THE STATE OF THE WORLD's FOREST GENETIC RESOURCES

COUNTRY REPORT

BULGARIA

This country report is prepared as a contribution to the FAO publication, The Report on the State of the World's Forest Genetic Resources. The content and the structure are in accordance with the recommendations and guidelines given by FAO in the document Guidelines for Preparation of Country Reports for the State of the World's Forest Genetic Resources (2010). These guidelines set out recommendations for the objective, scope and structure of the country reports. Countries were requested to consider the current state of knowledge of forest genetic diversity, including:

- Between and within species diversity
- List of priority species; their roles and values and importance
- List of threatened/endangered species
- Threats, opportunities and challenges for the conservation, use and development of forest genetic resources

These reports were submitted to FAO as official government documents. The report is presented on www. fao.org/documents as supportive and contextual information to be used in conjunction with other documentation on world forest genetic resources.

Country Report

for

The State

of World's Forest Genetic Resources

- Bulgaria

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C o n t e n t s

SECTION I: EXECUTIVE SUMMARY

Bulgaria covers 110993.6 km^2 in the eastern part of the Balkans with geographic co-ordinates: latitude 43^oN and longitude 25^oE. Topographically the country is divided into Danubian plain, Stara Planina Mt., Fore-Balkan valleys and Thracian plain, and Rilo-Rhodope massif. The altitudinal range is from sea level up to peak Musala (2925 m) in Rila mountain, including 5 height zones: lowlands (0-200 m a.s.l.) – 31.4%, hills (200-600 m a.s.l.) – 41.0%, low mountains (600-1000 m a.s.l.) – 15.3%, middle high mountains (1000-1600 m a.s.l.) – 9.8% and high mountains (1600-2925 m a.s.l.) – 2.5%. The average altitude of the country is 470 m. The lattitude and the relief determine variable and complex climate. In general, climate in the country is moderate continental with Mediterranean influence to the south and of the Black Sea – to the east. Average annual temperatures are within the range +10^oC in south to -3^oC in highest mountains, and the mean annual sum of precipitations – from 450 mm to 1300 mm (average precipitation 630 mm).

The Balkan Peninsula as a whole has not been affected by permanent glaciations and has become an enormous refugium. A great number of species and genera of deciduous families as Fagaceae, Betulaceae, Tiliaceae, Aceraceae, Rosaceae, Oleaceae, Ulmaceae, Corylaceae, etc. determine the basic composition of the contemporary forest on the Balkans. The diversity of coniferous species is determined mainly by some species from the Pinaceae family, the most important significance of which have Pinus, Abies and Picea.

A contact between three zones – the European deciduous forest zone, Mediterranean sclerophyllic forest zone and Eurasian steppe and forest-steppe zone, has been accomplished on the Balkans.

As a result of the convergence and divergence of the forest tree species areas, a process of hybridization has taken place, which has led to the differentiation of subspecies, varieties and forms.

The forest fund of the country ampounts 4 138 147 ha, from which 3 761 309 ha (woodiness 33.9%) are covered with forests, including 103 356 ha primary forests, 2 840 956 ha naturally regenerating forests and 816 997 ha afforestations. During the period 2000-2010, a stable trend is observed towards increasing of the area covered with forests with 11.4%. This is due, first of all, to including in the forest fund of abandoned and uncultivated lands from the agricultural fund, to self-afforested areas and to establishing of forest plantations on barrens, burnt out areas and wind throws.

The two major forest type categories in Bulgaria according to area are: temperate continental forest – 2 666 269 ha (71%) and temperate mountain forest – 1 095 040 ha (29%). From forestry economic and social point of view, the number of priority species is 46 (9 conifers + 37 deciduous).

The total number of indigenous forest tree and shrub species in Bulgaria is about 280, of them 110 trees and 170 shrubs. Besides, there are approximately 380 introduced species, most of them being presented by small groups or solitary individuals, as well as rare species grown in arboreta and botanical gardens. The introduced species of practical importance are no more than 100 trees and 80 shrubs; consequently it could be assumed that the forest flora in the country is composed by about 460 species (210 trees and 250 shrubs).

Regarding the distribution according to species, oaks (*Quercus* sp.) prevail, occupying 35,2%, followed by beeches (*Fagus* sp.) – 16,4%, Scots pine (*Pinus sylvestris* L.) – 14,8%, Austrian

black pine (*Pinus nigra* Arn.) – 7,6%, hornbeams (*Carpinus* sp.) – 8,0 %, Norway spruce [*Picea abies* (L.) Karst.)] – 4,3 %, black locust (*Robinia pseudoacacia* L.) – 4,0 %, limes (*Tilia* sp.) – 1,5 %, and other species – 8,2 %.

Forest trees and shrubs considered to be threatened in the country are as follows: high threat category – *Quercus thracica* Stef. et Ned.; medium threat category – *Castanea sativa* Mill. and *Eriolobus trilobata* Roem.; low threat category – *Aesculus hippocastanum* L., *Hippophae rhamnoides* L., *Taxus baccata* L., *Salix pentandra* L., etc.

The *in situ* genetic conservation of forest tree species is carried out mainly by the following protected areas: 90 reserves and maintained reserves located predominantly in 3 national parks and 11 nature parks, as well as permanent seed production stands.

The area managed for *in situ* gene conservation, amounting 109 522.4 ha, covers 16 847 populations and represents 2.9% of the area covered with forests, this index being 4% for the conifers and 2.5 % - for the deciduous. Participation of different forest tree species in the *in situ* conservation units varies but for most of them it is very well represented, as follows: for the conifers – *Pinus heldreichii* Christ. – 94% from the total area of the species, *Pinus mugo* Turra – 36%, *Pinus peuce* Gris. – 22.9%, *Abies alba* Mill. – 12.3%, *Picea abies* (L.) Karst. – 8%, and for the deciduous – *Fraxinus* sp. – 17.2%, *Acer* sp. – 9.1%, *Fagus* sp. – 5%. Insufficiently represented are some species from genus Quercus and *Pinus sylvestris* L. (1.9%).

The permanent seed production stands (PSPS) comprise 47 847.3 ha or 1.3% from the area covered with forests, 16 411.7 ha (1.5%) for coniferous and 31 435.6 ha (1.2%) for deciduous forests, respectively. Predominating part of forest tree species in the country is presented by sufficient seed production stands for the needs of intensive afforestation programmes.

The number of *ex situ* conservation units is 73, containing 381 seed lots and 34 clone banks with 1539 clones. The long-term preservation of forest seeds in refrigerator cameras is carried out in the forest seed bank in Plovdiv, mainly for coniferous species: *Pinus sylvestris* L., *Picea abies* (L.) Karst. and *Pinus nigra* Arn. (total 30 seed lots).

The number of selected plus trees is 5711, from them 2945 (51.6%) being coniferous, first of all *Pinus sylvestris* L. – 1018 (17.8%), *Picea abies* (L.) Karst. – 1007 (17.6%) and *Pinus nigra* Arn. – 420 (7.4%), while the deciduous species with most significant participation are *Quercus petraea* Liebl. – 893 (15.6%), *Fagus sylvatica* L. – 892 (15.6%) and *Quercus frainetto* Ten. – 343 (6.0%).

Because of the autochthonous forests in the country, the basic conservation method for forest genetic resources in Bulgaria is the *in situ* method, that's why the *ex situ* one has secondary significance.

Totally for the country, the annual yield of forest tree seeds from native species is 79.9% and only 5.5% of them are from non-documented sources, while seeds from seed orchards are in relatively small quantities.

The established seed orchards of first generation are totally 41 on area of 114.4 ha and include 6 coniferous species (*Abies alba* Mill., *Cedrus atlantica* Manetti, *Picea pungens* Engelm., *Pinus nigra* Arn., *Pinus peuce* Gris. and *Pinus sylvestris* L.), as well as 3 deciduous species (*Quercus suber* L., *Robinia pseudoacacia* L. and *Tilia tomentosa* Moench.). The area of vegetative seed orchards is almost 6 times larger than this one of generative ones (seedlings seed orchards).

This shows that years long forestry policy has been directed towards production of seeds from seed stands and it has been very little counted on seed orchards. Forest seed yield is directed predominantly to native forest tree species. This forestry policy for the production of forest seeds from seed stands and from native species in mountain country like Bulgaria proved to be ecologically most suitable, especially for the expected climate changes.

The annual number of seedlings from documented sources plus genetically improved ones is 89.9% from the total quality of seedlings planed, and 17.4% are genetically improved. Seedlings of native species represent 78.4%, and exotic ones – 21.6%. For coniferous species seedlings of native species are 89.9%, and for deciduous – 74.3%. Generalised data show clear domination of deciduous seedlings, which represent 73.8% of all seedlings, as well as strong domination of native species – 78.4%. This is in conformity with national policy for increasing of the share of deciduous and native tree species during afforestation.

Research activity, carried out on evaluation of genetic variability of forest tree species is mainly on 38 species (10 coniferous and 28 deciduous) wifh a stress on intraspecific variability, determining totally 449 varities and forms (118 at coniferous and 331 at deciduous species). There are also 37 ecotypes and 57 provenance tests established, comprising 260 provenances and 29 progeny tests with participation of 1526 families. Genetic characterization was carried out through biochemical markers for 9 tree species, and through DNA markers – for 6 tree species.

The number of clones selected is 1445, while the number of clones used – 671, moreover with domination of coniferous species.

In 2003 the Ministry of Agriculture and Forests developed National Policy and Strategy for Sustainable Development of the Forest Sector in Bulgaria 2003 – 2013. In chapter "Biological and Landscape Diversity", a strategic aim is mentioned: conservation and restoration of components of biological and landscape diversity through integration of conservation aims in forestry practices, development of adequate systems for *in situ* and *ex situ* conservation and close-to-nature management of forests.

Six institutions in Bulgaria are actively engaged in conservation and sustainableuse of forest genetic resources as follows: Forest Research Institute – Sofia, University of Forestry – Sofia, Experimental Station on Fast-growing Forest Tree Species – Svishtov, Experimental Station on Oak Forests – Burgas, Forest Seed Testing Station – Sofia and Forest Seed Testing Station – Plovdiv. The experimental stations and forest seed testing stations are under the Executive Agency of Forests.

There are several laws, which are linked up with forest genetic recources: Law for Forests (1997, 2011); Protected Areas Law (1998) and Biological Diversity Law (2002). On the basis of the new Law for Forests (2011), new instructions and regulations are in procedure.

Bulgaria is a regular member of the European Union since 2007 and the national legislation is synchronized with EU legislation, including that on forest genetic recources.

Bulgaria took part in all networks initiated by EUFORGEN (European Forest Genetic Resources Programme) in phases II, III and IV (2000-2014). Over the past 10 years the country participates as well in 3 mutual projects on forest genetic resources with Balkan countries and in 5 projects with countries from South-East Europe. There is a current co-operation with EUFORGEN, FAO and EU-COST Actions.

SECTION II: INTRODUCTION TO THE COUNTRY AND FOREST SECTOR

1. Main forest characteristics and tree resource management systems

Bulgaria occupies a territory of 110 993,6 km^2 and is situated in the eastern part of the Balkan Peninsula in Europe (fig. 1). Physical-geographical and climatic peculiarities of the country are determined by the various relief and great number of mounatins like Stara planina, Sredna gora, Rila-Rhodopes massif, Osogovo-Belasitsa mountain chain, Vitosha, Strandzha, Sakar, etc. The altitudinal range is from sea level up to peak Musala (2 925 m) in Rila mountain, and climate is moderate continental with Mediterranean influence to the south and Black Sea – to the east. Average annual temperatures are within the range from +10^{o}C in south to -3^{o}C in the highest mountains, and precipitations are from 450 mm to 1300 mm. Population towards 2011 amounts 7 364 570 with a trend to reduction due to emigration and decreasing of birth-rate.

The forest fund area is 4 138 147 ha, from them 3 761 309 ha covered with forests, comprising 103 356 ha primary forests, 2 840 956 ha – naturally regenerated forests and 816 997 ha planted forests (table 1).

Table 1 Forest characteristics and areas (FRA)

Main forest characteristics	Area (ha)
Primary forests	103 356
Naturally regenerated forests	2 840 956
Planted forests	816 997
Σ	**3 761 309**

2. Forest ownership

According to ownership, the forest fund area is shared as follows: public forests – 88,5% (state – 76,3%, municipal – 12,2%), private forests – 10,9%, and others – 0,6% (table 2).

Table 2 Forest ownership and area

Forest ownership	Area (ha)
Public	3 663 074
Private	451 830
Others	23 243
Σ	**4 138 147**

3. Trends in forest conservation and management, observed over the past 10 years

Over the past 10 years (2000-2010), a well-determined trend is observed to increasing of the forest fund area with 223 792 ha [3 914 355 ha (2000) – 4 138 147 ha (2010)], i.e. with 5,7%, and of the wooded area with 386 192 ha [3 375 117 ha (2000) – 3 761 309 ha (2010)], i.e. with 11,4%. This is due first of all to including in the forest fund of devastated and uncultivated lands from the agricultural fund, to self-planted areas and to establishment of forest plantations on barrens, burnt out areas and wind throws.

Besides, gradual decreasing of the percentage share of coniferous forests is observed, due to the continuing process of increasing of deciduous forest vegetation in mixed coniferous-deciduous forests, as well as spreading of deciduous forest tree species in coniferous forest plantations.

The area of high-stem deciduous forests is increasing as a result of transformation of coppice stands into high-stem ones, as well as of new afforestations.

4. Roles of forest resources in meeting the current demands for forest products

During the last decade, timber stock was increased with 118 289 932 m^3 from 526 063 147 m^3 in 2000 to 644 353 079 m^3 in 2010 or with 22.5%, which is significant biomass accumulation and CO_2 sequestration.

Average annual increment continues to grow from 12 348 000 m^3 (2000) to 14 400 000 m^3 (2010), i.e. with 16.6%.

For this 10-year period, annual utilization of timber grows from 4 647 438 m^3 (2000) to 6 726 540 m^3 (2010), i.e. with 44.7%, as really cut timber towards forest management plans is 68.8% for 2000 and 82.2% for 2010. This means that there is consistent cutting process under the limits according to forest management plans and considerably under the average annual increment.

SECTION III: MAIN BODY OF THE COUNTRY REPORT

Chapter 1: Current State of Forest Genetic Resources

Main forest tree species, associated with each major forest type (Table 3)

Table 3. Major forest type categories and main tree species

Major forest types	Area (covered by forest type, ha)	Main species for each type	
		Trees	**Other species if applicable**
Temperate continental	2 666 269	*Quercus petraea* Liebl.	*Acer* sp., *Alnus* sp., *Betula*

forest		*Quercus cerris* L. *Quercus frainetto* Ten. *Quercus pubescens* Willd. *Quercus robur* L. *Quercus hartwissiana* Stev. *Fagus sylvatica* L. *Fagus orientalis* Lipsky *Carpinus betulus* L. *Carpinus orientalis* Mill.	sp., *Castanea* sp., *Corylus* sp., *Fraxinus* sp., *Juglans* sp., *Platanus* sp., *Populus* sp., *Tilia* sp., *Ulmus* sp.
Temperate mountain forest	1 095 040	*Pinus sylvesrtis* L. *Pinus nigra* Arn. *Picea abies* (L.) Karst. *Abies alba* Mill. *Pinus peuce* Gris. *Pinus heldreichii* Christ.	*Fagus sylvatica* L. *Quescus petraea* Liebl. *Populus tremula* L. *Juniperus* sp.
	Σ 3 761 309		

1.1 Priority forest tree and other woody plant species and reason for priority (e.g. economic importance, threatened, etc.) (Table 4)

Table 4. Priority species

Priority species			**Reasons for priority**
Scientific name	**Tree (T) or other (O)**	**Native (N) or exotic (E)**	
Gymnospermae			
Pinus sylvestris L.	T	N	Economic and social importance
Pinus nigra Arn.	T	N	Economic and social importance
Picea abies (L.) Karst.	T	N	Economic and social importance
Abies alba Mill.	T	N	Economic and social importance
Pinus peuce Gris.	T	N	Economic and social importance
Pinus heldreichii Christ.	T	N	Economic and social importance
Pinus mugo Turra	T	N	Social importance
Pseudotsuga menziesii (Mirb.) Franco	T	E	Economic importance
Larix decidua Mill.	T	E	Economic importance
Angiospermae			
Quercus petraea Liebl.	T	N	Economic and social importance
Quercus cerris L.	T	N	Economic and social importance
Quercus frainetto Ten.	T	N	Economic and social importance
Quercus pubescens Willd.	T	N	Economic and social importance
Quercus robur L .	T	N	Economic and social importance
Quercus hartwissiana Stev.	T	N	Economic and social importance
Quercus rubra L.	T	E	Economic importance
Fagus sylvatica L.	T	N	Economic and social importance
Fagus orientalis Lipsky.	T	N	Economic and social importance
Carpinus betulus L.	T	N	Economic and social importance
Carpinus orientalis Mill.	T	N	Economic and social importance
Tilia cordata Mill.	T	N	Economic and social importance
Tilia platyphyllos Scop.	T	N	Economic and social importance
Tilia tomentosa Moench.	T	N	Economic and social importance
Populus nigra L.	T	N	Economic and social importance
Populus alba L.	T	N	Economic and social importance
Populus euroamericana (Dode) Guinier	T	E	Economic importance
Populus tremula L.	T	N	Economic and social importance

Fraxinus excelsior L.	T	N	Economic and social importance
Fraxinus oxycarpa Willd.	T	N	Economic and social importance
Fraxinus ornus L.	T	N	Economic and social importance
Betula pendula Roth.	T	N	Economic and social importance
Juglans regia L.	T	E	Economic and social importance
Acer platanoides L.	T	N	Economic and social importance
Acer pseudoplatanus L.	T	N	Economic and social importance
Acer campestre L.	T	N	Economic and social importance
Castanea sativa Mill.	T	N	Economic and social importance
Ulmus minor Mill.	T	N	Economic and social importance
Ulmus glabra Huds.	T	N	Economic and social importance
Ulmus laevis Pall.	T	N	Economic and social importance
Sorbus aucuparia L.	T	N	Economic and social importance
Sorbus domestica L.	T	N	Economic and social importance
Sorbus torminalis (L.) Crantz.	T	N	Economic and social importance
Sorbus aria (L.) Crantz.	T	N	Economic and social importance
Salix alba L.	T	N	Economic and social importance
Platanus orientalis L.	T	N	Economic and social importance
Robinia pseudoacacia L.	T	E	Economic importance

1.2. Main tree and other forest plant species actively managed for human utilization (Table 5)

Table 5. Forest species currently used

Species (scientific name)	**Native (N) or exotic (E)**	**Current uses (code)**	**If managed, type of management system (e.g. natural forest, plantation, agroforestry)**	**Area managed (ha)**
Gymnospermae				
Pinus sylvestris L.	N	1	natural forest, plantation	555 115
Pinus nigra Arn.	N	1	natural forest, plantation	287 482
Picea abies (L.) Karst.	N	1, 2	natural forest, plantation	160 110
Abies alba Mill.	N	1	natural forest, plantation	32 686
Pinus peuce Gris.	N	1	natural forest, plantation	13 942
Pinus heldreichii Christ.	N	1,6	natural forest	1 263
Pinus mugo Turra	N	6	natural forest	23 757
Pseudotsuga menziesii (Mirb.) Franco	E	1	plantation	7 371
Larix decidua Mill.	E	1	plantation	649
Other Gymnosprmae	N,E	1	natural forest, plantation	12 665
			Σ	**1 095 040**
Angiospermae				
Quercus petraea Liebl., *Q.frainetto* Ten., *Q.pubescens* Willd., *Q.robur* L.	N	1,3,4,5	natural forest, plantation	918 444
Quercus cerris L.	N	1,3,4,5	natural forest, plantation	407 514
Fagus sylvatica L., *F.orientalis* Lipsky	N	1,3,4	natural forest, plantation	615 277
Carpinus betulus L.	N	1,3	natural forest	156 812
Carpinus orientalis Mill.	N	1	natural forest	143 387
Tilia tomentosa Moench., *T.cordata* Mill., *T.platyphyllos* Scop.	N	1,4,5	natural forest, agroforestry	56 141
Populus nigra L. , P.alba L., *Populus x euramericana* (Dode) Guinier	N E	2,5	plantation, agroforestry	23 508
Populus tremula L.	N	1,2	natural forest, plantation	6 369
Fraxinus excelsior L., *F.ornus* L.,	N	1,5	natural forest, plantation,	14 976

F.oxycarpa Willd.			agroforestry	
Betula pendula Roth.	N	1,2,5	natural forest, plantation	9 091
Juglans regia L.	E	4,1,5	plantation agroforestry	7 201
Acer platanoides L., *A.pseudoplatanus* L., *A.campestre* L.	N	1,5	natural forest, plantation	4 308
Castanea sativa Mill.	N	4,1,5	natural forest, plantation, agroforestry	2 554
Ulmus minor Mill., *U.glabra* Huds., *U.laevis* Pall.	N	1,5	natural forest, plantation	2 022
Robinia pseudoacacia L.	E	1,3,5	plantation agroforestry	150 591
Other Angiospermae	N, E	1,2,3,4,5	natural forest, plantation, agroforestry	147 251
			Σ	**2 666 269**
			Total	**3 761 309**

***Current use:**

1 Solid wood products
2 Pulp and paper
3 Energy fuel
4 Non wood products (food, fodder, medicine, etc.)
5 Used in agroforestry systems
6 Other (please specify)

1.3. Main forest tree or other woody plant species actively managed or identified for environmental services (Table 6)

Table 6 Main tree and other woody forest species providing environmental services or social values

Biological and ecological pequliarities of tree and shrub species were specified according to Stefanov and Ganchev (1953), Delkov (1992), Vakarelov and Anisimova (2010).

Species (scientific name)	Native (N) or exotic (E)	Environmental service or social value (code)
Gymnospermae		
Pinus sylvestris L.	N	1, 3, 4, 5
Pinus nigra Arn.	N	1, 3, 5, 7-Drought resistant
Pinus peuce Gris.	N	1, 3, 4, 5
Pinus heldreichii Christ.	N	1, 3, 4,
Pinus mugo Turra	N	1, 3, 4, 5
Pinus halepensis Mill.	E	1, 5, 7-Drought resistant
Pinus halepensis var.bruttia	E	1, 5, 7-Drought resistant
Pinus pinaster Ait.	E	1, 5, 7-Recultivation value
Pinus strobus L.	E	1, 5
Pseudotsuga menziesii (Mirb.) Franco	E	1, 5
Picea abies (L.) Karst.	N	1, 3, 4, 5
Picea pungens Engelm.	E	1, 5, 7-Drought and smoke resistant
Larix decidula Mill.	E	1, 5
Abies alba Mill.	N	1, 3, 4, 5
Abies grandis Lindl.	E	1, 5
*Abies nordmanniana (*Stev.) Spach.	E	1, 5
Cedrus libavi A.Rich.	E	1, 5, 7-Drought resistant
Cedrus atlantica Manetti.	E	1, 5, 7-Drought resistant

Sequiadendion giganteum Buchh.	E	1, 5
Thuja plicata D.Don.	E	1, 5
Thuja occidentalis L.	E	1, 5, 7- Smoke resistant
Thuja orientalis L.	E	1, 5, 7- Drought resistant and salt tolerant
Calocedrus decurrens Florin	E	1, 5
Cupressus sempervirens L.	E	1, 5, 7- Smoke tolerant
Cupressus arizonica Greene	E	1, 5, 7- Drought resistant
Chamaecyparis lawsoniana Parl.	E	1, 5, 7- Salt tolerant
Chamaecyparis pisifera Endl.	E	1, 5
Juniperus communis L.	N	1, 3, 5
Juniperus oxycedrus L.	N	1, 3, 5, 7- Drought resistant
Juniperus excelsa Bieb.	N	1, 3, 5, 7- Drought resistant
Juniperus sabina L.	N	1, 3, 5, 7- Smoke resistant
Taxus baccata L.	N	1, 3, 5
Taxodium distichum Rich.	E	1, 2 , 5
Tsuga canadensis Carr.	E	1, 5
Ginkgo biloba L.	E	1, 5, 7-Smoke tolerant
Angiospermae		
Quercus petraea Liebl.	N	1, 2, 3, 4, 5
Quercus cerris L.	N	1, 2, 3, 4, 5, 7- Drought and smoke resistant
Quercus frainetto Ten.	N	1, 2, 3, 4, 5, 7- Drought resistant
Quercus pubescens Willd.	N	1, 2, 3, 4, 5, 7- Drought resistant
Quercus robur L.	N	1, 2, 3, 4, 5, 7- Smoke resistant and salt tolerant
Quercus hartwissiana Stev.	N	1, 2, 3, 4, 5
Quercus coccifera L.	N	1, 2, 3, 4, 5, 7-Drought resistant
Quercus rubra L.	E	1, 2, 5, 7- Smoke resistant
Quercus suber L.	E	1, 2, 5, 7- Drought resistant
Fagus sylvatica L.	N	1, 2, 3, 4, 5
Fagus orientalis Lipsky	N	1, 2, 3, 4, 5
Castanea sativa Mill.	N	1, 2, 3, 5
Betula pendula Roth.	N	1, 2, 3, 4, 5
Alnus glutinosa Gaertner	N	1, 2, 3
Alnus incana Moench.	N	1, 2, 3
Alnus viridis (Chaix) DC.	N	1, 2, 3
Carpinus betulus L.	N	1, 2, 3
Carpinus orientalis Mill.	N	1, 2, 3, 7-Drought resistant
Ostrya carpinifolia Scop.	N	1, 2, 3
Corylus aveleana L.	N	1, 2, 3
Corylus colurna L.	N	1, 2, 3
Corylus maxima Mill.	E	1, 2
Juglans regia L.	E	1, 2, 4, 5
Juglans nigra L.	E	1, 2, 5
Populus nigra L.	N	1, 2, 3, 4, 5, 7-Smoke tolerant
Populus alba L.	N	1, 2, 3, 4, 5, 7-Smoke and salt resistant
Populus tremula L.	N	1, 2, 3, 4, 5
Populus deltoides Marsh.	E	1, 2, 5
Populus x euroamericana (Dode) Guinier	E	1, 2, 5, 7-Smoke resistant and salt tolerant
Populus simoni Carr.	E	1, 2, 5, 7-Drought and smoke resistant
Salix alba L.	N	1, 2, 3, 7-Smoke and salt resistant
Salix fragilis L.	N	1, 2, 3
Salix triandra L.	N	1, 2, 3
Salix caprea L.	N	1, 2, 3
Salix purpurea L.	N	1, 2, 3
Salix babylonica L.	N	1, 2, 3, 5

Morus alba L.	E	1, 2, 5, 7- Drought, salt and smoke resistant
Morus nigra L.	E	1, 2, 5, 7- Drought, salt and smoke resistant
Ficus carrica L.	E	1, 2, 5
Ulmus minor Mill.	N	1, 2, 3, 5
Ulmus glabra Huds.	N	1, 2, 3, 5
Ulmus laevis Pall.	N	1, 2, 3, 5
Ulmus pumila L.	E	1, 2, 5, 7- Drought and salt resistant
Celtis australis L.	N	1, 2, 3, 7- Drought and smoke resistant
Celtis caucasica Willd.	N	1, 2, 3, 7- Drought resistant
Platanus orientalis L.	N	1, 2, 3, 4, 5, 7- Smoke tolerant
Platanus occidentalis L.	E	1, 2, 5, 7- Smoke tolerant
Berberis vulgaris L.	N	1, 2, 3, 7- Drought resistant
Tamarix ramosissima Ledeb.	N	1, 2, 3, 7- Recultivation value, salt resistant
Tamarix tetrandra Pall.	N	1, 2, 3, 7- Recultivation value, salt resistant
Tilia tomentosa Moench.	N	1, 2, 3, 4, 5, 7- Relativelly drought and smoke resistant
Tilia cordata Mill.	N	1, 2, 3, 4, 5
Tilia platyphyllos Scop.	N	1, 2, 3, 4, 5
Cotinus coggygria Scop.	N	1, 2, 3, 7- Smoke and drought resistant
Pistacia terebinthus L.	N	1, 2, 3, 7- Drought resistant
Rhus coriaria L.	N	1, 2, 3, 7- Drought resistant
Acer platanoides L.	N	1, 2, 3, 5
Acer pseudoplatanus L.	N	1, 2, 3, 4, 5
Acer campestre L.	N	1, 2, 3, 5, 7- Smoke resistant, drought tolerant
Acer heldreichii Orph.ex Boiss	N	1, 2, 3, 5
Acer hyrcanum Fisch. et C.A.Mey	N	1, 2, 3
Acer monspessulanum L.	N	1, 2, 3, 7-Drought resistant
Acer tataricum L.	N	1, 2, 3, 7- Drought and smoke resistant
Acer negundo L.	E	1, 2, 7- Drought resistant and smoke tolerant
Acer saccharinum L.	E	1, 2, 7- Relatively drought and smoke resistant
Aesculus hippocastanum L.	N	1, 2, 3, 5
Ilex aquifolium L.	N	1, 2, 3
Ailanthus altissima (Mill.) Swingle	E	1, 2, 5, 7- Drought resistant
Staphylea pinnata L.	N	1, 2, 3
Euonymus europea L.	N	1, 2, 3
Euonymus verrucosa Scop.	N	1, 2, 3
Euonymus latifolia Mill.	N	1, 2, 3
Euonymus japonica L.	E	1, 2
Paliurus spina-christi Mill.	N	1, 2, 3, 7- Drought resistant
Ribes petraeum Wulf.	N	2, 3
Ribes alpinum L.	N	2, 3
Ribes nigrum L.	N	2, 3
Ribes multiflorum Kit.	N	2, 3
Ribes uva-crispa L.	N	2, 3
Rosa canina L.	N	1, 2, 3, 7- Drought resistant
Mespilus germanica L.	N	1, 2, 3
Crataegus monogyna Jacq.	N	1, 2, 3, 7- Drought resistant
Crataegus orientalis Pall.	N	1, 2, 3, 7- Drought resistant
Crataegus pentagyna Waldst. et Kit.	N	1, 2, 3, 7- Drought resistant
Pyrus comminis L.	N	1, 2, 3
Pyrus amygdaliformis Will.	N	1, 2, 3, 7- Drought resistant
Pyrus elaegrifolia Pall.	N	1, 2, 3, 7- Drought resistant
Malus silvestris Mill.	N	1, 2, 3
Malus pumila Mill.	N	1, 2, 3

Malus praecox (Pall.) Borkh.	N	1, 2, 3
Sorbus chamaespilus (L.) Crantz.	N	1, 2, 3
Sorbus aria (L.) Crantz.	N	1, 2, 3, 5
Sorbus aucuparia L.	N	1, 2, 3, 5
Sorbus domestica L.	N	1, 2, 3, 5, 7- Drought resistant
Sorbus torminalis (L.) Crantz.	N	1, 2, 3, 5, 7- Drought resistant
Amygdalus communis L.	E	1, 2, 3, 7- Drought resistant
Cerasus avinum (L.) Moench.	N	1, 2, 3, 5
Cerasus fruticosa (Pall.) Woronow	N	1, 2, 3, 7- Drought resistant
Cerasus vulgaris Mill.	E	1, 2, 3, 7- Drought resistant and smoke tolerant
Laurocerasus officinalis M.J.Rolm.	N	1,2,3
Padus mahaleb (L.) Borkh.	N	1, 2, 3, 7- Drought and smoke resistant
Padus racemosa (Lam.) Gilib.	N	1, 2, 3
Prunus spinosa L.	N	1, 2, 3
Prunus cerasifera Ehrh.	E	1, 2, 3, 7- Drought resistant
Prunus insitita L.	N	1, 2, 3
Cercis siliquastrum L.	N	1, 2, 3, 7- Drought resistant
Gleditschia triacanthos L.	E	1, 2, 7- Drought resistant
Amorpha fruticosa L.	E	1, 2, 7- Reculvation value
Sophora japonica L.	E	1, 2, 5, 7- Drought resistant, salt and smoke tolerant
Robinia pseudoacacia L.	E	1, 2, 5, 7- Drought and smoke resistant
Caragana arborescens Lam.	E	1, 2, 5, 7- Drought resistant and salt tolerant
Laburnum anagyroides Medic.	E	1, 2, 5, 7- Drought and smoke resistant
Elaeagnus angustifolia L.	E	1, 2, 7- Drought and smoke resistant, recultivation value
Cornus mas L.	N	1, 3, 5, 7- Drought resistant and smoke tolerant
Cornus sanguinea L.	N	1, 3, 5, 7- Drought resistant and smoke tolerant
Paulawnia tomentosa Steud.	E	1, 2, 5
Rhododendron ponticum L.	N	1, 2, 3, 4, 5
Catalpa bignonioides Walt.	E	1, 2, 5
Fraxinus excelsior L.	N	1, 2, 3, 5
Fracsinus ornus L.	N	1, 2, 3, 5, 7- Drought resistant
Fraxinus oxicarpa Willd.	N	1, 2, 3, 5
Fraxinus americana L.	E	1, 2, 5, 7- Relatively drought resistant and smoke tolerant
Ligustrum vulgare L.	N	1, 2, 3, 5, 7- Drought resistant and smoke tolerant
Phillyrea media L.	N	1, 2, 3, 7- Drought resistant
Syringa vulgaris L.	N	1, 2, 3, 5, 7- Drought resistant
Viburnum lantana L.	N	1, 2, 3, 7- Drought resistant
Viburnum opulus L.	N	1, 2, 3, 5

Services and values include:

1 Soil and water conservation including watershed management
2 Soil fertility
3 Biodiversity conservation
4 Cultural values
5 Aesthetic values
6 Religious values
7 Other (please specify)

1.4 Forest tree and other woody species, which are endemic

1.4.1 Bulgarian endemic forest tree and other woody species

Quercus thracica Stef. et Ned.
Quercus mestensis Bond. et Gan.
Rosa bulgarica Dimitrov
Rubus oblongoobovatus Mark.
Pyrus bulgarica Khutath. et Sachok.
Chamaecytisus absinthioides subsp. rhodopaeus /Wagner ex Deg./ Kuzm.
Chamaecytisus frivaldszkyanus /Deg./ Kuzm.
Chamaecytisus kovacevii /Vell./ Rothm.
Astragalus aitosensis Ivanisch.

1.4.2 Balkan Peninsula endemic forest tree and other woody species

Pinus peuce Gris.
Abies borisii-regis Mattf.
Acer heldreichii Orph. ex Boiss
Aesculus hippocastanum L.
Genista rumelica Vel.

The share of endemic forest tree and shrub species – Bulgarian and Balkan endemites towards total number of native species is 7.3%.

1.5 Tree and other woody forest species identified as being threatened (include documented threatened populations) (Table 7)

Table 7 Tree and other woody forest species considered to be threatened in all or part of their range from genetic conservation point of view

Species	Area (ha) of species natural distri-bution, 1+ known	Average number of tree per ha, 1+ known	Proportion of species' natural distri-bution %	Distribution in the country wide spread (W) rare (R) or local (L)	Type of threat (code)	Threat category		
						High	Me-dium	Low
Trees								
Aesculus hippocastanum L.			20	L	11,13			x
Castanea sativa Mill.			5	R	3, 7, 11, 13		x	
Eriolobus trilobata Roem.			5	L	6		x	
Hippophae rhamnoides L.			1	L	5, 6			x
Quercus thracica Stef. et Ned.			100	L	6, 12, 13	x		
Salix pentandra L.			1	L	13			x
Taxus baccata L.			2	R	4, 7, 12, 13			x
Shrubs								
Caragana frutex K.Koch			2	L	4, 5, 6, 12		x	
Chamaecytisus ratisbonensis (Schaeff.) Rothm.			5	L	1, 3, 6		x	
Ephedra campylopoda C.A.Mey			10	L	1, 6		x	
Genista pilosa L.			10	R	1, 6			x

Pyracantha coccinea Roem.			10	L	1, 6			x
Rhododendron ponticum L.			5	L	2, 3, 13			x
Rubus macrophyllus Weihe et Nees			5	L	1, 3, 6		x	
Rubus thyrsiflorus Weihe et Nees			5	L	1, 3, 6		x	
Spirea cienata L.			1	L	1, 6		x	
Spirea hypericifolia L.			10	L	1, 6			x
Spirea salicifolia L.			2	L	1, 3, 6		x	
Vaccinium arctostaphylos L.			5	L	2, 4, 12			x

Type of threat:

1. Forest cover reduction and degradation
2. Forest ecosystem diversity reduction and degradation
3. Unsustainable logging
4. Management intensification
5. Competition for land use
6. Urbanization
7. Habitat fragmentation
8. Uncontrolled introduction of alien species
9. Acidification of soil and water
10. Pollutant emissions
11. Pest and diseases
12. Forest fires
13. Drought and desertification
14. Rising sea level
15. Other (please specify)

The propotion of the threatened tree and other woody species included in conservation programmes are as tollows: *Aesculus hippocastanum* L. – 100% (reserve Dervisha), *Castanea sativa* Mill. – 50% (former reserves Malkia mostik and Skoshnik), *Hippophae rhamnoides* L. – 100% (protected locality Cape Galata), *Rododendron ponticum* L. – 60% (reserves Lopushna, Silkosia, Tisovitsa), *Quercus thracica* Stef. et Ned. – 100% (nature landmark-protected specimen), *Taxus baccata* L. – 70% (reserves Tisovitsa, Alibotush, Vrachanski karst, Rilomanastirska gora, nature park Vitosha, national park Central Balkan), *Vaccinium arctostaphylos* L. – 80% (reserves Silkosia, Uzunbudzhak).

Documented threatened population

- remnant of *Pinus peuce* Gris. below Reznyovete on the east upper slope of Vitosha Mt. (Dimitrov et al., 1963);
- remnant of *Abies alba* Mill. in Slavyanka and foothill part of Eastern Balkan Range (Dobrinov et al., 1982);
- remnant of *Pinus sylvestris* L. – in the peripheral parts of Sofia plain – Bistritsa, Plana and Novi han (Dobrinov et al., 1982);
- remnant of *Picea abies* (L.) Karst – in Osogovo Mt at 1700 m a.s.l.

1.6 Regular assessment of threatened species.

The assessment of threatened species is carried out periodically by research institutes of the Bulgarian Academy of Science (BAS) and first entirely monograph "Red Data Book of Bulgaria", volume 1 "Plants" was published in 1984 (BAS, 1984). Later investigations on this subject were carried out by the Institute of Botany, the Forest Research Institute and the Laboratory of Ecology at BAS. New Red Data Book of Bulgaria, volume 1 – Plants and Fungi, BAS & MOEW, Sofia is published in 2011.

1.8 A system for documenting the forest reproductive material.

In practice, there is OESD system for control of forest reproductive materials, functioning in the country (Velkov et al., 1992).

The system for documented forest reproductive material is arranged by Regulation Nr.5/5 February 2004 (State Gazette, Nr.18, 2004). The production of reproduction material from tree species is carried out only by approved and registered in Register of forest seed-production base. Minimal requirements are determined for approvement of yield of forest tree reproductive material from the following categories: 1 – "identified", 2 – "selected", 3 – "qualified" and 4 – "tested ". Transfer and trade of forest reproductive material is obligatory accompanied by certificate for its identification.

Regulation Nr.2 for afforestation and inventory of forest plantations (State Gazette, Nr.15, 2009) gives preference to genetic resources of 76 indigenous tree and shrub species (12 coniferous and 64 deciduous), of 39 introduced species (23 coniferous and 16 deciduous), which have showed positive results after durable testing, and of 5 naturalised species.

1.9 Current state of forest reproductive material (native and exotic) identification (seed sources, provenance zones) and utilization (including vegetatively propagated material). (Table 8a and/or 8b).

Table 8a. Annual quantity of seed produced and current state of identification of forest reproductive material of ~~the~~ main forest tree and other woody species in the country.

Species		Total quantity of seed used (Kg)	Quantity of seed from documented sources (provenance/seed zones delimited)	Quantity of seed from tested provenances (provenance trials established and evaluated)	Quantity that is genetically improved (from seed orchards)
Scientific name	**Nature (N) or exotic (E)**				
Gymnospermae					
Pinus sylvestris L.	N	56.7	56.7		
Pinus nigra Arn.	N	161.9	113.3		48.6
Abies concolor Lindl.et Hildebr.	E	1.5			
Picea pungens Engelm.	E	0.2			
Picea abies (L.) Karst.	N	19.8	19.8		
Pseudotsuga menziesii (Mirb.) Franco	E	0.2	0.2		
Thuja orientalis L.	E	5.7			
Cedrus atlantica Manetti	E	57.0	57.0		
Cedrus deodara Loud.	E	17.3			
Cupressus sempervirens L.	E	1.4			
Chamaecyparis lawsoniana Parl.	E	2.2			
Total Gymnospermae		**323.9**	**247.0**		**48.6**
Angiospermae					
Robinia pseudoacacia L.	E	414.9			414.9
Betula pendula Roth.	N	6.2	6.2		

Ulmus laevis Pall.	N	6.0			
Fagus sylvatica L.	N	10.0	10.0		
Gleditschia traicanthos L.	E	25.4			
Prunus cearasifera Ehrh.	E	64.9			
Pyrus communis L.	N	3.1			
Cerasus avium (L.) Moench.	N	77.6	77.6		
Quercus petrea Liebl.	N	1 198.0	1 198.0		
Quercus suber L.	E	15.0	15.0		
Quercus rubra L.	E	11 037.0	11 037.0		
Quercus cerris L.	N	38 230.0	38 230.0		
Quercus coccifera L.	N	20.0			
Quercus frainetto Ten.	N	1 425.0			
Quercus robur L.	N	1 230.0	1 230.0		
Quercus pubescens Willd.	N	630.0	630.0		
Catalpa bignonioides Walt.	E	0.7			
Castanea sativa Mill.	N	971.0	971.0		
Aesculus hippocastanum L.	N	537.0			
Malus silvestris Mill.	N	6.5			
Celtis australis L.	N	18.0			
Tilia tomentosa Moench.	N	910.0			
Tilia cordata Mill.	N	8.0	8.0		
Tilia platyphyllos Scop.	N	12.0	12.0		
Padus mahaleb (L.) Borkh.	N	5.3			
Juglans regia L.	E	100.0			
Sorbus aucuparia L.	N	1.1			
Acer pseudoplatanus L.	N	227.3	227.3		
Acer platanoides L.	N	4.6	4.6		
Acer heldreichii Orph. ex Boiss	N	2.0			
Fraxinus americana L.	E	33.4			
Fraxinus excelsior L.	N	5.0	5.0		
Fraxinus oxycarpa Willd.	N	0.7			
Platanus orientalis L.	N	1.3			
Total Angiospermae		**57 237.0**	**53 661.7**		**414.9**
Total Gymnospermae + Angiospermae		**57 560.9**	**53 908.7**		**463.5**

The annual quantity of forest tree seeds produced from documented sources plus genetically improved ones are 94.5% from quantity of seeds used. For coniferous species this index is 91.3% and although the quantity of seeds from indigenous species is 74.0%, all of them are with determined provenance. For deciduous species the quantity of seeds from indigenous species is a bit higher (79.9%), but 5.5% are from non-documented origin.

Highest quantity of seeds from coniferous species is obtained from *Pinus nigra* Arn. (50.0%), *Pinus sylvestris* L. (17.5%), *Cedrus atlantica* Manetti (17.6%) and *Picea abies* (L.) Karst (6.1%), etc., and from deciduous species – from *Quercus cerris* L. (66.8%), *Quercus rubra* L. (19.3%), *Quercus frainetto* Ten. (2.5%), etc.

Totally for the country the annual yield of forest tree seeds from indigenous species is 79.9%, while seeds from seed orchards are in relatively small quantity (0,8%). This shows that years long forestry policy has been directed to production of seeds from seed stands, and it has not been very much relied on seed orchards. Forest seed yield is directed predominantly towards indigenous forest tree species. This forestry policy for production of forest seeds from seed stands and from indigenous species in mountain country like Bulgaria proved to be ecologically most suitable especially in expected climate changes.

Table 8b. Annual number of seedlings (or vegetative propagules) planted and state of identification of reproductive material used for main forest tree and other woody species in the country.

Species		Total quantity of seedlings planted	Quantity of seedlings from documented sources (provenance/ seed zones delimited)	Quantity of seedlings from tested provenances (provenance trials established and evaluated)	Quantity of vegetative reproductive material used	Quantity of seedlings that are genetically improved
Scientific name	**Nature (N) or exotic (E)**					
Gymnospermae						
Pinus sylvestris L.	N	962 900	962 900			
Pinus nigra Arn.	N	1 895 000	1 326 500			568 500
Pinus peuce Gris.	N	11 000				
Abies alba Mill.	N	29 200	20 500			8 700
Abies cephalonica Loud.	E	8 400	8 400			
Pseudotsuga menziesii (Mirb.) Franco	E	66 000	66 000			
Abies pinsapo Boiss.	E	3 600	3 600			
Picea abies (L.)Karst.	N	441 900	441 900			
Thuja orientalis L.	E	46 900				
Cedrus atlantica Manetti.	E	236 800	236 800			
Cedrus deodara Loud.	E	12 400				
Cupressus sempervirens L.	E	3 300				
Chamaecyparis lawsoniana Parl.	E	2 200				
Total Gymnospermae		**3 719 600**	**3 066 600**			**577 200**
Angiospermae						
Robinia pseudoacacia L.	E	1 670 000				1 670 000
Betula pendula Roth.	N	8 900	8 900			
Sorbus torminalis (L.) Crantz.	N	1 000				
Fagus sylvatica L.	N	701 900	701 900			
Gleditschia traicanthos L.	E	75 700				
Pyrus communis L.	N	38 700				
Cerasus avium (L.) Moengh.	N	40 300	40 300			
Quercus petraea Liebl.	N	326 300	326 300			
Quercus rubra L.	E	933 000	933 000			
Quercus cerris L.	N	4 457 400	4 457 400			
Quercus frainetto Ten.	N	544 800				
Quercus robur L.	N	415 500	415 500			
Quercus pubescens Willd.	N	105 800				
Catalpa bignonioides Walt.	E	1 000				
Castanea sativa L.	N	17 100	17 100			

Aesculus hippocastanum L.	N	23 900				
Malus silvestris Mill.	N	33 400				
Celtis australis L.	N	5 800				
Tilia tomentosa Moench.	N	409 500				
Tilia cordata Mill.	N	24 000	24 000			
Padus mahaleb (L.) Borkh.	N	1 600				
Juglans regia L.	E	13 200				
Acer pseudoplatanus L.	N	210 700	210 700			
Acer platanoides L.	N	19 100	19 100			
Acer negundo L.	N	1 100				
Fraxinus americana L.	E	21 800				
Fraxinus excelsior L.	N	59 300	59 300			
Fraxinus oxycarpa Willd.	N	64 900				
Platanus orientalis L.	N	9 900				
Populus ssp.		214 900				214 900
Total Angiospermae		**10 450 500**	**7 213 500**			**1 884 900**
Total Gymnospermae + Angiospermae		**14 170 100**	**10 280 100**			**2 462 100**

Annual number of seedings from documented sources plus genetically improved ones is 89.9% from the total quantily of seedlings planted, and 17.4% are genetically improved.

Seedlings from indigenous species are 78.4%, and exotic ones – 21.6%. For coniferous species seedlings from indigenous species are 89.9%, and for deciduous ones – 74.3%.

Highest quantity of planted seedlings from coniferous species is from *Pinus nigra* Arn. (50.9%), *Pinus sylvestris* L. (25.9%), *Picea abies* (L.) Karst. (11.9%), *Cedrus atlantica* Manetti. (6.4%), etc., and from deciduous species – from *Quercus cerris* L. (42.6%), *Robinia pseudoacacia* L. (16.0%), *Quercus rubra* L. (8.9%), *Fagus sylvatica* L. (6.7%), etc.

Generalised data from table 8b show clear domination of deciduous seedlings, which are 73.8% of all seedlings, as well as strong domination of indigenous species (78.4%). This is in conformity with the national policy for increasing of the share of deciduous and indigenous tree species in afforestation due to expected climate changes.

1.10 Current state of genetic characterization of main forest tree and other woody plant species. (Table 9).

Table 9. Forest tree species, whose genetic variability has been evaluated

Species		**Morphological traits**	**Adaptive and production characters assessed**	**Molecular characterization**
Scientific name	**Native (N) or xotic (E)**			
Gymno-spermae				
Pinus sylvestris L.	N	24 forms according to: branching habit (3), bark cracking (3); apophysis form (3), catkins color (2), seed color (5), wing color (5), resin productivity (2),	**-ecotypes:** 3 ecotypes according to altitude (Dobrinov, 1960; Kalinkov, Dobrinov, 1972; Dobrinov et al., 1982). **-provenance tests:**	**-biochemical markers:** polyphenols (Zhelev, Edreva, 1991); mono- and

		f.conglomerata Carr. (Dobrinov, 1960; Rosnev, 1968; Kalinkov, Dobrinov, 1972; Dobrinov, Kalinkov, 1972; Dobrinov et al., 1982).	6 provenance tests (Dobrinov, 1965; Dobrinov, Kalinkov, 1969; Dobrinov et al., 1982; Kostov et al., 1986). The highest intensity of photo-synthesis have provenances of Scots pine from altitudes near the optimum of this species in the certain mountain range or massive (Naidenova, Kostov, 1994). **-progeny tests:** 4 half-sib progeny tests (Dobrinov, Kalinkov, 1972; 1977; Gagov, Zhelev, 1996); coefficients of heritability of height and diameter growth were estimated (Zhelev, 1992; Gagov, Zhelev, 1996).	sesquiterpenes (Naydenov, 1998; Naydenov et al., 2005); isoenzymes (Zhelev, 1992; Zhelev et al., 1994). **-DNA markers:** chloroplast DNA (Naydenov et al., 2005).
Pinus nigra Arn.	N	4 varieties according to needle anatomy (Ivanov, 1971); 13 forms according to: branching habit (3), bark cracking (3), apophysis form (4), seed color (3) (Ivanov, 1971; Mihailov, 1993). Intra-population variation is bigger than inter-population variability (Mihailov, 1987).	**-ecotypes:** 3 ecotypes according to basik rock (Dobrinov et al., 1982). Radio resistance of seeds depends significantly from provenance, and the most drought-resistant ecotype is characterized with highest radio resistance (Dobrev, 1986). **-provenance tests:** 11 provenance tests (Kostov et al., 1979; Zahariev et al., 1983; Iliev et al., 1997). **-progeny tests:** 2 half-sib progeny tests (Dobrev, 1999); coefficients of family heritability and genetic correlations of height growth were estimated (Dobrev, 1999; 2002).	**-biochemical markers:** isoenzymes (Scaltsoyiannes et al., 2009); **-DNA markers:** chloroplast DNA (Naydenov et al., 2006).
Picea abies (L.) Karst.	N	16 varieties according to: needle morphology (2); color of young cones (2); scale shape (6); branching habit (6) (Alexandrov, 1966; 1970; 1984); (Dobrinov, 1973; Dobrinov et al., 1982). 14 forms according to: habit of second order branching (4); bark cracking (3); length of the female strobiles (2); seed color (5) (Alexandrov, 1966; 1970; 1984).	**-provenance tests:** 2 provenance tests (Александров, 1983; 1985). The most promising sort-population was selected and evaluated (Alexandrov, 1985). The highest intensity of photo-synthesis have provenances from altitudes near the optimum for the natural distribution of this species in the certain mountain range or massive (Alexandrov, Naidenova,1991). **-progeny tests:** 5 half-sib progeny tests (Alexandrov, 1984; 1985; 1990); coefficients of heritability of height and diameter growth were estimated (Alexandrov, 1984;	

			1990).	
Abies alba Mill.	N	24 forms according to: branching habit of the first order (3); branching habit of the second order (2); bark cracking and color (5); needle length (3); male katkins color (2); seed color (3); color of young cones (2); sizes and form of cones (4) (Gagov ,1973).	**-ecotypes:** 3 ecotypes according to altitude (Dobrinov et al., 1982). **-provenance tests:** 7 provenance tests (Gagov, 1979); the best provenance from Slavyanka was distinguished as *Abies alba* var. acutifolia Turill. (Dobrinov, Gagov, 1981). This gives the reason for considering the populations from Slavyanka as resistant to summer drought ecotype (Dobrinov, Gagov, 1981). **-progeny tests:** 4 half-sib progeny tests; genetic parameters of height and diameter growth were estimated (Plugchieva et al., 2003; Gagov et al., 2005; Gagov, Evtimov, 2007).	**-biochemical markers:** isoenzymes (Bergmann and Gagov, 2000; 2003).
Pinus peuce Gris.	N	2 varieties according to: immature cones color, size, and shape (Doykov, 1975). 15 forms according to: branching habit (3); bark cracking (4); needle length (2); seed color (3) wing color (3) (Doykov, 1981; Dobrev, 1996). Variance components and coefficients of repeatability of needle, cone, cone scale, wing and seed traits were estimated in two full seed years (Dobrev, 1995; 2000, 2007). 13 studied provenances were grouped and distinguished on the base of 31 morphological traits by PCA and MDS (Dobrev, 2007).	**-provenance and progeny tests:** 5 combined provenace and half-sib progeny tests (Dobrev, 1998; 2000); genetic parameters of height and diameter growth were estimated. A fast growing and adaptive population was selected and evaluated (Dobrev, 2007; 2009). Macedonian pine originated from the North Pirin (1900m a.s.l.) was characterized with the highest productivity and good adaptation to lower mountain and drier conditions (Dobrev, 2007; 2009).	**-biochemical markers:** isoenzymes (Zhelev et al., 2002; Zhelev, Tzarska, 2008).
Pinus heldreichii Christ.	N	6 forms according to; branching habit (3); bark cracking (3) (Dobrinov et al., 1982). Variability between and within populations was evaluated (Yurukov et al., 2005).		**-biochemical variability:** proteins (Balevska, Alexandrov, 1975). **-DNA markers:** chloroplast DNA (Naydenov et al., 2005).
Pinus mugo Turra	N			**-biochemical markers:** allozymes (Slavov, Zhelev, 2004).
Natural hybrids	N	Some characters of hybrids possess	**-progeny tests:** 3 half-sib progeny tests	

between *Pinus sylvestris* L. and *Pinus mugo* Turra		intermediate values in comparison with the parental species (Yurukov, Zhelev, 2006).	(Dobrinov, Yagdzidis, 1971; Dobrinov, Yurukov, 1986; Gagov, Zhelev, 1996).	
Larix decidua Mill. and *Larix kaempferi* (Lamb.) Carr.	E		**-provenance tests:** 1 provenance test (Milev, 1996).	
Pseudotsuga menziesii (Mirb.) Franco	E		**-provenance tests:** 2 provenance tests (Popov, Hristov, 1996; Popov, 2001); 4 provenance tests (Iliev, Petkova, 1999). Fast growing and adaptive provenances were selected (Popov, Hristov, 1996; Iliev, Petkova, 1999).	**-DNA markers:** RAPD (Antsipava et al., 2010).
Total Gymnospermae		**varieties and forms – 118.**	**ecotypes - 9; provenance tests – 38; progeny tests – 23.**	**biochemical markers – 12 publications; DNA markers – 4 publications.**
Angiospermae				
Quercus petraea Liebl.	N	2 forms according to leaf phenology; 27 forms according to: leaf length and form (14); branching habit (3); stem form (2); bark cracking (5); acorn sizes, form and color (3) (Garilov, 1969; 1972); (Velkov and Popov, 1969); (Peev, 2006; 2007).	**-ecotypes:** 3 ecotypes according to altitude (Garilov, 1969; 1972). **-provenance and progeny tests:** 1 combined provenance and half-sib progeny test; coefficients of heritability of height and diameter growth were estimated (Garilov, 1982).	**-biochemical markers:** isoenzymes (Gömöry et al. (2001).
Quercus cerris L.	N	2 forms according to leaf phenology; 24 forms according to: leaf length and form (6); bark cracking (8); acorn form (4); acorn sizes (3); acorn dome form (3) (Erbakamov, 2005).	**-provenance tests:** 1 collection of provenances (Erbakamov, 1995).	
Quercus frainetto Ten.	N	2 forms according to leaf phenology; 2 varieties with 7 forms according to leaf sizes and form (Damyanov et al., 1977; Dobrinov et al., 1982).	**-ecotypes:** 2 ecotypes according to drought tolerance (Damyanov et al., 1977).	
Quercus robur L.	N	2 forms according to leaf phenology (Denev, 1969); 24 forms according to: leaf sizes and form (9);	**-ecotypes:** 3 ecotypes according to drought tolerance (Hinkov, 2004). **-provenance tests:** 1 provenance test (Kostov,	**-DNA markers:** chloroplast DNA (Hinkov et al., 2003; Hinkov, 2004).

		acorn dome form (5); acorn form (6); crown form (4) (Hinkov, 2004).	1981). - **progeny tests:** 1 half-sib progeny test (Hinkov, 2004).	
Quercus thracica Stef. et Ned.	N		**-progeny tests:** 1 half-sib progeny test (Alexandrov, 1994).	
Quercus suber L.	E		**-provenance tests:** 7 trial plantations with selected provenance (Petrov, 1994).	
Fagus sylvatica L.	N	2 forms according to: leaf phenology; 19 forms according to: leaf length and form (5); branching habit (2); stem form (3); bark color (3); bark cracking (4); leaf color (2) (Dobrinov et al., 1982).	**-ecotypes:** 5 ecotypes according to altitude and mountain massif (Dobrinov et al., 1982). **-provenance tests:** 2 provenance tests (Botev, 1994; Alexandrov et al., 2006). Best provenances were selected and evaluated.	**-biochemical markers:** isozymes (Gömöry et al., 1999).
Castanea sativa Mill.	N	25 forms according to: bark cracking (2); leaf length and form (2); male katkins structure (5); size and weight of fruits (4); number of fruits in a dome (2); form of fruits (5); dome needles (4); f.spicata (Dobrinov et al., 1982; Glushkova, 2006).	**-provenance and progeny tests:** 3 combined provenance and half-sib progeny tests (Glushkova, 2006). Progenies from Berkovitsa-400m and 600m altitude were distinguished with highest survival and the best growth in height (Glushkova, 2006). **-clonal tests:** 5 tests with clones.	
Populus sp. and their artificial hybrids	N and E	*Populus tremula* L.: 2 forms according to leaf phenology; 21 forms according to: leaf form (6); stem form (2); crown form (3); bark color (6); bark cracking (4) (Dobrinov et al., 1982). *Populus alba* L.: 4 forms according to: bark thikness (2); crown form (2) (Tsanov, 1988). *Populus nigra* L.: 5 forms according to: bark cracking (2); crown form (2) (Tsanov, 1988); a curly form (Tsanov, 1989).	**-clonal tests:** 25 (Kolarov, 1978); 1 (Iliev et al., 1978); 2 (Ganchev, Svinarov, 1981); 1 (Ganchev et al., 1981); 64 (Tsanov, 1983); 1 (Tsanov et al., 1989). High productive and adaptive clones were selected (Ganchev et al., 1959; Petrov, 1967; Iliev et al., 1978; Iliev, 1983; Ganchev, Svinarov, 1981; Ganchev et al., 1981; Tsanov, 1983; Kolarov, 1989; Tsanov et al., 1989; Vasev, 2002).	
Salix sp. and their artificial hybrids	N and E	*Salix alba* L.: 11 forms according to: leaf form and color (4); crown form (3); bark color and cracking (4) (Tsanov, 1989). Intraspecies variation of *Salix alba* L. on the base of morphological traits was estimated (Tsanov, 1995).	**-clonal tests:** 64 clonal tests (Tsanov, 1983). 4 clones were selected: Salix alba kl. Bg-1/64; Bg-2/64; Bg-3/64 and Salix purpurea kl. "Vardimski", that have good stem form, fast growth and high productivity (Tsanov, 1989).	

Fraxinus excelsior L.	N	2 forms according to leaf phenology; 8 forms according to: leaf sizes (2); crown form (3); bark cracking (3) (Marinov, 1969; Dobrinov et al., 1982).	**-ecotypes:** 3 ecotypes according to altitude (Marinov, 1973). **-provenance and progeny tests:** 4 provenance tests; coefficients of heritability of height and diameter growth were estimated (Marinov, 1986; 1990).	**-DNA - markers:** microsatellite DNA (Heuertz et al., 2001).
Fraxinus oxycarpa Willd.	N	23 forms according to: hairiness of leaves, branches and buds (2); leaf sizes and form (3); leaf color (3); stem form (2); bark cracking (3); sizes and form of wings (10) (Marinov, 1976; Dobrinov et al., 1982; Genova, 1993).	**-ecotypes:** 2 ecotypes according to soil moisture (Dobrinov et al., 1982).	
Tilia tomentosa Moench.	N	21 forms according to: leaf and fruit sizes and form (7); stem form (2); crown form (3); bark cracking (3); color of young shoots (3); color of timber (2); f.praecox (Dobrinov et al., 1982).	**-ecotypes:** 3 ecotypes according to altitude (Kalmukov, 1994).	
Tilia cordata Mill.	N	7 forms according to leaf sizes and form (2); bark cracking (5) (Dobrinov et al., 1982).		
Tilia platyphyll os Scop.	N	7 forms according to leaf form (1); crown form (4); bark cracking (2) (Dobrinov et al., 1982).		
Betula pendula Roth.	N	3 phenological forms (Iliev, 1988); 20 forms according to: bark color (4); bark cracking (2); crown form (4); leaf color (2); leaf form (7); a curly form (Dobrinov et al., 1982; Iliev, 1988).	**-ecotypes:** 3 ecotypes according to altitude (Dobrinov et al., 1982).	**-biochemical markers:** isozymes (Iliev et al., 2010).
Acer pseudoplat anus L.	N	15 forms according to: leaf sizes and form (5); stem form (2); bark cracking (3); sizes and form of wings (3)**;** color of wings (2) (Pandeva, 2004; 2006); (Pandeva, Glushcova, 2005).	**- ecotypes:** 3 ecotypes according to drought resistance (Pandeva, 2004).	
Acer platanoide s L.	N	4 forms according to: stem form (2); bark cracking (2) (Pandeva, 2004).		
Acer campestre L.	N	7 forms according to: leaf sizes and form (3); stem form (2); sizes and form of wings (2) (Pandeva, 2004).	**- ecotypes:** f. *suberosa*, is found out for growing on very poor and dry calcareous soils (Pandeva, Peev, 2007).	

Acer heldreichii Orph. ex Boiss	N	8 forms according to: leaf sizes and form (4); stem form (2); sizes and form of wings (2) (Pandeva, 2004).		
Acer hyrcanum Fisch. et May	N	4 forms according to: stem form (2); color of wings (2) (Pandeva, Peev, 2007).		
Platanus orientalis L.	N	12 forms according to: leaf form (3); crown form (6); bark cracking (3) (Dobrinov et al., 1982).		
Corylus colurna L.	N	2 phenological forms; 7 forms according to: hairiness of leaves (2); leaf form (2); bark configuration (3) (Dobrinov et al., 1982).		
Juglans regia L.	E		16 sorts and forms were selected that are suitable either for high quality timber and fruit production (Popov, 1988).	
Paulownia sp. and their artificial hybrids	E		**-clonal tests:** 3 (Gyuleva, 2008).	
Robinia pseudoacacia L.	E		**-clonal tests:** 1 (Tsanov et al., 1992); 1 (Broshtilov, 2009); 19(Kalmukov, 2009). High productive and adaptive clones were selected (Tsanov et al., 1992; Dimitrova, 2005; Broshtilov, 2009; Kalmukov, 2009).	
Total Angio-spermae		**varieties and forms – 331.**	**ecotypes – 28; provenance tests – 19; progeny tests – 6; clonal tests – 187; sorts - 16.**	**biochemical markers – 3 publications; DNA markers – 3 publications.**
Total Gymno-spermae and Angio-spermae		**varieties and forms – 449.**	**ecotypes – 37; provenance tests – 57; progeny tests – 29; clonal tests – 187; sorts - 16.**	**biochemical markers – 15 publications; DNA markers – 7 publications.**

The evalutation of genetic variability of native forest tree species is carried out predominantly for 38 tree species (10 coniferous and 28 deciduous) with a stress on the intraspecific variability and totally 449 varieties and forms are determined – morphological traits (118 for coniferous and 331 for deciduous species). There are also 37 ecotypes and 57 provenance and 29 progeny tests established, as well as 187 clonal tests, and for *Juglans regia* L. – 16 sorts. Genetic characterization was carried out through biochemical markers for 9 tree species, and through DNA markers – for 6 tree species.

1.11 Collection of information on forest genetic resources as part of national forest surveys.

In Regulation for inventory and planning in forest territories, section IV from 2011 it is foreseen:

(1). On additional assignment, pointed out in the inventory task, survey on biological diversity is carried out, which includes determining of representative, rare and vulnerable forest ecosystems and localities of rare, threatened, protected and endemic plant and animal species.

(2). In generalization of information obtained during the survey, the following basic quantitative indices are included:

1. Changes in the area of natural, semi-natural, artificial and protected forest ecosystems.

2. Changes in the number and percentage of rare, threatened with extinction, protected and endemic species from their total number.

3. Changes in the relative share of stands, managed with the aim preservation and utilization of forest genetic resources from the total forest area.

4. Proportion between used indigenous and introduced tree species.

1.12 Developed genetic conservation strategies/programmes (including *in situ* and/or *ex situ*) for forest tree or other woody plant species.

The evaluation of the genetic variability of forest tree species in the country and the development of their genetic conservation programmes was carried out by four generations of forest biologists and is recorded predominantly in PhD theses and publications: Flora of Bulgaria (Stoyanov, Stefanov, 1924); Dendrology (Stefanov, 1934; Stefanov, Ganchev, 1953; Ganchev, Stefanov, 1958; Chernyavski et al., 1959; Dobrinov et al., 1982; Delkov, 1992; Vakarelov, Anisimova, 2010); *Pinus sylvestris* L. (Dobrinov, 1960; Rosnev, 1968; Zhelev, 1994); *Picea abies* (L.) Karst (Alexandrov, 1967, 1984); *Pinus nigra* Arn. (Ivanov, 1971; Dobrev, 1986; Michailov, 1993); *Abies alba* Mill. (Gagov, 1973); *Pinus peuce* Gris. (Dobrev, 2007); *Larix decidua* Mill. and *Larix kaempferi* (Lamb.) Carr. (Milev, 1996); *Pseudotsuga menziesii* (Mirb.) Franco (Popov, 1991); *Quercus robur* L. (Dakov, 1949; Denev, 1969; Hinkov, 2004); *Quercus petraea* Liebl. (Velkov, 1959; Garilov, 1972; Peev, 2007); *Quercus frainetto* Ten. (Kalinkov, 1961); *Quercus stranjensis* Turill. (Arabov, 1988); *Quercus cerris* L (Erbakamov, 2005); *Fagus sylvatica* L. (Garelkova, 1980; Dakov, 2011); *Fraxinus excelsior* L. (Marinov, 1970, 1986); *Fraxinus oxycarpa* Willd. (Marinova, 1993); *Platanus orientalis* L. (Delkov, 1977); *Populus* sp. (Petrov, 1967; Ganchev, 1967; Naydenova, 1972; Kolarov, 1989; Tsanov, 1989); *Salix* sp. (Tsanov, 1973, 1989); *Castanea sativa* Mill. (Glushkova, 2006); *Corylus colurna* L. (Alexandrov, Popov, 1971); *Betula pendula* Roth. (Iliev, 1988); *Tilia tomentosa* Moench (Kalmukov, 1987); *Acer* sp. (Pandeva, 2004); *Sorbus* sp. (Georgiev, 2011); *Ulmus* sp. (Stoyanov, 2004); *Junglans regia* L. (Popov, 1988); *Quercus suber* L. (Petrov, 1994); *Robinia pseudoacacia* L. (Dimitrova, 2005); *Paulownia sp.* (Gyuleva, 2008).

Chapter 2: State of *in situ* genetic conservation

2.1 Analysis carried out to evaluate genetic conservation of forest tree and other woody plant species in protected areas (national parks, ecological reserves, etc.).

All forests in Bulgaria are managed and mapped in different scales according to the purpose of maps (most often 1:50 000, 1:100 000). Mapping was carried out and inventory descriptions of main forest tree species was done, including also data about zoning, altitude a.s.l., exposure, population size, designation of areas.

Important contribution to the genetic conservation of forest tree species is carried out by the following protected areas: the three national parks – Rila, Pirin and Central Balkan with total forest cover of 119 226 ha, the eleven nature parks – Strandzha, Vrachanski Balkan, Rilski manastir, Vitosha, Bulgarka, Persina, Sinite kamani, Shumensko plateau, Rusenski Lom, Zlatni pyasatsi and Belasitsa, with total forest cover of 179 338 ha and 90 reserves&maintained reserves with total forest cover of 59 348.1 ha, as well as in some protected localities.

2.2 Proportion of all nature and other woody forest species conserved *in situ*. Proportion of threatened tree and other woody species included in conservation programmes.

All native and other woody forest species, conserved *in situ* include mainly the forest area of national parks, nature parks, reserves and seed production stands. Their share of the total forest cover is 10.8 %.

The share of threatened tree species included in conservation programes varies from 1% to 100% according to circumstances.

2.3 A programme for *in situ* conservation of forest genetic resources (Table 10)

The year 1952 could be considered as beginning of this programme, when the forest seed control stations in Sofia and Plovdiv were founded. These stations organized the establishment of permanent seed production stands. The programme for *in situ* conservation of forest genetic resources develops and is supplemented over the years in collaboration with researchers from the Forest Research Institute and Forestry Faculty at the University of Forestry. In fact, however, this activity has begun as early as with the establishment of the first reserve – Silkosia in Strandzha mountain in 1933 and of the first national park – Vitosha mountain in 1934.

Table 10. Target forest species included within *in situ* conservation programmes/units

Species (scientific name)	**Purpose for establishing conservation unit**	**Number of populations or stands conserved**	**Total Area ha**
Gymnospermae			
Abies alba Mill.	Reserves	774	2 617.1
	Sustained Reserves	19	34.8
	Permanent Seed Production Stands	152	1 248.2
	Former PSPS in National Parks	45	126.5
	Σ	**990**	**4 026.6**
Juniperus communis L.	Reserves	4	331.0
Juniperus excelsa Bieb.	Reserves	40	244.4
Picea abies (L.) Karst.	Reserves	1282	7 034.7
	Sustained Reserves	15	37.6

	Permanent Seed Production Stands	673	4 991.6
	Former PSPS in National Parks	135	795.3
	Σ	**2 105**	**12 859.2**
Pinus heldreichii Christ.	Reserves	178	1 107.1
	Permanent Seed Production Stands	2	28.1
	Former PSPS in National Parks	5	52.2
	Σ	**185**	**1 187.4**
Pinus mugo Turra	Reserves	332	8 558.8
	Former PSPS in National Parks	1	2.1
	Σ	**333**	**8 560.9**
Pinus nigra Arn.	Reserves	348	1 239.6
	Sustained Reserves	35	188.0
	Permanent Seed Production Stands	183	1 183.5
	Former PSPS in National Parks	8	39.3
	Σ	**574**	**2 650.4**
Pinus peuce Gris.	Reserves	523	2 710.5
	Permanent Seed Production Stands	16	207.2
	Former PSPS in National Parks	58	275.9
	Σ	**597**	**3 193.6**
Pinus sylvestris L.	Reserves	559	1 438.0
	Sustained Reserves	2	1.7
	Permanent Seed Production Stands	933	8 736.1
	Former PSPS in National Parks	96	454.3
	Σ	**1 590**	**10 630.1**
Taxus baccata L.	Permanent Seed Production Stands	2	17.0
Total Gymnospermae	Reserves	4 040	25 281.2
	Sustained Reserves	71	262.1
	Permanent Seed Production Stands	1 961	16 411.7
	Former PSPS in National Parks	348	1 745.6
	Σ	**6 420**	**43 700.6**
Angiospermae			

Acer campestre L.	Reserves	120	84.3
	Sustained Reserves	16	20.8
	Σ	**136**	**105.1**
Acer platanoides L.	Sustained Reserves	1	2.1
	Permanent Seed Production Stands	3	26.1
	Σ	**4**	**28.2**
Acer pseudoplatanus L.	Reserves	155	137.3
	Permanent Seed Production Stands	8	120.7
	Σ	**163**	**258.0**
Acer tataricum L.	Sustained Reserves	1	0.4
Aesculus hippocastanum L.	Sustained Reserves	10	18.6
Alnus glutinosa (L.) Gaertn.	Sustained Reserves	5	28.5
	Permanent Seed Production Stands	6	2.2
	Σ	**11**	**30.7**
Betula pendula Roth.	Reserves	145	177.2
	Permanent Seed Production Stands	23	244.7
	Σ	**168**	**421.9**
Carpinus betulus L.	Reserves	548	1 519.7
	Sustained Reserves	34	129.0
	Permanent Seed Production Stands	20	364.9
	Former PSPS in National Parks	1	1.0
	Σ	**603**	**2 014.6**
Carpinus orientalis Mill.	Reserves	410	2 188.9
	Sustained Reserves	29	70.4
	Σ	**439**	**2 259.3**
Castanea sativa Mill.	Reserves	15	120.5
	Permanent Seed Production Stands	15	128.9
	Σ	**30**	**249.4**
Corylus colurna L.	Permanent Seed Production Stands	1	2.0
Fagus sylvatica L.	Reserves	2 107	16 644.8
	Sustained Reserves	58	348.3

	Permanent Seed Production	995	11 116.5
	Former PSPS in National Parks	42	534.5
	Σ	**3 202**	**28 644.1**
Fagus orientalis Lipsky	Reserves	403	1 720.5
	Sustained Reserves	3	9.8
	Permanent Seed Production Stands	69	666.9
	Σ	**475**	**2 397.2**
Fraxinus excelsior L.	Reserves	81	224.9
	Sustained Reserves	2	6.4
	Permanent Seed Production Stands	22	256.7
	Σ	**105**	**488.0**
Fraxinus ornus L.	Reserves	323	585.5
	Sustained Reserves	17	9.8
	Σ	**340**	**595.3**
Fraxinus oxycarpa Willd.	Reserves	282	850.0
	Sustained Reserves	50	391.5
	Permanent Seed Production Stands	16	257.8
	Σ	**348**	**1 499.3**
Juglans regia L.	Reserves	7	7.7
	Sustained Reserves	2	0.2
	Σ	**9**	**7.9**
Ostrya carpinifolia Scop.	Reserves	144	523.0
	Sustained Reserves	2	1.7
	Σ	**146**	**524.7**
Platanus orientalis L.	Permanent Seed Production Stands	4	33.8
Populus alba L.	Reserves	1	2.7
	Sustained Reserves	13	22.1
	Σ	**14**	**24.8**
Populus nigra L.	Sustained Reserves	6	14.0
Populus tremula L.	Reserves	176	268.4
Cerasus avium (L.) Moench.	Permanent Seed Production Stands	18	307.9

Pyrus communis L.	Sustained Reserves	1	0.8
Quercus cerris L.	Reserves	329	474.2
	Sustained Reserves	30	26.9
	Permanent Seed Production Stands	243	3 208.5
	Σ	**602**	**3 709.6**
Quercus frainetto Ten.	Reserves	635	2 081.6
	Sustained Reserves	35	139.7
	Permanent Seed Production Stands	384	4 561.6
	Σ	**1 054**	**6 782.9**
Quercus petraea Liebl.	Reserves	1 087	3 968.4
	Sustained Reserves	47	110.5
	Permanent Seed Production Stands	642	7 766.0
	Former PSPS in National Parks	3	45.9
	Σ	**1 779**	**11 890.8**
Quercus pubescens Willd.	Reserves	71	265.7
	Sustained Reserves	10	23.5
	Permanent Seed Production Stands	13	184.1
	Σ	**94**	**473.3**
Quercus robur L.	Reserves	68	194.4
	Sustained Reserves	36	166.0
	Permanent Seed Production Stands	39	394.1
	Σ	**143**	**754.5**
Salix alba L.	Reserves	1	2.7
	Sustained Reserves	10	11.4
	Σ	**11**	**14.1**
Salix caprea L.	Reserves	25	12.6
Sorbus aria (L.) Crantz.	Sustained Reserves	3	3.0
Sorbus aucuparia L.	Reserves	3	7.5
Sorbus domestica L.	Permanent Seed Production Stands	3	31.0
Sorbus torminalis (L.) Crantz.	Reserves	33	9.9
	Permanent Seed Production Stands	8	81.0

	Σ	**41**	**90.9**
Tilia cordata Mill.	Reserve	1	0.5
Tilia platyphyllos Scop.	Permanent Seed Production Stands	21	246.4
Tilia tomentosa Moench.	Reserves	64	87.6
	Sustained Reserves	8	2.1
	Permanent Seed Production Stands	121	1 433.8
	Σ	**193**	**1 523.5**
Ulmus glabra Huds.	Reserve	1	0.5
Ulmus laevis Pall.	Sustained Reserves	10	20.5
Ulmus minor Mill.	Sustained Reserves	31	62.7
Viburnum opulus L.	Reserves	2	3.1
Total Angiospermae	Reserves	7237	32 164.1
	Sustained Reserves	470	1 640.7
	Permanent Seed Production Stands	2 674	31 435.6
	Former PSPS in National Parks	46	581.4
	Σ	**10 427**	**65 821.8**
Total Gymnospermae + Angiospermae	Reserves	11 277	57 445.3
	Sustained Reserves	541	1 902.8
	Permanent Seed Production Stands	4 635	47 847.3
	Former PSPS in National Parks	394	2 327.0
	Σ	**16 847**	**109 522.4**

Area managed for *in situ* gene conservation, amounting to 109 522.4 ha, represents 2.9% from area covered with forests and this index for conifer forests reaches up to 43 700.6 ha (4%), and for deciduous forests – 65 821.8 ha (2.5%). At total number 16 847 populations or stand reserved, their average size is 6.5 ha (6.8 ha for coniferous and 6.3 ha for deciduous species), whose size is determined by strongly variable ecological conditions in the mountain landscape of Bulgaria.

Participation of different forest tree species within *in situ* conservation units is uneven. Highest value has *Pinus heldreichii* Christ. (94%), i.e. almost its entire area followed by *Pinus mugo* Turra (36%), *Pinus peuce* Gris. (22.9 %), *Abies alba* Mill.(12.3 %) and *Picea abies* (L.) Karst. (8%), which show very good *in situ* gene conservation. The participation of deciduous species within *in situ* conservation units is less but also reaches good representation: *Fraxinus* sp. (17.2%), *Castanea sativa* Mill. (9.8%), *Acer* sp. (9.1%), *Fagus* sp. (5.0%), *Betula pendula* Roth (4.6%), etc. Insufficiently represented are *Quercus* sp., *Carpinus* sp., *Populus* sp., etc.

The permanent seed production stands (PSPS) cover 47 847.3 ha or 1.3% of the area covered with forests, respectively 16 411.7 ha (1.5%) for coniferous and 31 435.6 ha (1.2%) for

deciduous forests. The coniferous forest tree species, with the exception of *Pinus nigra* Arn., have a share in PSPS, which is enough according to area, and compared to their total area (*Abies alba* Mill. – 3.8%, *Picea abies* (L.) Karst – 3.1%, *Pinus heldreichii* Christ. – 2.2%, *Pinus sylvestris* L. – 1.6%, *Pinus peuce* Gris. – 1.5%, while for *Pinus nigra* Arn. it is only 0.4%). The greater part of deciduons forest tree species have enough percentage share in seed production stands (*Castanea sativa* Mill. – 5.0%, *Fraxinus* sp., *Acer* sp. – 3.4%, *Tilia* sp. – 3.0%, *Betula pendula* Roth. – 2.7%, *Carpinus betulus* L. – 2.3%, *Fagus* sp. – 1.9%, *Quercus* sp. – 1.4%). The permanent seed production stands of some species, however, are absent or insufficient (*Juglans regia* L., *Sorbus aucuparia* L., *Sorbus aria* (L.) Crantz., *Pyrus communis* L.).

2.4 The main constraints to improving *in situ* genetic conservation programmes.

The main constraint is the lack of financial resources during the last 20 years.

2.5 Country's priorities for future *in situ* conservation actions.

- Financial security of *in situ* conservation actions
- Preserving of forest seed control stations.
- Proceed with research activities and capacity-building.

2.6 Other relevant information on *in situ* conservation

Due to the relatively big share of the *in situ* conservation actions in comparison with other countries, area reduction of seed stands is foreseen in turn of their better management and division according to tree species.

2.7 Conservation of species on farms (*circasitu*).

They are predominantly *Juglans regia* L. and *Castanea sativa* Mill.

Chapter 3: State of *ex situ* genetic conservation

3.1 Target forest tree species included in *ex situ* conservation programmes/units (Table 11)

Table 11. *Ex situ* conservation

Species		Field collections				Germplasm banks			
Scientific name	Nature (N) or exotic (E)	Collections, provenance or progeny tests, arboreta or conservation stands		Clone banks		In vitro (including cryo conservation)		Seed banks	
		No. stands	No. acc.	No. banks	No. clones	No. banks	No. acc.	No. banks	No. acc.
Gymnospermae									
Abies alba Mill.	N	7	22	1	426				
Cedrus atlantica Manetti.	E	1	1						
Cedrus deodara Lond.	E	1	1						
Larix decidua Mill. *Larix kaempferi* (Lamb.) Carr.	E	1	16						
Picea abies (L.) Karst.	N	2	26					1	10
Picea pungens Engelm.	E			1	30				

Pinus sylvestris L.	N	6	12	6	329			1	14
Pinus nigra Arn.	N	11	20					1	6
Pinus peuce Gris.	N			1	40				
Pinus strobus L.	E			1	30				
Pseudotsuga menziesii (Mirb.) Franco	E	6	55	1	30				
Total Gymnospermae		**35**	**153**	**11**	**885**			**1**	**30**
Angiospermae									
Amygdalus spp.	N			1	4				
Castanea sativa Mill.	N			5	12				
Corylus spp.	N			3	5				
Eucommia ulmoides Oliv.	E	1	1						
Fagus sylvatica L.	N	1	49						
Fraxinus exelsior L.	N	4	8						
Fraxinus oxycarpa Willd.	N	1	4						
Juglans regia L.	N	2	1	3	6				
Paulownia sp.	E			3	10				
Populus spp.&hybrids	N			2	360				
Quercus hartwissiana Stev.	N	1	1						
Quercus cerris L.	N	1	13						
Quercus frainetto Ten.	N	3	52						
Quercus petraea Liebl.	N	3	63						
Quercus protoroburoides Don.et.Buz.	N	1	1						
Quercus pubescens Willd.	N	3	3						
Quercus robur L.	N	1	10						
Quercus rubra L.	E	3	1						
Quercus thracica Stef.et Ned.	N	1	1						
Quercus suber L.	E	7	1						
Robinia pseudoacacia L.	E			3	70				
Salix spp.&hybrids	N			2	120				
Tilia tomentosa Moench.	N	3	4						
Ulmus spp.	N	2	15	1	60				
Total Angiospermae		**38**	**228**	**23**	**647**				
Total Gymnospermae and Angiospermae		**73**	**381**	**34**	**1532**			**1**	**30**

***Ex situ* conservation** means the conservation of components of biological diversity outside their natural habitats (CBD, 1992).

3.2 Main constraints to improving *ex situ* conservation

Due to the autochthonous forests in the country, the basic conservation method for forest genetic resources in Bulgaria is *in situ*, that's why the *ex situ* method has a secondary importance.

Main coustraints to apply *ex situ* conservation of forest species in larger scale are deficiency of financial resources and great number of native forest trees and shrubs, as well as of introduced species.

Important characteristic for provenance trials is that reproductive materials were collected as population bulked samples in full seed years from felled trees after fellings in temporary seed producing stands. This was a common practice mainly for conifer forest tree species in the country (Dobrinov et al., 1982).

Usually one temporary seed producing stand was used up to 10 years in the period of final cutting in mature stand, and it must have mean tree density of 0.4 over the all stand area. This means that one provenance is represented by hundreds of native individuals in one population (bulked) seed sample, which in turn was used for production of seedlings for planting of provenance tests.

3.3 The priorities for future *ex situ* conservation actions

Conservation of forest gene resources by the *ex situ* method is priority for introduced forest tree species so far, including fast growing and adaptive to climate changes clones of poplars, willows and black locust.

The object of *ex situ* conservation could be rare and endangered, as well as protected by the Law for biological diversity (2002) forest tree species, and also some endangered populations with very low number of individuals.

For improvement of *ex situ* conservation it is foreseen to continue with the establishment of vegetative seed orchards with selected clones in the best provenances of economically important forest trees.

3.4 Other relevant information on *ex situ* conservation

Ex situ conservation of forest tree and shrub species is carried out also in 5 botanical gardens: Bulgarian Academy of Sciences – Dragalevtsi (30.6 ha), Sofia State University – Varna (36. ha), Balchik (6.5 ha), University of Forestry (4.5 ha) and University of Sofia (0.5 ha), i.g. with more than 300 species on 78.1 ha, as well as in 12 arboreta : Forest Researcs Institute (3.0 ha), Biological Faculty, University of Sofia (0.29 ha), University of Forestry (0.35 ha), Yundola – University of Forestry (1.6 ha), Barzia – University of Forestry (3.1 ha), Primorsko (13.6 ha), Malko Tarnovo (3.0 ha), Svishtov Forest Exp. St. (0.5 ha), General Toshevo (1.0 ha), Vitosha Mt (2.0 ha), Koevtsi (1.0 ha) and Popovo (2.9 ha), i.g. with more than 400 species on 32.3 ha.

Tne botanical gardens and arboreta are established by the Bulgarian Academy of Sciences, University of Sofia, University of Forestry, National Forest Service and Agricultural Academy.

Chapter 4: State of Use and Sustainable Management of Forest Genetic Resources

4.1 The annual quantity of seed transferred internationally. (Table 12)

Table 12. Seed and vegetative propagules transferred internationally per annuum (average of last 5 years).

Species		Quantity of seed (kg)		Number of vegetative propagules		Number of seedlings		Purpose
Scientific name	Nature (N) or exotic (E)	Import	Export	Import	Export	Import	Export	

There are no data available in authorized government organization to be submitted.

4.2 Species, which are presently subject to tree improvement programmes.

4.3 The main improvement objective (Table 13)

Table 13. Forest improvement programmes.

Species		Improvement programme objective					
Scientific name	**Nature (N) or exotic (E)**	**Timber**	**Pulpwood**	**Energy**	**MP***	**NWFP****	**Other**
Gymnospermae							
Abies alba Mill.	N	+					
Abies borisii-regis Mattf.	N	+					
Picea abies (L.) Karst.	N	+					
Picea pungens Engelm.	E	+					
Pinus nigra Arn.	N	+					
Pinus peuce Gris.	N	+					
Pinus strobus L.	E	+					
Pinus sylvestris L.	N	+					
Pseudotsuga menziesii (Mirb.) Franco	E	+					
Angiospermae							
Acer platanoides L.	N	+					
Acer pseudoplatanus L.	N	+					
Betula pendula Roth.	N	+					
Carpinus betulus L.	N	+		+			
Corylus colurna L.	N					+	
Fagus sylvatica L.	N	+		+			
Fraxinus excelsior L.	N	+					
Fraxinus oxycarpa Willd.	N	+					
Juglans regia L.	E	+				+	
Paulownia sp. and their artificial hybrids	E		+	+			
Populus nigra L.	N	+					
Populus sp. and their artificial hybrids	N	+	+				
Quercus cerris L.	N	+		+			
Quercus frainetto Ten.	N	+					
Quercus petraea Liebl.	N	+		+			
Quercus robur L.	N	+		+			
Quercus rubra L.	E	+					
Quercus thracica Stef. et S. Ned.	N						+
Quercus suber L.	E					+	
Robinia pseudoacacia L.	E	+			+		
Salix sp. and their artificial hybrids	N	+					
Sorbus torminalis (L.) Crantz.	N	+					
Tilia cordata Mill.	N	+					
Tilia tomentosa Moench.	N	+			+		

4.4 The number of plus trees and genetic tests (Table 14).

Table 14. Tree improvement trials

Species		Plus trees	Provenance trials		Progenies trials		Clonal testing and development			
	Nature	**Number**	**No of trials**	**No of prov.**	**No of trials**	**No of families**	**No of testes**	**No of Clones**	**No Clones**	**No Clones**

Species (scientific name)	(N) or exotic (E)							tested	selected	used
Gymnospermae										
Abies alba Mill.	N	288	7	22	4	650			426	426
Larix decidua Mill.; *Larix kaempferi (Lamb.) Carr.*	E		1	16						
Picea abies (L.) Karst.	N	1007	2	26	5	443				
Picea pungens Engelm.	E								30	
Pinus nigra Arn.	N	420	11	20	2	83				
Pinus peuce Gris.	N	149	5	13	5	170			40	
Pinus strobus L.	E	27							30	
Pinus sylvestris L.	N	1018	6	12	4	28			329	150
Natural hybrids between *Pinus silvestris* L. and *Pinus mugo* Turra	N				3	20				
Pseudotsuga menziesii (Mirb.) Franco	E	36	6	55					30	
Total		**2 945**	**38**	**164**	**23**	**1 394**			**885**	**576**
Angiospermae										
Acer platanoides L.	N	41								
Acer pseudoplatanus L.	N	3								
Betula pendula Roth.	N	100								
Carpinus betulus L.	N	5								
Castanea sativa Mill.	N		3	10	3	78	5	12		
Corylus colurna L.	N	25								
Fagus sylvatica L.	N	892	2	52						
Fraxinus excelsior L.	N	19	4	8						
Fraxinus oxycarpa Willd.	N	231								
Juglans regia L.	E	5								
Paulownia sp. and their artificial hybrids	E						3	10	10	
Populus sp.and their artificial hybrids	N and E						94	151	360	44
Quercus cerris L.	N	48	1	13						
Quercus frainetto Ten.	N	343								
Quercus petraea Liebl.	N	893	1	2	1	40				
Quercus robur L.	N		1	10	1	13				
Quercus rubra L.	E	10								
Quercus thracica Stef. et Ned.	N				1	1				
Quercus suber L.	E		7	1						
Robinia pseudoacacia L.	E	4					21	43	70	45
Salix sp. and their artificial hybrids	N						64	22	120	6
Sorbus torminalis (L.) Crantz	N	6								
Tilia cordata Mill.	N	17								
Tilia tomentosa Moench.	N	124								
Total		**2 766**	**19**	**96**	**6**	**132**	**187**	**238**	**560**	**95**
Total Gymnospermae and Angiospermae		**5 711**	**57**	**260**	**29**	**1 526**	**187**	**238**	**1 445**	**671**

Table 15. Seed orchards

Species (scientific name)	Seed orchards* (vegetative)	Seed orchards* (seedling)

	Number	Area	**Generation	Number	Area	**Generation
Gymnosperms						
Abies alba Mill.	1	3.1	1			
Cedrus atlantica Manetti	2	4.8	1			
Picea pungens Engelm.	1	2.2	1			
Pinus nigra Arn.	4	12.0	1			
Pinus peuce Gris.				2	4.3	1
Pinus sylvestris L.	4	10.3	1			
Total	**12**	**32.4**	**1**	**2**	**4.3**	**1**
Angiosperms						
Quercus suber L.				1	10.8	1
Robinia pseudoacacia L.	23	60.3	1			
Tilia tomentosa Moench.	2	4.9	1	1	1.7	1
Total	**25**	**65.2**	**1**	**2**	**12.5**	**1**
Total Gymnosperms and Angiosperms	**37**	**97.6**	**1**	**4**	**16.8**	**1**

4.5 Established information systems on tree breeding programmes.

4.6 Quantities of improved seed, pollen, scions and/or other.

Table 16. Type of reproductive material available

Species (scientific name)	Tupe of material	Available for national requests only		Available for international requests	
		commercial	research	commercial	research
Gymnosperms					
Pinus sylvestris L.	seeds	687,2			
Pinus nigra Arn.	seeds	429.8			
Picea abies (L.) Karst.	seeds	352.2			
Picea pungens Engelm.	seeds	0.5			
Chamaecyparis lawsoniana Parl.	seeds	0.5			
Thuja orientalis L.	seeds	3.8			
Cupressus sempervirens L.	seeds	1.0			
Cedrus atlantica Manetti	seeds	6.0			
Total		**1 481.0**			
Angiosperms					
Robinia pseudoacacia L.	seeds	198.8			
Betula pendula Roth.	seeds	4.0			
Fagus sylvatica L.	seeds	15.0			
Alnus glutinosa (L.) Gaertn.	seeds	0.8			
Catalpa bignoniodes Walt.	seeds	0.5			
Tilia tomentosa Moench.	seeds	10.0			
Total		**229.1**			
Total Gymnosperms and Angiosperms		**1 710.1**			

Chapter 5: State of National Programmes, Research, Education, Training and Legislation

National programmes

5.1 National forest programmes including forest genetic resources.

A national forest programme entitled: *"Programme for expanded accelerated reproduction and most effective complex utilization of forest resources in Bulgaria for the period 1990-2040"* was prepared in 1988 under the leadership of Prof. M. Dakov (vice-president of the Bulgarian Academy of Sciences). A chapter "Genetic and selection basis for the extended reproduction of forest tree resources" was written by Prof. D. Velkov and Dr. R. Dobrev (Forest Research Institute – Sofia). A separate tree breeding programme, based on the actual state of the forest resources for the most economically important forest tree species in Bulgaria was proposed.

In 1996 the Committee of Forests published "National strategy for preservation of forests and development of forestry". In part III "Economic activities – afforestation and erosion control", the following is foreseen: further development of forest seed production base with the aim preservation and improvement of existing gene pool. Realisation of scientific achievements in the activities of experimental and seed control stations in the breeding and testing of sort reproductive material.

In 2003 the Ministry of Agriculture and Forests developed National Policy and Strategy for Sustainable Development of the Forest Sector in Bulgaria 2003-2013. In chapter "Biological and landscape diversity", a strategic aim is pointed out: conservation and restoration of components of biological and landscape diversity through integration of conservation aims in forestry practices, development of adequate systems for *in-situ* and *ex-situ* conservation and close-to-nature management of forests.

5.2 Type of institutions (government, university, private, etc.) actively engaged in conservation and sustainable use of forest genetic resources. (Table 17)

Table 17. Institutions involved in conservation and use of forest genetic resources.

Name of institution	Tupe of institution	Activities or programs	Contact information
Forest Research Institute - Sofia	Research Institute	Preservation and utilization of forest genetic resources	132, St. Kliment Ohridski, Blvd., Sofia - 1756 Phone: +359-2-9620442 Fax: +359-2-9620447 Email: forestin@bas.bg URL: www.bas.bg/fribas
University of Forestry - Sofia	University	Management and sustainable use of forest resources	10, St. Kliment Ohridski Blvd., Sofia - 1756 Phone: +359-2-9625997 Fax: +359-2-9622830 Email: rector@ltu.bg URL: www.ltu.bg
Experimental Station on Oak Forests – Burgas at the Executive Forest Agency	Experimental Station	Applied research on oak forests	Izgrev estate, Bourgas - 8008 Phone: +359-56-860950 Fax: +359-56-860953 Email: OSDGBurgas@nug.bg
Experimental Station on Fast-growing Forest Tree Species - Svishtov at the Executive Forest Agency	Experimental Station	Applied research on fast-growing forest tree species	18, Nove St., Svishtov - 5220 Phone.: +359-631-60743 Fax: +359-631-60743 Email: OSBRGDVSvishtov@nug.bg
Forest Seed Testing Station - Plovdiv at the Executive Forest Agency	Seed Testing Station	Registration and Control of forest reproductive materials	82, Slavyanska St., Plovdiv- Phone: +359-32-628467 Fax:: +359-32-633183 Email: GSSPlovdiv@nug.bg

Forest Seed Testing Station - Sofia at the Executive Forest Agency	Seed Testing Station	Registration and Control of forest reproductive materials	5, Iskarsko shose St., Sofia- Phone.: +359-2-9731180 Fax: +359-2-9731180 Email: GSSSofia@nug.bg

5.3 National co-ordination mechanism established to include different institutions or a national programme for forest genetic resources.

In 1962 a national meeting on forest genetics, breeding and seed production took place in Borovets. It analysed the status and showed the terms of reference for their development, as well as tasks of the national programme for forest genetic resources conservation.

In 1965 a National Commission on Forest Seed Production was founded at the Ministry of Forests and Forest Industry, which was supposed to consult and co-ordinate this activity.

5.4 Structure and main functions of the national co-ordination mechanism and the national programme for forest genetic resources.

The National Commission on Forest Seed Production included prominent researchers from the Forest Research Institute and the University of Forestry, directors of the Forest Seed Testing Stations in Sofia and Plovdiv and from the Experimental Stations in Burgas and Svishtov, as well as experts from the ministry. The commission issued temporary manual for breeding, management and utilization of forest seed production units.

In 1992 commission members presented Instructions for Establishment, Management and Utilisation of Forest Seed Production Base, Preparation of Forest Seeds, Collecting, Processing, Conservation and Pre-Sowing Preparation. After approval the Committee of Forests at the Coucil of Ministers issued the instructions (Committee of Forests, 1992).

In 2001 the Ministry of Agriculture and Forests issued Regulation Nr.5 for forest breeding and seed production, to synchronise this activity legislatively with the EU instructions (State Gazette, 2001). Riders and changes in these instructions later on were published in the State Gazette (State Gazette Nr.18/2004).

5.5 Trends in support for forest genetic resources changed over the past 10 years.

The trends in support of FGR for this period become stronger (membership in EUFORGEN) but the funding of the Programme decreased in spite of some engagements for financial support

Research, Education and Training

5.6 Budget allocated to forest genetic resource research in the country. Proportion of the forestry budget to forest genetic resources.

No precise and reliable data about the budget for forest genetic resources are available due to the fact that the institutions involved in this activity are subordinated to different ministries, as follows: the University of Forestry - to the Ministry of Science, Education and Youth; the Forest Research Institute - to the Bulgarian Academy of Sciences; the Experimental Station on Oak Forests – Burgas, the Experimental Station on Fast-growing Forest Tree Species – Svishtov, the Forest Seed Testing Station – Plovdiv and the Forest Seed Testing Station – Sofia - the Executive Forest Agency at the Ministry of Agriculture and Foods.

Approximately, the annual budget allocated to forest genetic resources research in the country is about 780 000 USD. The proportion of forestry budget to forest genetic resources is roughly 1%.

5.7 Courses and universities and forest genetic resources explicitly covered in the country.

The university course for bachelor's degree lasts 9 semesters, for master's degree – 3 semesters at the Faculty of Forestry in the University of Forestry – Sofia.

Institutions, that are accredited to award the educational and scientific degree "Doctor" (PhD) are the Forest Research Institute at the Bulgarian Academy of Sciences and the University of Forestry – Sofia. The scientific subject for PhD in the field of forest genetic resources is indicated by digital code 04.04.01 "Forest plantations, tree breeding and seed production". Duration – 3 years.

5.8 Needs and priorities for research, education and training to support the conservation and sustainable use of forest genetic resources.

Some of the priorities are:

- inter- and intrapopulation variability of main forest tree species by biochemical and molecular-genetic DNA markers
- genetic determination of some peculiarities like speed of growth, timber quality and resistance to diseases, insects and climate changes
- establishment of series of combined half-sib and provenance trials, clone collections and seed orchards.
- establishment of forest tree sort-clones and sort-populations.

National Legislation:

5.9 Legislation or regulations that are relevant to forest genetic resources (phytosanitary, seed production, community rights, patent legislation, other).

There are several laws, which are linked up with forest genetic resources: Law for the forests (1997, 2011); Protected areas law (1998) and Biological diversity law (2002).

On the basis of Law for the forests (1997), the following instructions and regulations tied with forest genetic resources were published:

- Instruction No 5, (2001) for forest tree breeding and seed production.
- Instruction №56 (2003) for protection of forests from pests, diseases and other damages.
- Instruction №5 (2004) for production and trade with forest reproductive materials.
- Instruction №7 (2005) for the conditions and fixed routine for determination of sources of forest seed production base, collection and procession of forest reproductive materials intended for forest plantations and their quality description, including imported reproductive materials.
- Regulation No 29 (2006) for the conditions and fixed routine for production of seedlings for afforestation in forest nurceryes – state ownership.
- Regulation No 2 (2009) for afforestation and inventory of forest plantations.

On the basis of the new Law for the forests (2011), new instructions and regulations are in procedure or in state of expectation (on forest genetic resources, too).

Selected and established sorts of forest tree species were registered in the State Selection Commission and since 21 February 2010 – in the Executive Agency for Sort Testing, Approvement and Seed Control at the Ministry of Agriculture and Foods.

The agency manages the procedure on testing, acknowledgement and registration of plant sorts (including forest tree species). The State Selection Commission and the Executive Agency for Sort Testing, Approvement and Seed Control have issued certificates for sorts of *Juglans regia* L., *Castanea sativa* Mill., *Pinus sylvestris* L., *Picea abies* (L.) Karst., *Populus* spp., *Salix* spp., etc.

Bulgaria is regular member of the European Union since 2007 and the national legislation is synchronized with the EU legislation, including that on forest genetic resources.

5.10 Legal framework established for forest genetic resources strategies, plans and programmes.

5.11 Identified needs in the country for developing or strengthening forest genetic resources legislation (Table 18).

Table 18. Needs for developing forest genetic resources legislation.

Needs	Priority level			
	Not applicable	Low	Moderate	High
Improve forest genetic resources legislation		+		
Improve reporting requirements			+	
Consider sanction for non-compliance		+		
Create forest genetic resource targeted regulations		+		
Improve effectiveness of forest genetic resources regulations			+	
Enhance cooperation between forest genetic resources national authorities			+	
Create a permanent national commission for conservation and management of forest genetic resources			+	
Other (Please specify)				

Public awareness:

5.12 Necessary initiatives for greater visibility for forest genetic resources.

It is desirable to establish experimental plots demonstrating obvious differences in productivity and quality of wood in selected sort-clones and sort-populations in comparison with control ordinary trees.

5.13 Specific awareness programme for forest genetic resources.

Public awareness programmes for forest genetic resources are developed predominantly by the Ministry of Environment and Waters, the Executive Forest Agency at the Ministry of Agriculture and Folds and some NGOs. Tens of books, leaflets, flyers and posters about gentic resources of the country have been published, concerning specific mountains, national parks, nature

parks, reserves, territories of regional forestry boards, state forest and game enterprises, educational-and-practical forest enterprises and specialized forest schools.

Routes have been differentiated and expositions and paths have been established to get to know forest genetic resources. Forest experimental plots, arboreta and forest museums also play this role.

5.14 Needs and priorities for raising awareness of forest genetic resources issues (Table 19).

Table 19. Awareness raising needs

Needs	Priority level			
	Not applicable	Low	Moderate	High
Prepare targeted forest genetic resources information			+	
Prepare targeted forest genetic resources communication strategy			+	
Improve access to forest genetic resources information		+		
Enhance forest genetic resources training and education			+	
Improve understanding of benefits and values of forest genetic resources			+	
Other (Specify)				

Chapter 6: State of Regional and International Agreements and Collaboration

International networks:

6.1. Regional, subregional, forest genetic resources-bases or thematic networks participation for forest genetic resources over the past 10 years, and benefits result.

Bulgaria took part in all networks initiated by EUFORGEN (European Forest Genetics Programme) in phase II (2000-2004), phase III (2005-2009) and phase IV (2010-2014), as follows:
EUFORGEN – Conifers Network;
EUFORGEN – Mediterranean Oaks Network;
EUFORGEN - Noble Hardwoods Network;
EUFORGEN - *Populus nigra* Network;
EUFORGEN – Temperate Oaks and Beech Network;
EUFORGEN - Stand-forming Broadleaves Network;
EUFORGEN - Scattered Broadleaves Network.
EUFORGEN – Forest Management Network.

Balkan collaboration in study, protection and management of forest genetic resources included teamwork in the following projects:

- "Genetic resources of *Quercus robur* L. in the Danube plain" – with Romania;

- "Forestry and agroforestry systems as a tool for sustainable and natural output" – with Greece;

- "Genetic resources and breeding of *Pinus peuce* Grsb." – with FYR of Macedonia.

Collaboration in the frames of South-Eastern Europe included the following projects:

-"Models for cultivation of gene resources of agroforestry species" – CNR – Italy, BAS – Bulgaria;

- "Genetic resources of broadleaved forest tree species in South-East Europe" – IPGRI – Rome – Bulgaria, Moldova, Romania;

- "Study on the resources of *Robinia pseudoacacia* L. for restoration of degraded terrains" – INCO-COPERNICUS – Italy, Hungary, Bulgaria, Greece;

- Chloroplast DNA map for *Quercus robur* L. - ARCS, Austria, Bulgaria;

- "Genetic resources of *Quercus petraea*, *Q. robur* and *Q. pubescens* in South-Eastern Europe" – Bulgaria, Moldova.

6.2. Needs and priorities to develop or strengthen international networks for forest genetic resources.

Bulgaria needs faster development of scientific infrastructure, advanced methodologies, and modern and unique laboratory equipment.

Priorities for international networks with: EU, Balkan countries, Russian Federation, USA.

International Programs:

6.3. Most beneficial international programmes for forest genetic resources.

The international programmes EUFORGEN, EUFGIS, COST, MATRA and the Framework Research Programmes of EU have been most beneficial for forest genetic resources in the country.

6.4. The agencies and the main results of these programmes.

IPGRI - Biodiversity;

EU-EC;

Royal Dutch Society for Nature Conservation (KNNV).

The most important obtained results were published in monographs:

The contract PINMATRA/2002/011 "Inventory and strategy for sustainable management and protection of virgin forests in Bulgaria" between the Royal Dutch Society for Nature Conservation (KNNV) and the Forest Research Institute at the Bulgarian Academy of Sciences (FRI-BAS) was signed in 2002. A specialized methodology was developed and 103 356 ha virgin forests, or 2,9% of Bulgarian forests were inventoried. A database was established with maps and descriptions of these forests. A concept was elaborated for conservation and management strategy of virgin forests in the country. A monograph "Virgin forests in Bulgaria" was published in 2006.

Project "ICP Forests" included 20 years large-scale monitoring of forest ecosystems. It searched for regularities between climate changes, entomological and phytopathological impacts, anthropogenic, incl. industrial loading, abiotic and other factors from one side and the condition of ecosystems on the other. A monograph "International Cooperative Program "Forests" – Estimation the impact of polluted air on the forests" was published in 2006.

6.5. Trend to international financial support to forest genetic resources over the past 10 years.

It changed very slightly downward.

6.6. Needs and priorities for future international collaboration

Bulgaria is reach of forest genetic resources, so the main way for their preservation is the *in situ* method.

Enhancing research education and training as well as use of forest genetic resources presents a precondition for international collaboration

It is necessary to establish a laboratory for molecular-genetic DNA analyses of inter- and intrapopulation variation of forest tree species in the country.

Some changes in the legislation are desirable in order to include the permanent seed producing stands in the category of protected territories.

Enhancing information management and public awarenss for forest genetic resources will also contribute to interstate co-operation.

International agreement

6.7. Subscribed international agreements, treaties, conventions, or trade agreements that are relevant to the sustainable use, development and conservation of forest genetic resources.

International conventions, which are directly related with preservation and sustainable use of forest genetic resources in Bulgaria, are:

- "Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971)" - in Bulgaria come into force since 24.01.1976;
- "Convention conserving the protection of the world cultural and natural heritage (1972)" - in Bulgaria come into force since 17.12.1975.
- "Convention on International Trade in Endangered Species of Wild Fauna and Flora - CITES (1973)" - in Bulgaria come into force since 16.04.1991;
- "Convention on the Conservation of European Wildlife and Natural Habitats (1979)" – in Bulgaria come into force since 01.05.1991;
- "Convention for Biological Diversity - CBD (1992)" **–** ratified by Bulgaria on 29.02.1996.

6.8. The impact of these agreements with regard to the conservation and sustainable use of forest genetic resources.

The impact of the above-mentioned agreements for conservation and use of forest genetic resources is definitely positive.

6.9. The impact of the international conventions, treaties or agreements that the country has signed with regard to the conservation and sustainable use of forest genetic resources.

Bulgaria is a contracting party by all international conventions, which have relation to the protection of biological diversity, climate change, and desertification combat.

These conventions are normative base for announcement of a number of protected territories, and included unique samples of forest gene pool.

International Collaboration

6.10. Description of country's current international collaboration

EUFORGEN – European Forest Genetic Resources Program – phase IV (2010-2014).

EUFGIS - European Forest Geographic Information System (2007-2010).

FAO - The state of the World's Forest Genetic Resources (2010-2012).

EU-COST Action E52 - Evaluation of Beech Genetic Resources for Sustainable Forestry (2006-2010).

EU-COST Action 871 - Cryopreservation of crop species in Europe (2006-2010).

EU-COST Action 0703 - Expected Climate Change and Options for European Silviculture (2008-2011).

EU-COST Action 0803 - Established and emerged Phytophthora: Increasing treats to woodland and forest ecosystems in Europe (2008-2012).

EU-COST Action FP 0905 – Biosafety of forest transgenic trees: improving the scientific basis for save tree development and implementation of EU policy directives (2010-2014).

6.11. Participation in regional, sub-regional, forest genetic resources-based or thematic networks for forest genetic resources. (Table 20)

Table 20. Overview of the main activities carried out through networks and their outputs

Network name	Activities*	Genus/species involved (scientific names)
Genetic resources of forest tree species in Europe (EUFORGEN) - phase III (2005-2009)	Information exchanges; Development of shared databases; Development of technical guidelines; Elaboration, submission and execution of joint research projects; Joint publications.	*Pinus* spp. *Picea* spp. *Abies* spp. *Fagus* spp. *Quercus* spp. *Acer* spp. *Robinia pseudoacacia* L etc.
Genetic resources of forest tree species in Europe (EUFORGEN) - phase IV (2010-2014)	Information exchanges; Establishment of genetic conservation strategies; Development of shared databases; Development of technical guidelines; Elaboration, submission and execution of joint research projects; Joint publications.	*Pinus* spp. *Picea* spp. *Abies* spp. *Fagus* spp. *Quercus* spp. *Castanea sativa* Mill. *Sorbus* spp. etc.

*** Examples of activities:**

- Information exchanges
- Development of technical guidelines
- Development of shared databases
- Establishment of genetic conservation strategies
- Germplasm exchange
- Elaboration, submission and execution of joint research projects.
- Other (please specify)

6.12. Needs and priorities for future international collaboration. (Table 21)

Table 21. Needs for international collaboration and networking

Needs	Level of priority			
	Not applicable	Low	Medium	High
Understanding the state of diversity			+	
Enhancing *in situ* management and conservation		+		
Enhancing *ex situ* management and conservation			+	
Enhancing use of forest genetic resources				+
Enhancing research				+
Enhancing education and training				+
Enhancing legislation		+		
Enhancing information management and early warning systems for forest genetic resources			+	
Enhancing public awareness			+	
Any other priorities for international programmes				

Chapter 7: Access to Forest Genetic Resources and Sharing of Benefits Arising out their Use

Access to forest genetic resources:

7.1 Regulations with respect to access and benefit sharing of forest genetic recources.

Legal regulations that work at present include:

- Convention for Biological Diversity (1992);
- Law for protected territories (1998);
- Law for biological diversity (2002).

According to the Law for protected territories (1998), one of the targets in the management of reserves and sustained reserves, is the preservation of genetic resources.

According to the Law of biological diversity (2002) genetic resources can be consigned for use from other countries after preliminary agreement in written form for the condition and sharing benefits. The agreement can predict free of charge consign of genetic resources, when they are intended for non-commercial aims: scientific studies, teaching, protection of biological diversity and public health.

7.2 Legislation for limiting access and movement of forest genetic resources into or out of the country.

The access and the movement of forest genetic resources are determined by:

- Control on import and export of forest reproductive materials (Regulations №5 for production of and trade with forest reproductive materials – State Gazette Nr.18, 2004);
- Permit list of tree and shrub species used for afforestation in Bulgaria, including 76 indigenous species (12 coniferous + 65 deciduous) and 44 introduced species (23 coniferous + 16 deciduous + 5 naturalised) (Regulations №2 for afforestation and inventory of forest plantations – State Gazette Nr. 15, 2009);
- Regulations for work with genetically modified organisms (GMO) in controlled conditions (Decree №21 of the Council of Ministers from 2005 – State Gazette Nr. 81, 2005;

Amendment of the regulations – Decree №97 of the Council of Ministers from 2011 – State Gazette Nr. 33, 2011).

7.3 Opportunity to improve access.

Improvement of access to forest genetic resources in the countries will be determined by forestry legislation on the basis of research investigations.

Sharing of benefits arising out of the use of forest genetic resources:

7.4 Established mechanisms for recognizing intellectual property rights related to forest genetic resources.

They are established according to:

- Law for copyrights and related rights (1993);

- International Convention for protection of new sorts of plants (1991), ratified by the National Assembly of the Republic of Bulgaria in 1998.

The Executive Agency of Sort Testing, Approvement and Seed Control issues nominal certificates to the authors of sorts of forest tree species and shrubs.

7.5 Established mechanisms of sharing benefits arising out of the use of forest genetic resources.

Mechanisms arise out of the following documents with legislative duties:

- Convention for Biological Diversity, ratified in 1996 by the National Assembly of the Republic of Bulgaria;

- Law for biological diversity (2002);

- Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (2011), accepted by Bulgarian Government.

Chapter 8: Contribution of Forest Genetic Resource to Food Security and Poverty Reduction

Table 22. Tree and other woody species that are important for food security of livelihoods

Species		Use for food security	Use for poverty reduction
Scientific name	**Nature (N) or exotic (E)**		
Juglans regia L.	E	+	+
Castanea sativa Mill.	N	+	+
Corylus colurna L.	N	+	+
Corylus avelana L.	N	+	+
Corylus maxima Mill.	E	+	+
Amygdalus communis L.	E	+	+
Cornus mas L.	N	+	+
Cerasus avium (L.) Moench.	N	+	+
Cerasus fruticosa (Pall.) Woronow	N	+	+
Cerasus vulgaris Mill.	E	+	+
Malus silvestris Mill.	N	+	+
Malus pumila Mill.	N	+	+
Malus praecox (Pall.) Borkh.	N	+	+

Mespilus germanica L.	N	+	+
Morus alba L.	E	+	+
Morus nigra L.	E	+	+
Padus racemosa (Lam.) Gilib.	N	+	
Padus mahaleb (L.) Borkh.	N	+	
Prunus spinosa L.	N	+	
Prunus carasifera Ehrh.	E	+	+
Prunus insitita L.	N	+	
Pyrus communis L.	N	+	+
Pyrus amygdaliformis Will.	N	+	+
Pyrus elaeagrifolia Pall.	N	+	
Ribes nigrum L.	N	+	+
Ribes multiflorum Kit.	N	+	
Ribes petraeum Wulf.	N	+	
Ribes alpinum L.	N	+	
Ribes uva-crispa L.	N	+	
Rosa canina L.	N	+	+
Rubus ideans L.	N	+	+
Sorbus domestica L.	N	+	
Sorbus torminalis (L.) Crantz.	N	+	
Tilia tomentosa Moench	N	+	+
Tilia cordata Mill.	N	+	
Tilia rubra DC.	N	+	
Vaccinium myrtillus L.	N	+	+
Vaccinium vitis-idea L.	N	+	+
Vaccinium uliginosum L.	N	+	+
Vaccinium arctostaphylos L.	N	+	+

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Corrections in the rows "Permanent seed producing stands" of Table 10 for native stands that have the statute of approved sources of forest reproductive materials

Forest tree species	Category of reproductive materials /native stands/			
	"source-identified"		"selected"	"qualified"
	ha	number of trees*	ha	parents of families
Abies alba Mill.			752.4	
Picea abies (L.) Karst.			4023.7	
Pinus heldreichii Christ.			9.8	
Pinus nigra Arn.			1026.5	
Pinus sylvestris L.			7300	
Total conifers			**13112.4**	
Acer platanoides L.		32	3.4	
Acer pseudoplatanus L.		150	15.2	
Alnus glutinosa Gaertner			1.1	
Betula pendula Roth.			146.9	
Carpinus betulus L.		150	108.8	
Castanea sativa Mill.			40.6	
Cerasus avinum (L.) Moench.		223	16.4	
Fagus sylvatica L.	3.1		9748	
Fraxinus excelsior L.		67	43.9	
Fraxinus oxicarpa Willd.	14.4		211.9	
Populus spp.&hybrids			53.3	41
Quercus cerris L.	18.4		1916.3	
Quercus petraea Liebl.			5463.8	
Quercus pubescens Willd.	28.7		74.6	
Quercus robur L.	28.7	40	251.3	
Tilia platyphyllos Scop.			153.6	
Total deciduous	**93.3**	**662**	**18249.1**	**41**
Total conifers and deciduous	**93.3**	**662**	**31361.5**	**41**

*for the mixed stands, where it is impossible to fix real area of different species, the number of trees is pointed.