*Pelodytes caucasicus*). Among the insects – Caucasian Ground Beetle (*Carabus caucasicus*), Rhesus capricorn (*Rhesus sericollis*), Clouded Apollo (*Parnassius mnemosyne*).

The Caucasus Forest ecosystems play an exceptional role in maintaining populations of rare trees and shrubs (at least 10 species): East Mediterranean pine (*Pinus brutia subsp. pityusa*), English Yew (*Taxus baccata*), Greek Juniper (*Juniperus excelsa*), Caucasian Birch (*Betula raddeana*), Asiatic Persimmon or Date Plum (*Diospyros lotus*), Common fig (*Ficus carica*), Wingnut (*Pterocarya pterocarpa*), Colchis Boxwood (*Buxus colchica*), Etruscan honeysuckle (*Lonicera etrusca*), Turkestan Burning Shrub (*Euonymus nana*), and also at least 14 species of vascular herbaceous species.

European forests. Mixed and broadleaf forests of the European part of the Russian Federation associated with such rare species as: animals – European bison, birds – Short-toed Eagle, Golden Eagle (*Aquila chrysaetos*), insects – Giant Noctule, Hermit beetle (*Osmoderma eremita*), Clouded Apollo. Russian Desman (*Desmana moschata*) inhabits the floodplain forests of Central Russia (Oksky Reserve and its environs), while its number is declining throughout historical range (the river basins of Dnieper, Volga, Don, and Ural).

The special nurseries are built to restore the populations of European bison in the territory of certain Reserves (Prioksko-Terrasny, Oksky). The resulting bison's offsprings are moved for resettlement in other parts of the European part of Russia.

In the forest-steppe areas, the forest outliers are the nesting places for predatory birds: Levant Sparrowhawk (*Accipiter brevipes*), Imperial Eagle (*Aquila heliaca*), and Saker falcon (*Falco cherrug*). Between trees, the chalk pine (*Pinus sylvestris var. cretacea*) has the limited range and lives in separate stands in the chalk geological outcrops in the forest-steppe zone.

A limited distribution in the area of broadleaf forests has a number of species of vascular plants, such as: Hanging Sedge (*Carex umbrosa subsp. Umbrosa*), Lathyrus venetus (*Lathyrus venetus*), Russian fritillary (*Fritillaria ruthenica*), Narrow-leaved and Red Helleborine (*Cephalanthera longifolia, C. rubra*), Litvinovi pea (*Lathyrus litvinovii*), and other.

Ural and Siberia Forests. In the forested floodplains of the Northern Ural Mountain and in the upper part of the Yenisei river (Western Siberia) lives the Western Siberian beaver (*Castor fiber pohlei*), which range has the greatly reduced range.

The forests of the Southern Siberia are important to conservation populations of Tuvinian Beaver (*Castor fiber tuvinicus*), Imperial Eagle, Saker falcon, Clouded Apollo and plants: Siberian fawn lily (*Erythronium sibiricum*), Dagana fritillaria (*Fritillaria dagana*).

1.3.b. Population levels of selected forest associated species to describe genetic diversity

The frame for all activities on the forest biological resources conservation is the obtaining the information about the native population genetic structure of tree species. As the dominant keystone species for the complex forest ecosystems, the trees should be the primary targets of protection. Populations of forest trees determine a well-being for a range of animal and plant species.

The evaluation and monitoring of genetic diversity level - quantitative estimation of the amount and distribution of genetic variability of species and populations - are the basis for sustainability and breeding (including production) capacity of the forest populations. Modern molecular technologies (allozymes and DNA markers) provide an opportunity to assess the level of genetic diversity in the particular tree's stands or seed lots. These estimations are objective, since the molecular variation does not virtually depend on the environmental conditions and developmental stage. The assessment on genetic differentiation of populations provides us with the information on the degree of difference between compared populations, groups of individuals (selected on any ground), or individual specimens. Population genetic studies conducted in Russia revealed molecular-genetic variability of the main forest forming coniferous and deciduous species associated with the country's geographical regions (for examples see Fig. 10 and 11 and also www.vigg.ru).

Coniferous species form the main forest abundance of Russia. The examination of the most common pine, spruce, fir, and larch species by the means of allozyme analysis showed the high level of intra-population genetic variability for these species' populations in the territory of the Russian Federation. High heterozygosity and allelic diversity are characteristic for the Scots pine and Dwarf Siberian pine, as well as the European spruce and Siberian spruce (especially in the area of their introgression hybridization in the Urals and Western Siberia) and also for the Yeddo (Jezo) Spruce. Typical for coniferous medium level of allele and gene diversity have the populations of Siberian stone pine and Korean pine. The species of larches and firs possess lower gene diversity levels. Endemic species and marginal populations of conifers often, but not necessarily, are genetically impoverished.

The level of gene diversity (the average expected heterozygosity) in widespread species of stone pines is in between 0.109-0.235 and decrease in a line from widespread species to narrow range species (Dwarf Siberian pine -› Siberian stone pine + Korean pine -› Swiss Stone pine). Dwarf Siberian pine has extremely high values of allelic diversity and heterozygosity that are close to the absolute maximum for conifers and plants in general, that could be associated with high longevity of this specie and its adaptation to extreme conditions. Typical for coniferous medium levels of allele and gene diversity are described the populations of Siberian stone pine and Korean pine.

The deficiency of heterozygotes, comparing to the normal panmictic situation, was found in embryo samples of Stone pines that is associated with self-fertilization and close pollination. The different species self pollination rates vary from 2-10% for Korean pine and 2–20% for Siberian stone pine to 45% for Dwarf Siberian pine.

Swiss Stone pine, despite the fragmentation of habitat, has the level of genetic subdivision only slightly higher than that of Siberian (Fig. 12). Differences between the populations of these two species are the same as those within species.

A Korean pine has revealed the average level of intra- and inter-population variability.

The genetic differentiation in populations of Dwarf Siberian pine reflects the history of specie's settlement and the today's distribution. The Pacific complex of Dwarf pine's populations fully represents the specie’s gene pool. The Baikal populations are genetically unique, while populations in Baikal-Amur railroad zone take an intermediate position.

In the Siberia, pine species have low spatial differentiation inside their ranges, especially where they are dominant and grow in optimal conditions. It is explained by continuous ranges and similar selection vectors with a predominance of its stabilizing forms. Populations of Siberian pine in its optimum (mountains of Southern Siberia) are poorly genetically differentiated. The differentiation is more pronounced in the eastern part of the range and is maximal between the northern samples and the rest of the range. The inter-population variability share of the total genetic variation of species is between 2–4% for Korean pine and Siberian stone pine (in the central part of the range) and up to 15% for the complex of European spruce and Siberian spruce.

The population-genetic studies conducted in Russia shows that the examined coniferous species of family Pinaceae of the Northern Eurasia (pines and