

Figure 10. Level of genetic diversity of Scots pine population

complex of spruces European and Siberian) are characterized by high levels of allele and gene diversity and low differentiation in the ranges.

1.3.c. Status of *in-situ* and *ex-situ* efforts focused on conservation of genetic diversity

According to the National Strategy of Biodiversity Conservation in Russia (2001) there are following options for preserving the genetic diversity of populations of rare and endangered species in the artificially created habitat: in nurseries, zoos, botanical gardens (see also Indicator 1.2.c). The main problem arising is maintaining the minimum necessary size of populations that will be able to provide sufficiently high level of genetic diversity, i.e. to preserve the genetic structure of the specie.

The in-breeding depression can be developed after reducing the population size below the allowable limit, and the genetic variability may be gradu-

ally lost. This limits the specie's ability of adaptation to the changing or new living conditions and in particular to the climate change, new forms of infection, etc. In this regard, during storage *ex situ*, the special care is given to using the best scheme for sharing specimens between nurseries, zoos, and botanical gardens for preserving genetic diversity within group of individuals and within population in general.

In recent years, the rapid development of biotechnology has changed the conservation of genetic resources *ex situ*. First, there are new kinds of genetic resources – a library of genes and DNA. Second, there are sharply increasing numbers of genetic resources collections created during the scientific researches. Third, the genetic materials of different organisms are actively used for the development of new pharmaceutical, biotechnological, and other goods and services that significantly expand the list of genetic resources and increase their economic value.

In Russia, the storing of the genetical and biological materials is provided by specialized organizations – Botanical Gardens RAS, the structural

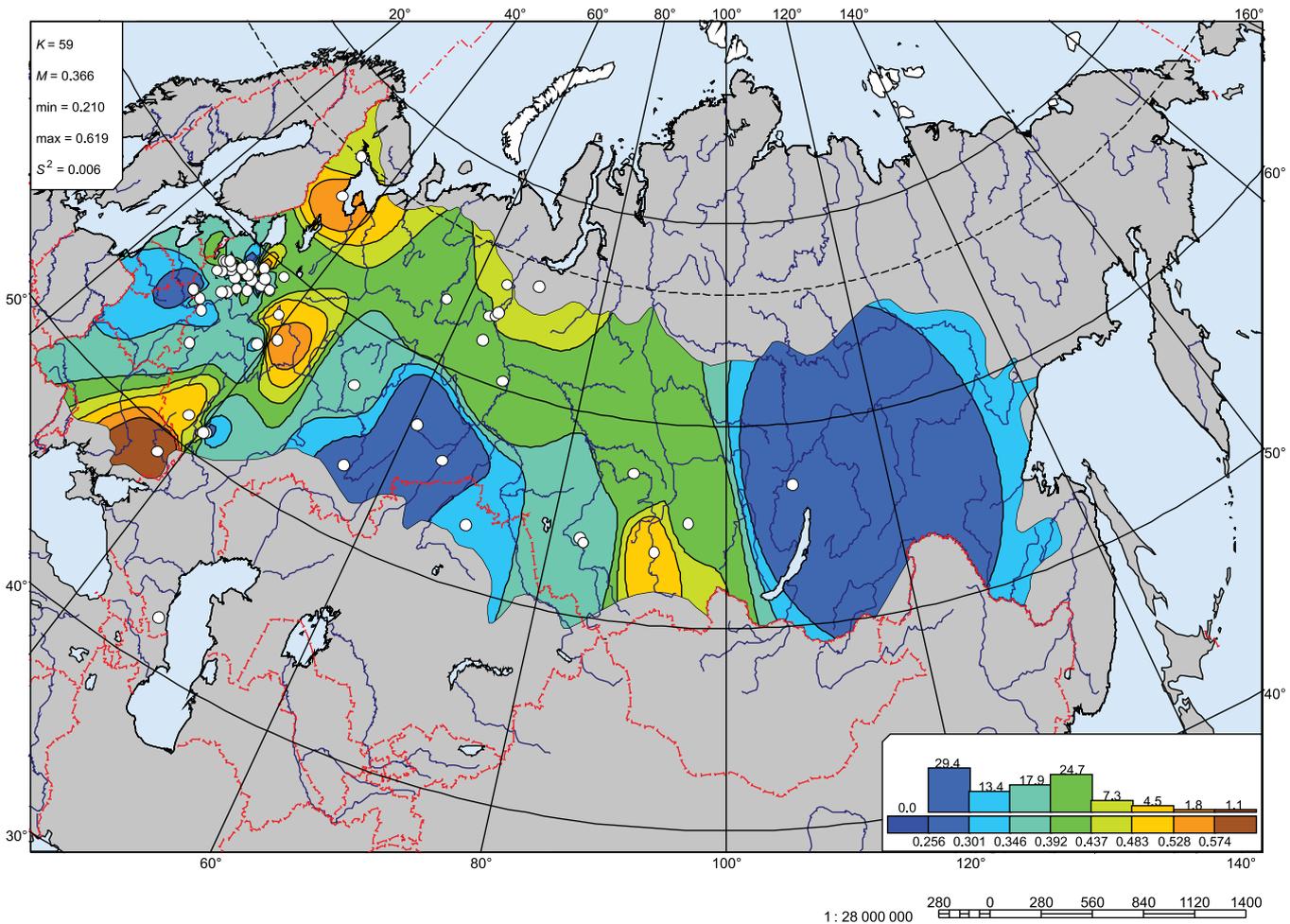


Figure 11. Allele ADH-1.2 (isozyme loc) frequencies in Scots pine populations

CRITERION 1

CONSERVATION
OF BIOLOGICAL
DIVERSITY

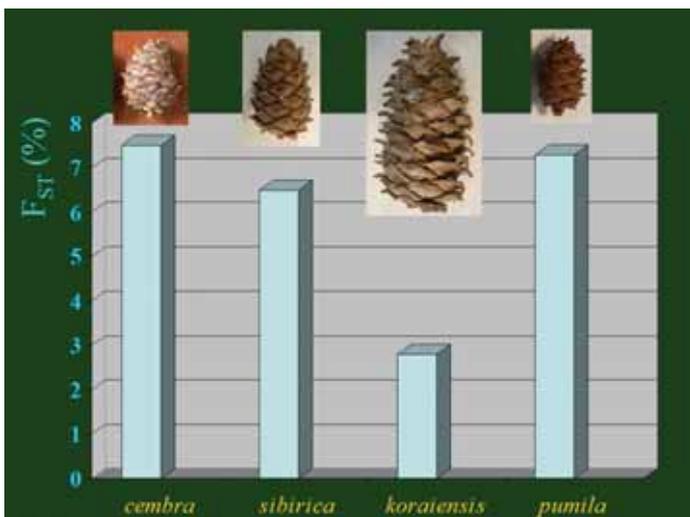


Figure 12. Genetic subdivision of Stone Pines (Fst, %)

is not a core function (nurseries, wild animal farms, zoos, etc.). These organizations belong to the different departments: Russian Academy of Sciences, Russian Academy of Medical Sciences, Russian Academy of Agriculture Sciences, Ministry of Agriculture of the RF, Ministry of Education and Science of the RF, Russian Ministry of Health, and Ministry of Defense of the Russian Federation.

The Informational system «The Genetic and Biological (Zoological and Botanical) Collections of the Russian Federation» (www.sevin.ru/collections/) was implemented as a public WEB-server designed to perform key functions on inventory and documentation of genetic resources.

The general way of preserving gene pool of tree species *in situ* is the Forest Genetic Reserves – plots of the forest that are typical by their genotypic structure, phytocenotic, silvicultural, and other parameters for this climatic region. They are allocated for one edificatory specie or their complexes – in complex composition biocenoses. While allocating the Forest Genetic Reserves, the representation of the particular populations in the Specially Protected Natural Territories of that region is taken into

units of Science Research organizations (the Collection of microorganisms and cell cultures), the working Collection of laboratories doing research on genetics and selection, as well as a number of organizations for which storage of genetic material



account. Forest Genetic Reserves have been allocated in Russian forest on 205.3 thousand ha.

The scientifically organized Forest Seed Industry helps to preserve genetic diversity of the forest main species. According to the Directions on the Forest Seed Industry in the Russian Federation (2000), the units providing the conservation of the gene pool of forest trees and plantings outside the natural habitats are the following facilities allocated in the nature or artificially created facilities: Archives and Stoolbeds of Plus Tree Clones, the Testing Culture, the Geographical and Population-Ecological Cultures, the Forest Seed and Stocking Plantations, Collecting Sites of outstanding forms, Genetic Reserves, as well as Gene Banks of seeds, pollen grains, and meristems of the forest plants.

The Forest Seed Industry to a great extent determines the productivity and quality of forest of the future. In Russia, the works in Forest Seed Industry are carried out in accordance with the Federal law "On Seed Breeding".

The main goal of the Forest Seed Industry is the providing the reproduction of forest using the improved regionalized seeds and grown from these seed planting materials. To do this, a Common Genetic-Breeding Complex (CGBC) is established in the country. It includes Plus Trees, Plus Stands, Archives and Stoolbeds of Plus trees Clones, Forest Seed Plantations, Permanent Forest Seed Sites, and also the units of conservation and research of genetic fund of the forest: Forest Genetic Reserves, Testing and Geographic Cultures.

**Units of the Common Genetic-Breeding Complex
(as of 2008)**

Plus Trees, thousand trees	36.6
Plus stands, thousand ha	15.3
Forest Seed Plantations, thousand ha	6.7
Permanent Forest Seed Sites, thousand ha	24.7
Archives of Plus Tree Clones, ha	608.3
Stoolbeds of plus trees, ha	223.1
Testing Cultures, ha	914.2
Geographic Cultures, ha	926.8
Forest Genetic Reserves, thousand ha	205.3

Currently, the share of the seeds with improved heritable characteristics that are harvested in the Forest Seed Plantations, Permanent Forest Seed Sites, and the Plus stands is no more than 5% of the total mass of seeds used for reforestation. The task is to bring this share up to 30% in the next 10-15 years.

Types of forest seeds and their harvested amount in the regions are defined by forestry management of the constituent entities of the Russian Federation.

The Forest Seed Industry in Russia is supported by 28 specialized forest districts, 5 Selecting and Seed Breeding Centers, 32 Forest Seed Breeding Stations. In 2009, the FSD "Roslesozaschita" started the laboratory working on the genetic certification of the Plus trees and Forest Seed Plantations (issuing the passports) on the basis of DNA analysis. In the coming years a few more such laboratories will be created in different regions. They will provide the genetic control of the forest seeds used in the reproduction of forests.



A draft of federal target program «Development of Forest Seed Industry for the period of 2009–2020» was prepared, as well as the Project of Allocation Selecting and Seed Breeding Centers in the territory of the Russian Federation.

Summary Criterion 1

The Criterion 1 and related indicators reveal the contents of the forest policy of the Russian Federation and assess their conformity with the principles of biodiversity conservation and sustainable forests management. The Russian Forests play a crucial role in preserving biodiversity in temperate and boreal regions of Eurasia on the levels of ecosystems, species, and genes.

The maintenance of ecosystem diversity is ensured by retaining the constant level of forested land area for a long period of time. In the Russian Federation, the Forest Fund areas occupied by forests with dominance of the certain groups of species little have changed over the past decades. That proves the stability of this indicator. The species composition of Russian forests is quite diverse. The most of the forested land is occupied by coniferous (more than 70% of the area). Soft broadleaved, in the most cases derivative, species occupy 16% of the forested land. At the same time, Russia has an imbalance in the age structure of the forest, which works out at dominance of mature and over-mature trees.

In general, the condition of the species diversity in the Russia is quite satisfactory. The major complexes of fauna and flora have been conserved in all landscape zones of the country. The large areas of exotic trees plantations are not specific for Russia.

The Specially Protected Natural Territories (SPNT) play an important role in the conservation of biodiversity. The increasing of SPNT areas is a positive trend. By now, they cover about 7% of the forested land. The protected in other ways forests cover about 26% of the total forested area. There are currently no data on the SPNT in terms of repre-

sentation of the diversity of forest ecosystem types.

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.

Most of the forest land belonging to the zones of coniferous and mixed forests has a relatively low degree of fragmentation that beneficial to the conservation of many forest associated species.

In Russia, the Red Books are maintained on two levels: federal (the Red Book of Russia) and regional (the territorial lists of protected species and the Red Books of the constituent entities of the Russian Federation). They are complementing each other and have been created by a uniform method. The forest associated plants have a large proportion (40%) of the total number of species included in the Red Book of the RF. It regards mostly to the Gymnosperms, Fungi, and Lichens that are closely associated with the forest ecosystems. In agree with the RF Red Book, the list of trees and shrubs species for those timber harvesting is not permitted in the RF territory was approved.

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 intrapopulation genetic variability for these species' populations in the territory of the Russian Federation.

The general way of preserving gene pool of tree species *in situ* is the Forest Genetic Reserves – plots of the forest, typical by their genotypic structure, phytoecenic, silvicultural, and other parameters for this climatic region. The Forest Genetic Reserves have been allocated in Russian forests on 205.3 thousand ha.

The scientifically organized Forest Seed Industry helps to preserve genetic diversity of the forest main species. In Russia, 36.6 thousand of Plus trees and 15.3 thousand ha of Plus stands have been allocated; 6.7 thousand ha of Forest Seed Plantations has been established.

CRITERION 2

MAINTENANCE OF PRODUCTIVE CAPACITY OF FOREST ECOSYSTEMS





Indicator 2.a. Area and percent of forest land and net area of forest land available for wood production

Forests of Russia are located on the land of Forest Fund and the land of other categories. The Forest Fund is a combination of forest and non-forest land within the boundaries established in accordance with Forest and Land legislation.

Civil Law and the Forest Code of the Russian Federation guarantee to the citizens the right to freedom of stay in the Forest Fund and forests outside the Forest Fund.

The total area of the Russian Federation land covered with forest, as of 01.01.2007, is 1,182.9 million ha, and among them the area of the Forest Fund land is 1,140.9 million ha.

According to their functional designation, the Forest Fund land is divided on forest land and non-forest land. Non-forest land includes wetlands, meadows, sands, pastures, roads, and other woodless territories. Forest land consists of covered (forested land) and temporary non-covered with forest vegetation territories (clearcuts, sparse forest, barrens, and grassy glades). During the last 30 years the total forest land has not changed significantly (Fig. 13).

More than half of Russian forests grow on permafrost soil in the harsh climate (Siberia and the Far East). Because of that, these forests have low productivity, fragmentary mature forest stands and low economical attractiveness value.

An available for exploitation forest is defined as forest «which shall be developed for purposes of sustainable, maximum efficient production of high-quality wood, other forest resources, and products of their processing while preserving their beneficial functions» (Articles 12 and 108 Forest Code RF). They are located mostly in the Taiga (boreal forest) zone and the Coniferous and Broadleaf forest zone. Of the Russian Federation land covered with forest vegetation, 54.6 % (328.0 million ha) are available for timber produc-

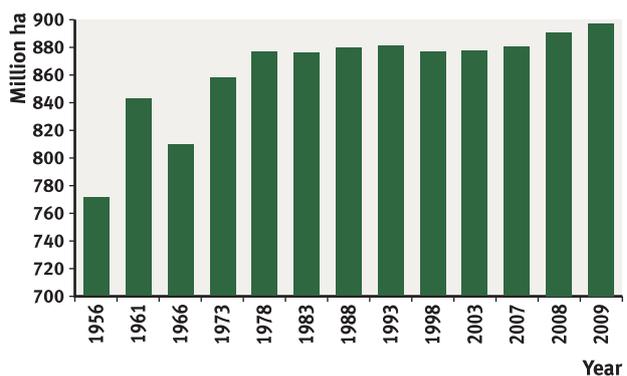


Figure 13. Dynamic of area of the Russian Federation Forest Land, million ha



Table 6.
Area of forested land available for exploitation

Groups of forest forming species	Forested area, thousand ha	
	Total	Including mature and over-mature
Total for RF	797,014.0	335,619.4
Including available for exploitation:		
Coniferous	227,363.5	102,684.6
Hard broadleaved	7,563.3	3,473.1
Soft broadleaved	90,193.9	32,544.2
Shrubs and others	2,880.4	1,815.9
Total available for timber production	328,001.1	140,517.8

tion (Table 6). However, as a result of extensive logging during last century the majority of these forests – in European North, Ural region, and along the Tran-Siberian Railroad – have been considerably exhausted. The commercial availability of mature forest is even lower: the percentage of productive (I–III classes of site index or bonitaet) mature and over-mature coniferous forest does not surpass 16% (39 million ha), while the percentage of low productive (IV–Vb classes of site index) forest is 101 million ha and in some regions reaches 80%.

The most productive and available for exploitation forest stands are concentrated in the European part of the country. The spacious, undeveloped, exploitable forests are located mainly in distant

north and middle territories of Taiga in the Asian Part of the country; moreover, the greater part of them are in mountains and on permafrost soil. During the last 30 years, the area of mature and over-mature forests in RF decreased by 66.1 million ha, despite their constant replenishment by immature stands and by lowering the age of felling.

Indicator 2.b. **Total growing stock and annual increment of both merchantable and non-merchantable tree species in forests available for wood production**

The total growing stock in the Forest Fund of Russia is 79.76 billion m³, including mature and over-mature stands – 43.8 billion m³ (Table 7). The distribution of forest resources among Federal districts is presented on Figure 14. In the forests that are available for harvesting the total timber stock exceeds 42.6 billion m³, which equals 53.4% of the total timber stock available in the country.

Altogether in the country the average volume of the growing stock per 1 ha (Fig. 15) in mature and over-mature stands (without shrubs) is 134 m³, including those stands that are in the forests avail-



Table 7.
Total Volume and the Annual Increment of Growing Stock in Forests Available for Timber Production

Groups of forest forming species	Growing stock, million m ³		General average increment, million m ³	Average age, years
	Total	Including mature and over mature		
Total in RF	79,760.40	43,817.29	947.30	
Including available for timber production:				
Coniferous	27,804.90	16,611.80	314.50	97
Hard broadleaved	877.47	466.86	11.52	90
Soft broadleaved	10,708.37	5,996.77	223.09	47
Shrubs and others	142.16	130.52	1.26	103
Altogether	39,532.90	23,205.95	550.37	

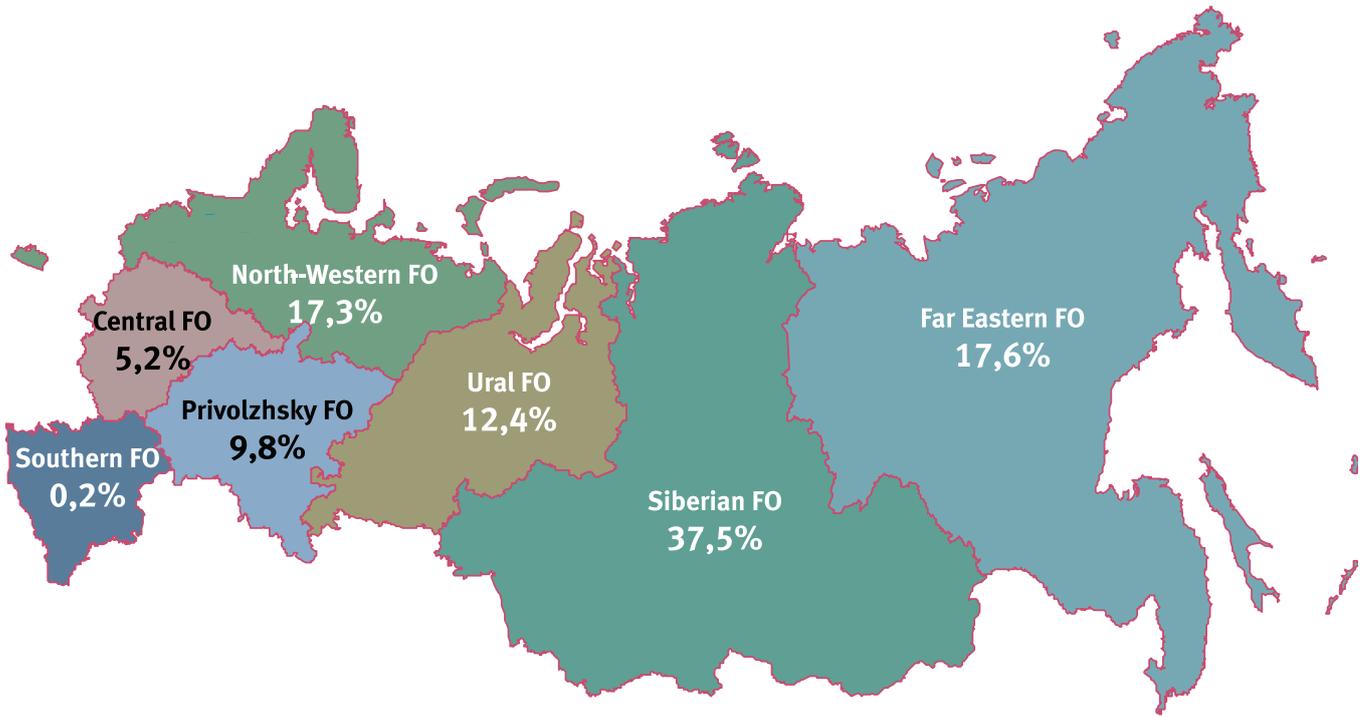


Figure 14. Distribution of forest resources among Federal Okrugs (FO), % total stock



Figure 15. Average growing stock per hectare, m³/ha

able for exploitation – 165 m³. The annual increment of the growing stock in the Russian forests is 947.3 million m³, or 1.29 m³ per 1 ha on land covered with forest (Fig. 16).

During the last 50 years, the amount of growing stock in the RF has been increasing (Fig. 17). It is explained by the afforestation of deserted agricultural lands (the specific growing stock and the average increment per hectare did not change signifi-

cantly during the same period of time) and by the specification of growing stock assessment (using regional growth tables, conducting a ground-based Forest Inventory and Planning, using more advanced methods of inventory). Under reasonable management the available forest resources of the Russian Federation will cover current and future domestic needs in timber and wood products and also expand the export of wood products.